Healthy streetlife: an ecologic exploration of residents' health practices in the street environment

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Abstract

Background

Good health is a human right and the built environment is recognised as a wider determinant of health but many studies focus only on physical health not mental or social health. The street is a microscale of the built environment yet relatively overlooked in the literature. Additionally, built environment practice tends to focus on the physical over the social and exclude residents' knowledge.

Methodology

During the Covid-19 pandemic this qualitative research investigated residential streets as a health setting. Residents' everyday health practices were explored within the socio-ecologic paradigm and transdisciplinary knowledge was created using a constructivist-interpretivist epistemology. Data comprised semi-structured interviews with participants (n=20), street observations (n=18), and desktop data. Data analysis included a modified reflexive thematic analysis and ecologic analysis.

Findings

The street is evidenced as a health setting. Findings are reported for the street as a physical and social environment linked to health-related outcomes. Characteristics of the street physical environment (n=61) are reported in themes (n=11): bike hire and storage; car charging and parking; cycle lane and cycle friendliness; green space, planting, river, and trees; living space; street holistic, layout, dimensions; sun, temperature, wind; visual appearance, housing design, materials, views; waste; sounds from street; and specific buildings on street.

The street social environment is reported through everyday health practices (n=50) in themes (n=6): being in green space and nature in the street; the street as a social space; neighbourly things to do; getting everyday necessities done; getting from A to B in the street; and the streetlives of children, parents, and adults.

The street is a domain of transdisciplinary knowledge. Complex and ecologic pathways to health impact in the residential street are reported.

Conclusion

This thesis contributes an outward demand to address residential streets as health settings: to co-create streets reflective of the diversity, complexity, and interconnectedness of contemporary societies, whilst promoting social justice and community wellbeing. Healthy streets prioritise local knowledge and link to other settings including Healthy Cities from the grassroots. A *translational urbanism* is proposed to be operationalised through *Transdisciplinary CoLabs*.

The research contributes a new approach, new methods, new data, understudied areas (spatial and temporal), and new findings. Recommendations for policy, practice, and research are made. This thesis is an original contribution and a call to take the socio-ecologic paradigm of health further: addressing not just the wider determinants of health, but the wider, wider determinants of health.

Copyright statement

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Acknowledgements

I have persevered with this PhD, part-time over seven and a half years, self-funded, as a parent of young children, whilst making a significant career change, starting a new business, undertaking a year-long house renovation, and on top of that there was the Covid-19 pandemic. I could not have done this alone and thank the following people and organisations.

I thank all my family for their inspiration, love, and care. First and foremost, to Laura who has supported me in every way throughout the PhD and been with me on this journey before it even had a name. To Isabel and Euan who have rescued me from the computer for food on many occasions, held up scripts for videos, and enthusiastically joined in many home-schooling lessons planned around streets and health! I thank my parents, Olive and John, whose own journey as practical theologians has inspired my own passion for practice-based research.

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the participants who shared their deep insights and lived experience, it has been a privilege to work with the perspectives they shared in developing this thesis.

This thesis also honours the memory of two wonderful people who have subsequently passed on: first participant ‘Mabon’ who set out the most wonderful vision of community ownership in streets based on his experience from visiting Cuba. Secondly, Caroline Barr whose selfless community work was self-evident in our short meeting and who helped me to connect with participants.

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1.1 Preface to the Introduction

> ...the street remains a social space like no other. Even in the context of divided and segregated cities, gated communities and 'privatopias', streets continue to provide spaces for public congregation, encounter and community making. (Hubbard and Lyon, 2018, p.938)

Imagine you are opening your front door to leave your home. You step through the door and into the street. These few steps represent a tiny journey yet an important change of setting from the more private and individual realm of your home to the more public space of your street.

The street environment, without you necessarily thinking about it has already affected your experience: maybe there's a front garden you enter first, or a shared communal stair, or maybe you stepped straight out onto the pavement. You are now in the street but still right outside home, it is a space you know well. You feel comfortable right here.

There was likely a reason to step out in the first place, it might have been a seemingly normal or small thing like putting the rubbish out, or to go somewhere like the local shop, to work, or for a doctor's appointment. These reasons might then lead to other things happening like greeting a neighbour as you walk along the street.

> "Lowly, unpurposeful, and random as they may appear, sidewalk contacts are the small change from which a city's wealth of public life may grow." (Jacobs, 1962, p.83)

These seemingly small activities and interactions in the street, many of them repeated daily, are exactly what this research is about. For Jacobs (1962) they have importance for public life. In this research they are investigated as being important for health and wellbeing.

These *activities* in this research are thought about as *practices*. The practice of going to the doctor might have an obvious link to health and wellbeing, but what about the impact of other

everyday practices in the street? For example, greeting a neighbour might be a very positive thing for your health and wellbeing especially if it happens every day. In contrast, witnessing or experiencing violence in the street might not happen often but if you do experience violence, it may have a long-term negative effect on your health and wellbeing.

The street environment plays a role in these health practices too – both as a physical space and a social one. This role might be quite obvious, such as, whether it's normal to say hello to neighbours on your street, or if you return home and are injured tripping over a badly placed kerb. The role of the street environment can also be more subtle, such as having a front garden. During Covid-19 lockdowns this space might have helped you feel more comfortable saying a socially distanced hello to people. Equally, *not* having such a front garden space could have an impact too.

On your walk, imagine carrying on, beyond where you feel most comfortable in the street. Going further you leave the street you move into the wider neighbourhood and city. This short journey represents what this research and thesis is about: the street setting – both the physical and social environment – where people live, the practices that happen there, and how this relates to health and wellbeing.

1.2 Context and rationale

Understandings of health change over time. In public health research and practice this has for some time meant an increased recognition of the role of wider determinants of health, for example education, work environment, housing, and other living and working conditions (Dahlgren and Whitehead, 2006). A socio-ecologic paradigm has emerged (McMichael, 1999; Susser and Susser, 1996a; Krieger, 1994; Weinblatt *et al.*, 1978). Public health, with its focus on population health, is increasingly recognised as a complex system (Rutter *et al.*, 2017) which develops the idea of health being like a spider's "web of causation" (Krieger, 1994, p.899). In practice what this has led to is addressing health topics like obesity not as linear cause and effect but as complex / web-like systems (Griffiths *et al.*, 2023). This shift has been reflected at a global policy level also. For example, the World Health Organization (WHO) has created a division focussed on: "Climate Change, Health and Environment; Social Determinants of Health;

Nutrition and Food Safety, and Health Promotion." (Tedros, 2019, p.19). This reframing of health has supported practitioners from other disciplines – who have a role as public health actors – to understand how they can contribute to supporting health. Frameworks that have conceptualised this shift include Dahlgren and Whitehead's (1991) determinants of health model which includes living and working conditions as determinants. Barton and Grant's (2006) Health Map for the Local Human Habitat includes built environment, with streets as part of this. Pineo's (2020) framework Towards Healthy uRbanism: InclusiVe Equitable Sustainable (THRIVES) integrates thinking on equity, sustainability, and inclusion.

In parallel with the emergence of the socio-ecologic paradigm in public health, development of settings-based approaches for health have also been important. These include *healthy cities*, *healthy schools*, and *healthy universities* as a "natural corollary of… a shift of focus away from problems… and toward environments and settings." (Dooris *et al.*, 1998, p.22) The WHO Ottawa Charter states:

> Health is created and lived by people within the settings of their everyday life; where they learn, work, play and love. (World Health Organization, 1986)

This charter put forward a vision of a "new public health" (World Health Organization, 2023a) and brings in the idea that people's activities – learning, working, playing, loving, and many more besides – in these settings matter for health. Pineo highlights the importance of these activities yet notes they are not widely acknowledged in the public consciousness:

> The activities of daily life - travelling to work, collecting children from school and picking up food for dinner - have a much bigger impact on health and wellbeing than most people realise. (Pineo, 2022, p.141)

This thesis develops an argument for the street environment as a health setting for everyday activities and uses practice theory to investigate these activities as health practices.

The frameworks above draw on a range of disciplinary thinking including: public health, built environment disciplines, urban health, "healthy urbanism" (Pineo, 2022), and social theory. It has been argued that a "…transdisciplinary knowledge domain is urgently required to address the complexity of urban health challenges and formulate effective responses to them."

(Lawrence and Gatzweiler, 2017, p.595). Transdisciplinarity is a recurrent theme and argument in this thesis: the street as a health setting and as such a transdisciplinary place of knowledge.

1.3 Problematising the topic

The street physical environment is part of the built environment which includes buildings and physical infrastructure as well as the outdoor spaces between buildings. The built environment is increasingly recognised and researched as a wider determinant of human health including for risk factors such as, i) a lack of physical activity; ii) environmental risks (such as air pollution and climate change), and iii) unhealthy diet. In Europe, these three alone are related to a burden of 26 million Disability Adjusted Life Years (DALY) (WHO Regional Office for Europe, 2015, pp.8–10). Bird et al.'s umbrella review identified how built environment planning principles impact health outcomes and risk factors including under the topics of: "…neighbourhood design, housing, healthier food environment, natural and sustainable environment, and transport." (2017, p.6)

Additional evidence of links to human health is reported in systematic reviews for built, physical, and urban environments. This includes: health in young people and adolescents (Audrey and Batista-Ferrer, 2015); physical activity in adults (McCormack and Shiell, 2011) and in older adults (Barnett *et al.*, 2017; Van Cauwenberg *et al.*, 2011); moderate to vigorous physical activity (MVPA) in young people (McGrath, Hopkins and Hinckson, 2015); mental health and wellbeing in adults (Moore *et al.*, 2018); cardiovascular disease and risk factors (Malambo *et al.*, 2016); and cardiometabolic health (Chandrabose *et al.*, 2019) and risk factors (Leal and Chaix, 2011).

Whilst not explicitly excluding the street this evidence does not bring the street scale into clear focus allowing its contribution – if any – to be understood. During this research no systematic reviews of built environment: health interactions with a specific focus on the street scale were identified. This therefore became an early objective within this research. Existing evidence nevertheless points to the importance of the street scale even if indirectly (Bagnall *et al.*, 2018; Bird *et al.*, 2017; Cerin *et al.*, 2017; Beyer, Wallis and Hamberger, 2015; Jackson, Denny and Ameratunga, 2014; Sugiyama *et al.*, 2012; Yen, Michael and Perdue, 2009).

Two particular gaps in this existing literature were identified and are now discussed: first, a lack of evidence at the street scale; and second a narrow scope of health outcomes and risk factors addressed in this literature.

1.4 Importance of the street scale

Detailing the first gap further, the street scale matters because intervention at the street scale might be a more practical one at which to address health improvement interventions compared to trying to make the same changes at the whole neighbourhood or city scale. Ehrenfeucht and Loukaitou-Sideris (2010) provide an example: that town planners could change their practise to intervene in small scale and incremental ways such as simply through pavement provision. In the built environment the street environment is the smallest scale of public space outside the more private space of the home. However, small does not mean streets taken together are insignificant. Streets are also "the most common public space" globally (UN Habitat, 2015, p.iv) even though not every street is publicly accessible by everyone.

In the existing evidence base the street scale is often overlooked at various levels. Conceptually, Sarkar, Webster, and Gallacher's "health niche" model of the city includes scales of: "individual, household, neighbourhood, city, region" (2014, p.50), but not streets. Methods and tools tend to overlook the street and 91% of Urban Health Indicator tools identified in a systematic review (Pineo, Glonti and Rutter, 2018) were evaluated (for this thesis) as being at scales larger than the street. Through a systematic review, the literature on street physical environment and certain health outcomes is also identified as small and scientifically weak (see Chapter 2.1 and Appendix 2). One included study found street scale associations independent of neighbourhood associations (Cain *et al.*, 2014). This indicates that despite existing gaps, when focused on through the research question, the contribution of the street environment can be disentangled from other built environment scales and warrants investigation.

Settings-based approaches such as healthy cities bring health down to the scale of the city but also leaves smaller scales like the street overlooked. The street and other scales like healthy neighbourhoods may be understood implicitly as part of healthy cities but are rarely

foregrounded. This research explores streets nested as “elemental settings” within “contextual settings” such as healthy neighbourhoods and healthy cities (Galea, 2000, p.170).

This thesis argues that the street is an essential component of the built environment with potential value for health yet it is relatively under researched, few research tools address it directly, and some theoretical frameworks for health in the built environment also overlook it.

1.5 Defining the street environment

To enable this first gap to be addressed the street needs to be clearly defined. In this research the street is defined as both a physical / morphological environment *and* equally a social environment. From an urban design and planning perspective Barton *et al*. describe the street as: “A cluster of dwellings often developed at the same time, with shared identity or character, grouped round a common access...” (2010, sec.32). The built environment including the street environment is also viewed as a complex system that needs to be understood as a whole (Barton, Grant and Guise, 2010).

Whilst streets often occur in urban spaces, in this research they are defined simply as spaces which can occur in any built-up residential area that fits the above definition.

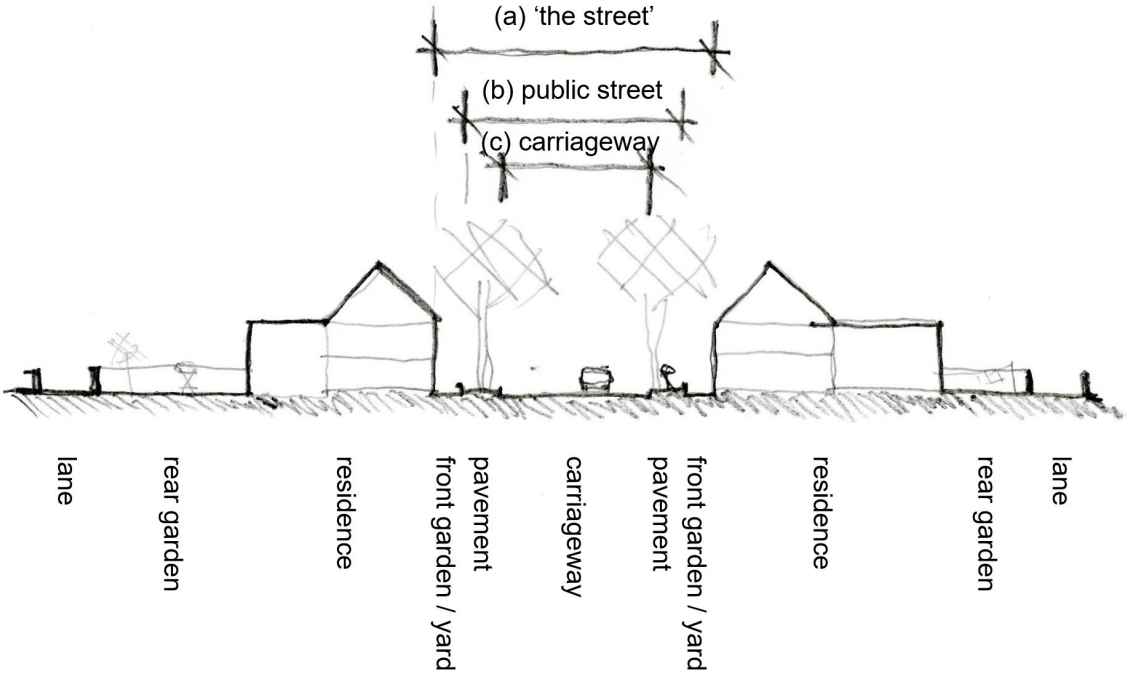


Figure 1: Glossary of street terms in this research, not to scale

Figure 1 identifies some key terms used in this research illustrated on a typical cross section of a Victorian street of bylaw terraced housing. Not all streets in this research have all these features. The street physical environment in this research is taken to mean between the faces of houses where present (dimension a) and horizontally for 400m from participants' homes. As this research is in residential streets those buildings are typically residential houses (this is also a feature of the streets being in Cardiff, Wales). The carriageway (dimension c) is where vehicles drive and may include parking space. The pavement (sometimes called footway or sidewalk) is where pedestrians walk. The carriageway and pavement together (dimension b) make up the public part of the street, typically in the United Kingdom this is under the control of the local authority. Front gardens or yards where present are part of the overall street physical environment, this space is typically controlled by the homeowner or landlord.

These morphological definitions address the street as a physical environment but less so as a social one. Hubbard and Lyon highlight this duality:

> "By definition, most streets are linear forms, conduits for flows of different types, both above (cars, people, traffic) and below (water, gas, electricity) ground. But opposed to mere roads (or motorways and highways), they are also woven into the social fabric of the city in multiple ways, adjoining any number of buildings, public facilities, open spaces and commercial venues and providing some form of interaction and relationality between them." (2018, p.940)

A sociological perspective on the street environment links closely to people's activities or *social practices* that happen there. The street plays an important social role for people to develop a sense of identity and belonging. The street as a fieldsite for sociology, "…remains a social space like no other." (Hubbard and Lyon, 2018, p.938). The street in sociology is often considered to be public territory (Lofland, 1998) on a public / private axis (see Chapter 2.1). This research does not start with an assumption of the street as a public space but rather seeks to investigate this characteristic through the phenomenon of social practices. It is the nature of these practices that define whether the street is a public sort of space, a private sort of space, or something in between. These practices in the street and "…activities of daily life…" are the

same ones that Pineo identifies as having “a much bigger impact on health and wellbeing than most people realise.” (2022, p.141)

Everydayness has particular meaning in sociology and during the Covid-19 pandemic everyday activities were drastically impacted. Government interventions globally such as stay at home lockdowns placed restrictions on people’s movement including in the street. These responses to Covid-19 affected many pre-existing everyday activities whilst at the same time giving rise to new ones such as ‘clap for carers’ in the UK where streets came out to show their support for workers in caring professions (Saner, 2020). What was previously an everyday practice, like stepping outside your front door into the street, became exceptional, even potentially illegal.

This research defines the street as a physical environment that can be morphologically described *and* as a social environment that links closely to people’s social practices there.

1.6 Importance of holistic health and wellbeing

Focusing on the second gap previously highlighted, existing research both in the wider built environment and at the street scale have prioritised physical health outcomes and risk factors. Physical health is important. However, no included studies in the systematic review for this research (see Chapter 2.2) addressed mental health outcomes which are also important. In contrast, a systematic review focussed on green space including at the neighbourhood scale identifies benefits for young people’s (14-24 years old) mental health (Bray *et al.*, 2022). Green space can be present in the street physical environment, yet street scale literature identified is limited in its consideration of mental health outcomes. A lack of action in policy and practice on the potential of the built environment to support positive mental health and wellbeing is a problem that Roe and McKay (2021) identify. They particularly highlight this in context of the Covid-19 pandemic, the main health impact of which they state as being psychological. The development of tools in public health practice such as mental wellbeing impact assessment (MWIA) reflect a shift in practice focus, partly in response to Covid-19 (Edmonds *et al.*, 2022). Research on the drivers for mental health outcomes are a global urban health priority (World Health Organization, 2022b) and should be included in built environment research.

The Importance of addressing holistic health can be argued from various perspectives. A rights based argument is that health – both physical and mental – is a human right (United Nations, 1976) and health as defined by the WHO is a holistic concept (World Health Organization, 1946). A theory-based argument is that, as a complex socio-ecologic system, an understanding across all health domains is important. One practical argument is that a focus on physical health and not mental and social health may result in practitioners and policy makers addressing mainly physical health. Another related practical argument is that people who intervene in the street – residents, practitioners, and policymakers – have different tools and practises available to them so a broader evidence base might open more possibilities for effective interventions, supporting these people to be effective public health actors at the street scale.

1.7 Defining health and wellbeing

In response to this gap, health is defined in this research as physical, mental, and social health (World Health Organization, 1946) and on a continuum from ill health and disease at one end through to positive health and wellbeing at the other, defined as, “the resilience or capacity to cope and maintain and restore one’s integrity, equilibrium, and sense of wellbeing.” (Huber *et al.*, 2011, p.2) This definition of health is a salutogenic one closely linked to health promotion approaches (Antonovsky, 1979, 1996). Being based on the socio-ecologic paradigm of public health this research is also focused on population health as opposed to individual health.

In this research the terms *health* and *wellbeing* refer to this definition across a continuum. Differing disciplinary terminology is discussed at Chapter 4.4. The thesis generally uses the term *health* except where direct participant quotes are given and *health-related outcomes* is used as an overarching term to include health and wellbeing outcomes, risk factors, and determinants of health. Such a broad definition of health has direct methodological implications in this research. For example, the research questions are developed to look broadly at pathways to health impact across that complex web (see also Chapter 4.5).

Two particular gaps have been described around the importance of a holistic definition of health and the importance of the street scale. This research therefore focuses both on the physical and

social environment at the street scale and uses a broad definition of health and wellbeing to do so.

1.8 Health practices in the residential street

This research has developed logically from the understanding of the strengths of – and gaps – in the existing evidence base. One such gap is the need for increased understanding of the processes, mechanisms, and pathways to health impact in the street environment. This drives the rationale in this research to focus at that systemic level, and not for example on a narrower set of environment characteristics and / or health topics. The street setting demanded investigation as a socio-ecologic health setting and this required development of a suitable research design through which to investigate that.

The activities and social practices of people in the street have already been mentioned. The simple starting point for the research design was to investigate what those activities were. Practice theory was used as part of the methodology in the research. Investigating *social practices* as *health practices* links to public health thinking and responds to the challenge Cohn (2014) sets out that there is a need to move away from deterministic approaches to health – including health behaviours and a focus on the individual – and to address the social and environmental context. Cohn argues that health practices as a phenomenon can support doing so by refocusing on a "whole variety of social and material factors." (Cohn, 2014, p.160)

Practice theory also links with urbanism and urban health: Knöll and Roe posit the concept of "health-related everyday urban practices" (2017, p.502) in their work on adolescent health. Knöll and Roe describe health practices as, "dynamic patterns of actions (travelling, learning, eating, working, hanging out with friends and family, etc.) manifesting in sequences of settings (home, school, open spaces, etc.)." (2017, p.502)

Health practices therefore are used to frame the research questions as the phenomenon of interest. Health practices perform a practical role of linking together theories in these different disciplinary areas.

1.9 Covid-19: whole population, government led interventions on health practices in the street

When ethical approval for this research was received in January 2020 it was not known that within weeks there would be a government led intervention, at a whole population level, restricting people's everyday practices in the street: something the ethics committee would undoubtedly have refused had it been proposed as part of this research! Fieldwork from May 2020 onwards was undertaken at a time when many people were forced by circumstance to reappraise things previously taken for granted. For example, what it is to have good health, everyday freedoms and practices previously taken for granted, and the role of local environments in enabling or restricting activities like going outdoors. The research must then be viewed in this context of Covid-19.

This context and rationale section has outlined how the street scale became the focus of this research, and health defined holistically within this. It has detailed how health practices provided a theoretical lens to address health practices as the phenomenon of interest in the street setting.

1.10 Research aim

This research aims to evidence the residential street environment as a health setting.

1.11 Research questions

To address the research aim the main research question links three key components together: the phenomenon of health practices; the setting of the residential street environment; and the relationship between both of these and health.

These components are illustrated in Figure 2. The main research question is:

> What are people's everyday health practices in their residential street environment; which street environment characteristics impact those practices; and how are these both to be understood within a socio-ecologic paradigm of population health?

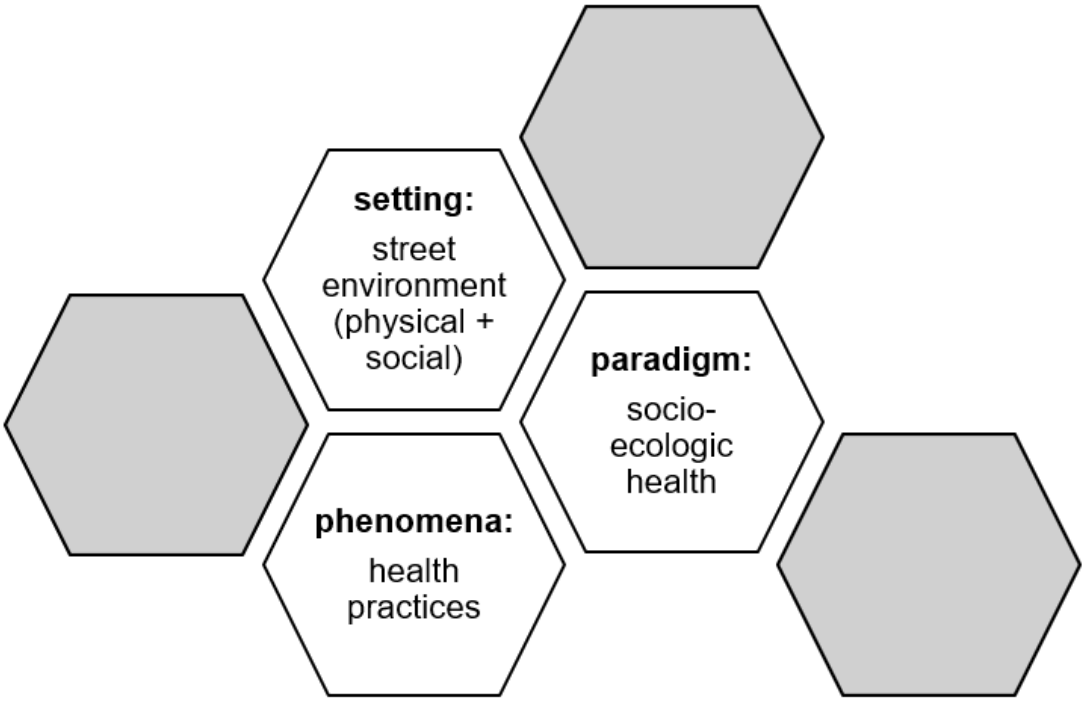


Figure 2: Key Components of Research Question

This multi-faceted main question is broken down into a series of pre-requisite questions: i) what are residents' everyday practices in the residential street environment; ii) do these practices relate to residents' health and if so how; iii) do street physical environment characteristics impact on these health practices and if so how; iv) how can any pathways to health impact linking health practices and street environment be understood within the socio-ecologic paradigm of population health?

A series of supporting or co-requisite questions were also developed: i) how do residents define 'My Street', their perceived boundaries of the street where they live; ii) describe sampled participants from a range of perspectives including demographics and current health status; and iii) describe the physical environment of sampled streets from a range of perspectives including a variety of visual and design practice approaches.

1.13 Area of research

This thesis links to an area of research that has variously been termed *healthy urbanism* (Pineo, 2022) or *healthy placemaking* (Design Council and Social Council UK, 2018). It seeks to address environmental and social determinants of health at a population level. It is a practice-oriented area that views human and planetary health as essential components in sustainable development (Barton, Grant and Guise, 2021). Values are intrinsic to this area of research including working to address issues of social justice.

It is a transdisciplinary area (Pineo, 2022; Lawrence and Gatzweiler, 2017) linking population health to the built environment. In this research that includes thinking from public health, urban health, urban design and urbanism, and sociology. Urbanism in this thesis denotes an expanded area of research beyond the disciplinary norms of urban design, beyond physical space to include the "…structures and dynamics that actually shape cities…" (Inam, 2022, p.655) and in this research, shape streets.

A focus on the street environment requires linking areas of research on streets from different disciplines (Hubbard and Lyon, 2018; Transport for London, 2017; Global Designing Cities Initiative, 2016; Young *et al.*, 2010; Davis and Huxford, 2009; Appleyard, 1981) including streets as a "…healthy local human habitat…" (Barton, Grant and Guise, 2021, p.1). This research links to concepts of urban-ness. The street in this research is not defined *a priori* as an urban space for methodological and contextual particularities including a Welsh context which are reviewed later (Chapter Section 2.1.7)

1.14 Theoretical stance

This research is framed within the socio-ecologic paradigm in public health. The overall methodology has been designed to select appropriate components responding to the research questions. A constructivist-interpretivist epistemology is used within a relativist ontology. This means the phenomenon of health practices is investigated as a social construction through a joint process of interpretation by participants and researcher. Reflexivity about the researcher's position therefore forms an important part of this theoretical stance. Figure 3 summarises this methodological arrangement (see Chapter 3.0).

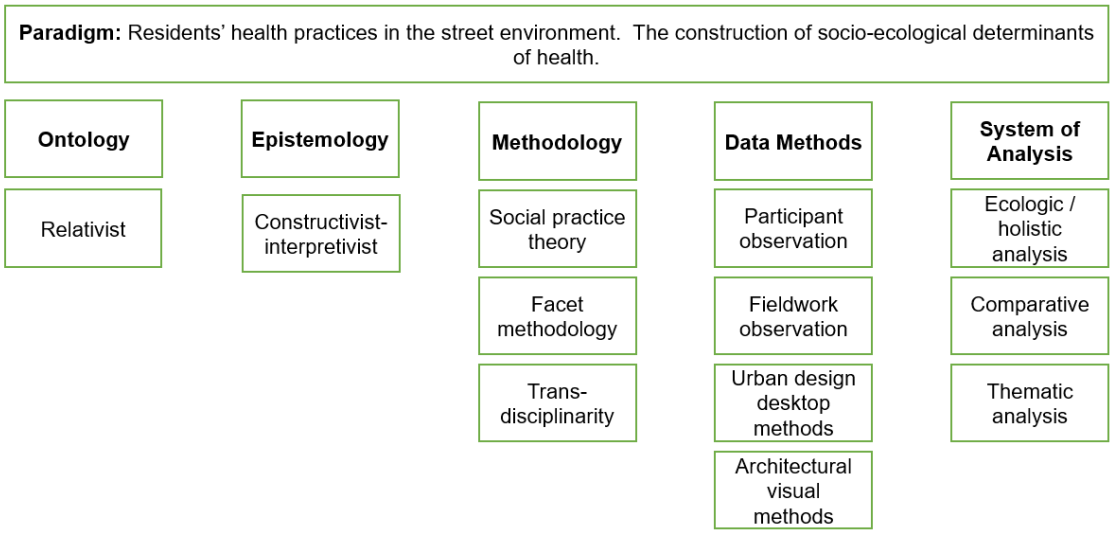


Figure 3: Methodological Framework

1.15 Reflexive researcher motivations

My motivation for this research comes from my conclusion, after 20 years' professional experience as an architect, that the practice and profession of architecture is failing to deliver on creating health and wellbeing despite claiming to do so. This failure, in my professional experience with responsibility for multidisciplinary teams, extends systemically to the wider built environment professions and sector. The disaster at Grenfell Tower is a shocking yet predictable outcome of this failure and as Samuel states, "…provides clear evidence of the failure of the construction industry to protect vulnerable people." (2018, p.17)

This motivation is not based on detached, theoretical observations and three examples are given to illustrate this. These examples also further problematise the research context from a practice perspective. First, was direct experience as part of a large design team for Glasgow's new 'super hospital', opened in 2015 at a capital cost approaching one billion pounds. This wonderful professional experience on an advanced healthcare treatment facility left me wondering, 'where is the equal and equivalent investment in keeping people healthy in the first place'? My professional training however did not give me the skills to define this question further, impeding my ability to address it.

Second, was involvement as an industry partner on a research project looking at learning outcomes of primary age children in different classroom environments (Barrett *et al.*, 2015). This study evidenced that school learning environments matter for learning outcomes and I was very motivated to be both involved in translation of findings into practice and to understand that practitioners could perform a meaningful role in research. However, I came to understand that the use of evidence and evaluation in built environment practice isn't the norm, for example, an industry survey of UK architectural practice found less than three percent undertaking evaluation of completed projects (Clark, 2015).

Third is my direct experience of, and supporting evidence for, systemic unethical practice in the built environment sector and the resultant harm to health from this. From my professional experience, my client at a UK police force convicted of corruption was not the most unethical example I observed, with at least one other example knowingly creating health risks for vulnerable population groups such as due to fire safety. Systemically, during my professional experience since 2003, 103 construction firms including some of the largest construction companies in England participated in illegal price fixing (Competition and Markets Authority, 2009); and over 30 UK construction companies including eight of the largest in the UK participated in systematic and illegal blacklisting of construction workers including those who raised concerns about health and wellbeing in the sector (Designing Buildings, 2021). The Grenfell Inquiry is yet to report its findings, pending this it has been noted that for the construction industry, "…despite Grenfell and other notable examples over the past decade… there has been little progress in addressing these systemic industry failures." (Oswald *et al.*, 2021, p.951) These are not just systemic technical failures but also ethical ones in the built environment sector both for individual practitioners and for professions collectively (Roberts, 2018).

These observations motivated me to undertake this research to: better address interventions for population health particularly in the built environment; develop skills for using evidence informed approaches; and to operationalise this learning for ethical practice. This motivation could also be described as delivering on professional ethical standards including those found in public

health and, albeit only recently, in architecture (Royal Institute of British Architects, 2019, 2021; Faculty of Public Health, 2016).

1.16 Research activities and timeline

The research activities were developed from the research questions and in response to the methodology, system of analysis, Covid-19, and available resources. The research has been undertaken part-time over seven years (three and a half years full time equivalent); broad timescales are indicated below by part-time year of study. Figure 4 illustrates the research objectives and timeline. This process involved recursive development throughout.

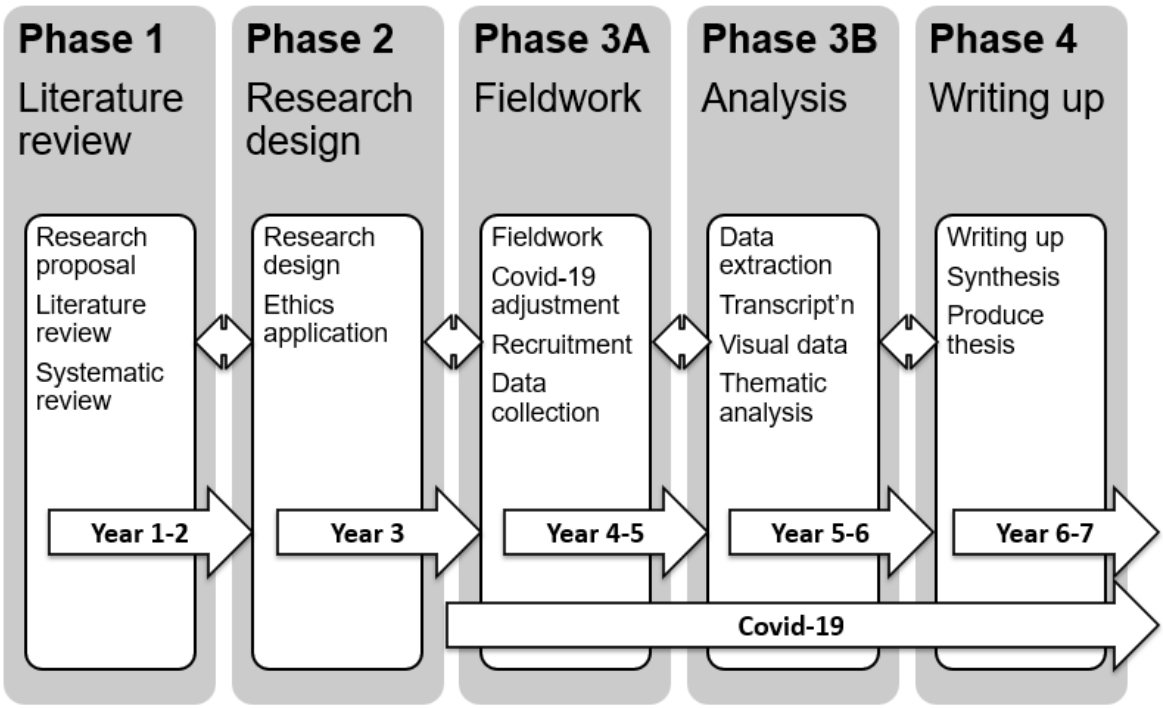


Figure 4: Objectives and Timeline

Phase 1: literature review (Year 1-2)

This phase included development and approval of the research proposal and conducting a systematic review of the literature.

This systematic review was undertaken as a module within health psychology and written up as a journal article. A key refinement from this stage was to extend the focus of the research from

non-communicable diseases to a broader definition of health: physical, mental, and social. This phase involved the first disciplinary transgression into public health and health psychology.

Phase 2: research design (Year 3)

This phase included research design, and ethics application, review, revision, and approval (ethics approval reference: FET.19.10.015, received 30 January 2020).

This was an intensive stage of research design development, resulting in health practices being selected as the phenomenon to investigate. Reflexively, this phase saw an important and timely shift in my thinking and understanding of the street as a social environment as well as a physical one, requiring further disciplinary crossing into social theory, and sociology.

Phase 3: 3A fieldwork (Year 4-5) and 3B analysis (Year 5-6)

This phase included fieldwork preparation and adjustments due to Covid-19 in close consultation with my supervisory team and constant consideration of ethical implications. Participant information including a booklet and video was produced. Pilot participant observations (semi-structured interviews) were undertaken and with small adjustments following reflection, the main fieldwork proceeded.

Participant recruitment was a significant investment of time to ensure the sampling criteria were met including a heterogenous range of ethnic identities: a strength of the sample. Following recruitment, participant (n=20) and street (n=18) observations were completed over 10 months from May 2020. In parallel, desktop data were also collected and extracted.

Time spent in participant recruitment was important due to the potentially stressful circumstances of Covid-19, to build trust, and to support participant wellbeing. Ultimately this extra time paid dividends in the quality of data collected.

The analysis sub-phase followed sequentially with: data extraction including transcription of interviews; collation of visual data and desktop data (participant demographics; street characteristics; etc.); and a modified reflexive thematic analysis (Braun and Clarke, 2022) was undertaken.

Whilst carried out as planned, this phase was where the real integrative work happened across the whole methodology. It was also necessary to address the impact of having collected separate participant and street observations, which was a change of methods resulting from the impact of Covid-19.

Phase 4: writing up, review and revision, and submission of thesis (Year 6-7)

This stage involved synthesis of findings and producing this thesis.

1.17 Thesis outline

The thesis is structured in five chapters (Figure 5) which follow the sequence of the objectives. Selected materials are included in appendices also.

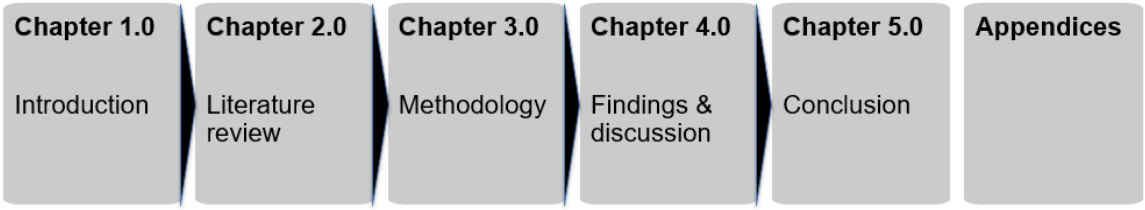


Figure 5: Thesis Structure

The research has produced a large amount of data. This includes both qualitative data extracts (176,000 words transcribed from 22 hours of participant observations) and visual data (such as that presented at Appendix 1) that have informed the findings. In preparing this thesis, strategic and pragmatic selection of data presented has been made. The thesis contents are necessarily focused on addressing the research question.

The first chapter is this introduction.

The second chapter is a literature review in two parts: the first part situates this research topic and the street as a field site from an interdisciplinary perspective across public health, urban health, urban design, and social theory. The second part is a systematic review of the literature.

The third chapter addresses methodology at all levels, as shown previously in Figure 3, as well as a description of the sample.

Chapter four presents combined findings and discussion. Findings start from the semantic and move to the latent, and from descriptive to more conceptual. The chapter is split into two main parts. Part 1 which comprises the largest part presents granular and disaggregated findings for: street physical environment (including visual analysis at Appendix 1); street social environment – health practices; and health and wellbeing-related outcomes. Part 2 presents high level, complex, and aggregated findings for: ecological pathways to health impact in the street; the street as a health setting; and the street a field of transdisciplinary knowledge. The chapter ends with discussion of methodological findings. Figure 6 illustrates the described chapter structure.

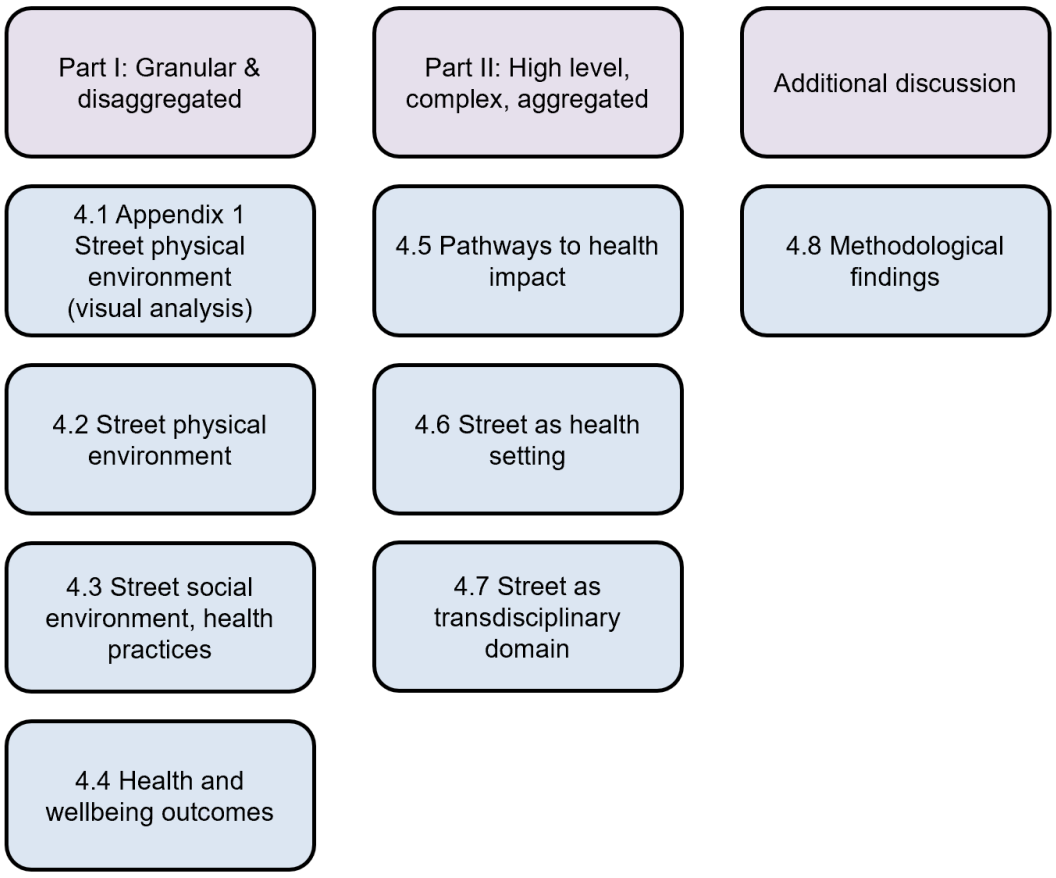


Figure 6: Diagram of Chapter 4, findings sections

The fifth and final chapter addresses: contribution to new knowledge; limitations; researcher personal reflections; conclusion of the thesis; and recommendations for practice, policy, and future research.

1.18 Contribution to knowledge

The broad contribution this research makes is to take the socio-ecologic paradigm of health further: to address not just the wider social and environmental determinants of health but the wider, wider determinants in all their ecologic complexity.

Healthy streetlife is a salutogenic orientation to healthy streets that integrates the physical and social. The term 'healthy streetlife' in this thesis encapsulates this orientation, it is how this thesis addresses the topic of healthy streets but also differentiates and emphasises the contribution to new knowledge this thesis makes compared to other approaches including the Healthy Streets (2024a) approach (see Chapter 2.1.7).

The contribution to knowledge also includes (see Chapter 5.2): a new approach, arguing for the street as a health setting and an important scale in its own right with healthy streetlife as central component of this; a new method, both in combination of methods and response to Covid-19; new data, including several new datasets; a contribution to an understudied area – both the street as a place, and an area in time during the Covid-19 pandemic; and new findings, relating to health practices, street environment, and ecologic pathways to health impact in the street setting.

1.19 Chapter Conclusion

Having introduced the thesis, Chapter 2.0 Literature Review now situates the research in relation to the existing literature including from a disciplinary and theoretical perspective. Its purpose includes addressing the requirement to, "…demonstrate a critical understanding of the current state of knowledge…" (UWE Bristol, 2023).

Chapter 2.0 Literature Review

This chapter firstly presents the street in context through the different disciplinary perspectives of urban design, public health, urban health, and sociology. The second part of this chapter presents findings from a systematic review of the literature.

2.1 Literature Review, The Street in Context

2.1.1 Introduction

This section situates the street and the research design in context through different disciplinary perspectives and theories. It underpins Chapter 3 Methodology which explains how these different perspectives were brought together within the research design. Firstly, an overview is provided.

Urban design: is a new discipline developed since the 1960s, it exists between planning (city scale) and architecture (buildings) and is both a creative design and analytical discipline. In this research it is somewhat used as a placeholder for broader built environment disciplines and design practice too, particularly architecture and planning.

Public health: this research is specifically situated within the fourth paradigm of public health – the socio-ecological paradigm. This has been current and increasingly mainstreamed in the discipline since the 1990s.

Urban health: an emergent field / discipline, increasingly since the 2000s. Urban health is situated across public health and some built environment disciplines. 'Urban' is a contested term, for example, contributing to an arguably artificial urban / rural separation. Urban health tends to focus at the city scale and so the street is often overlooked. The WHO Healthy Cities programme is a settings-based approach that incorporates elements of urban health thinking.

Sociology: in this research is drawn on both from a theoretical perspective around social life and for the street as a fieldsite. Sociology relates to economic, social, legal, and sensory structures in the street (Dines, 2018). Sociological concepts in this research include

foregrounding the materiality of the street, rhythms / patterns of streetlife, the street as a social production (e.g., Lefebvre, 2004; Berman, Marcus and Sclan, 2017); everyday streetlife (Jones, 2018); “everyday life sociology” (Adler, Adler and Fontana, 1987, p217 at p1004); and everyday practices (De Certeau, 1984).

There is overlap with other disciplines too, which are not detailed here but are acknowledged. Figure 7 shows how these are seen as relating to each other and the street in this research. Colouring indicates a main link between public health and urban design. Urban health spans these two and sociology is distinguished as it is linked primarily at the level of concepts and theories. The size and relative position of the elements here show the primary relationships and overlap, secondary connections are not shown.

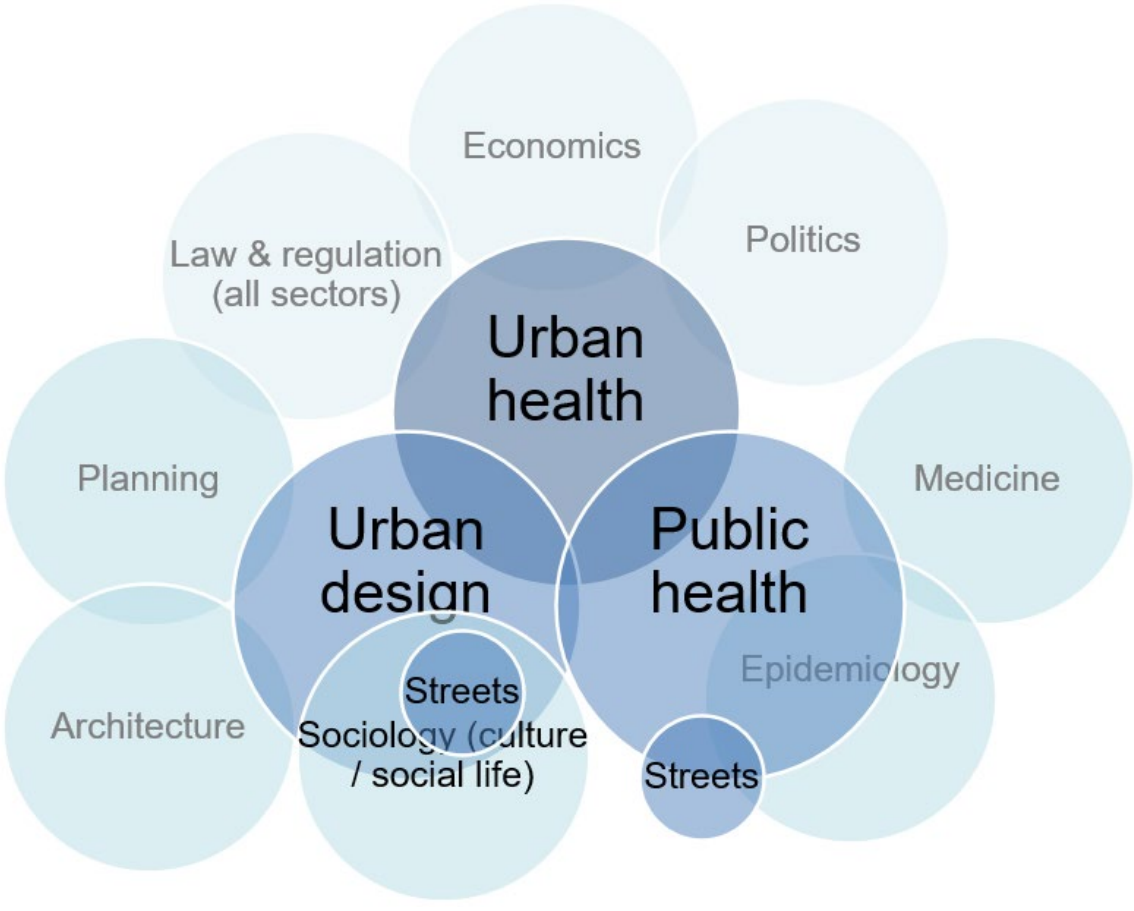


Figure 7: Illustration of disciplinary intersections of research topic and the street, primary connections only

The following sections provide further detail for each discipline.

2.1.2 Urban design

Street origins

> Nearly everyone in the world lives on a street. People have always lived on streets. They have been the places where children first learned about the world, where neighbors met, the social centers of towns and cities, the rallying points for revolts, the scenes of repression. (Appleyard, 1981, p.1)

Streets are a human creation, and the history of streets is entwined with the history of humanity. The first streets are not identified in literature but are assumed to have emerged with the development of cities although, one of the earliest cities, Çatalhöyük, in fact had no streets with tightly packed buildings being accessed over rooftops. Nevertheless, by the time Pompeii was built (~70BCE) streets as we recognise them were established with pavements, carriageways, and lined with buildings either side.

The street environment is part of the wider built environment, the next scale up from the more private space of the individual dwelling or house: yet smaller than the neighbourhood scale. The Global Street Design Guide defines a street as:

> …the basic unit of urban space through which people experience a city. It is often misconceived as the two-dimensional surface that vehicles drive on when moving from one place to another. Streets are, in fact, multidimensional spaces consisting of many surfaces and structures. They stretch from one property line to another, including the building edges, land uses, and setbacks that define each side. They offer space for movement and access and facilitate a variety of uses and activities. Streets are dynamic spaces that adapt over time to support environmental sustainability, public health, economic activity, and cultural significance. (Global Designing Cities Initiative, 2016, p.4)

A wide range of actors are involved in creating, designing, or otherwise influencing the built environment and the range of these actors has increased over time (The Farrell Review Panel,

2014). They include: street residents, town planners, urban designers, landscape architects, architects, building contractors, property developers, a broad range of local authority departments, civil engineers, highways engineers, transport planners, and lighting and utilities engineers. The UK Manual for Streets contains a different list of "…those with a part to play in the planning, design, approval or adoption of new residential streets, and modifications to existing residential streets." (Davis and Huxford, 2009, p.12) Notably this definition does not include the residents of streets themselves as active agents able to create change.

The street physical environment may appear to be a singular entity but in fact is comprised of a wide range of aspects including but not limited to: engineering features, housing design, green infrastructure, accessibility features, utilities, and water management. Within each of these there are many individual sub-items or characteristics. In this research all these aspects and the sub-items within them are defined as *street physical environment characteristics*.

The systematic review for this research (Chapter 2.2) reports 244 different street physical environment characteristics synthesised into categories of: land use and mix; urban and housing design; micro-climate; green infrastructure; identity; public transport; walking and cycling; motor vehicles; facilities; security and safety. All except for micro-climate are associated with non-communicable disease risk factors.

Urban design is the main discipline that aims to bring all these elements together and address street design holistically. Practitioners of urban design in the UK are often architects or planners with their professional bodies established over a century ago. Urban design by contrast is a relative newcomer. As this mix of professionals suggests, urban design definitions are not universally agreed, "The lack of a common understanding of what urban design is about is an issue that needs to be resolved." (Cozzolino *et al.*, 2020, p.36)

Much thinking on urban design is focused on the development of cities and urban environments. This research is more interested in the street as objectively part of a *built-up* area rather than an *urban* one as urban is not a neutral term. Jacobs (1962) traces thinking on cities from Ebenezer Howard (Howard, Mumford and Osborn, 1946; Howard, 1898) and the Garden City movement through thinkers such as Patrick Geddes' (1949) approach to regional planning.

Black and Sonbli (2019) trace urban design through diverse twentieth century philosophies including those that Jacobs had identified nearly six decades earlier including the city beautiful movement and The Athens Charter (Le Corbusier, 1973). Jacobs had earlier argued that these approaches are problematic and detached from an understanding of how cities actually function:

> From beginning to end, from Howard and Burnham to the last amendment on urban-renewal law, the entire concoction is irrelevant to the workings of cities. Unstudied, unrespected, cities have served as sacrificial victims. (Jacobs, 1962, p.35)

This background is important to understand because Garden City principles remain influential to the present day including for their stated health benefits (Town and Country Planning Association, 2023). It is notable that whilst contemporary scholars trace a similar lineage to early thinkers like Jacobs that a number of these earlier critiques remain unresolved and are in tension in current thinking and practice.

Urban design as a discipline emerged from The Harvard Conference in 1956 (Black and Sonbli, 2019), formative literature followed (e.g. Alexander, 1967; Jacobs, 1962; Cullen, 1961; Lynch, 1960) and later consolidated including Towards an Urban Design Manifesto (Jacobs and Appleyard, 1987). Streets are an integral part of much of this literature, Appleyard is noted for a focus on the street and the concept of liveable streets (Appleyard, 1981; Appleyard and Lintell, 1972). Streets are central to Jacobs' analysis, identifying their vital role in safety; for social contact; and as a space for children.

In contrast to some examples that exclude residents as active agents in the city, people and city functioning are central to Jacobs' formative analysis. As noted in Chapter 1.0, Jacobs identifies the importance of contact, of trust between people, and of small everyday exchanges including at the street scale (Jacobs, 1962). Jacobs' recognises residents as key actors in the street not as "passive beneficiaries" but rather "active participants" (Jacobs, 1962, p.39). In this research these activities in are investigated as potential health practices.

Jacobs emphasises streets as some of the most important spaces in the city and the main public space in a city:

> “Streets and their sidewalks, the main public places of a city, are its most vital organs. Think of a city and what comes to mind? It’s streets. If a city’s streets look interesting, the city looks interesting; if they look dull, the city looks dull.” (Jacobs, 1962, p.39)

The street is closely related to urban design and its development as a discipline but has not always been centred in subsequent decades. The same is true for residents, the physical environment has sometimes been prioritised over the social environment. Today, the challenge for streets includes domination by motor vehicle traffic and for Black and Sonbli it is necessary to “re-orientate thinking to consider streets as public places, accessible to all.” (Black and Sonbli, 2019, p.113) These risks, notably from motor vehicle traffic, were foreseen in Jacobs’ work in the 1960s in New York – the impact of this has intensified and spread so that for urban design scholars and practitioners in other contexts globally the problems have grown in size and intensity. While the proposed solutions to address them are similar, a focus on places for people, the inertia needed to shift practice – after over half a century of development in the opposite direction – is even greater than the very large effort already needed by early innovators like Jacobs.

The street within urban design

Defining urban design and therefore locating the street within it has remained elusive over time. Black and Sonbli (2019) attempt to describe tacit practitioner knowledge defining urban design as, “…the process of providing quality contextual places for people.” (Black and Sonbli, 2019, p.21) The street can therefore be viewed as part of creating such places. Responding to contemporary context such as the climate crisis, Black and Sonbli emphasise urban design as comprising both theoretical and vocational application through design and the, “…production of quality sustainable places.” (2019, p.7)

Urban design operates at a particular spatial scale which relates to disciplinary norms, “…between the scales of the town planner and architect, shaping neighbourhoods and places through effective engagement with local context.” (Black and Sonbli, 2019, p.10) This scale is broken down further yet the street is not explicit within this, “…the city / regional scale; the neighbourhood / district scale; and the site / block scale.” (Black and Sonbli, 2019, p.22) The

inclusion of neighbourhood here is notable, as previously identified the neighbourhood scale has been privileged compared to streets in the literature: a systematic review of Urban Health Indicator tools identified (Pineo, Glonti and Rutter, 2018) 30% being at the scale of the neighbourhood whereas only 9% are at scales smaller than the neighbourhood.

Black and Sonbli's definition represents a mainstream view of urban design. It is capable of being critiqued and Jacobs stated much earlier that a focus on neighbourhoods as a spatial scale is harmful, "Neighbourhood is a word that has come to sound like a valentine. As a sentimental concept, 'neighbourhood' is harmful to city planning." Jacobs proposes a different set of spatial scales: "street neighbourhoods" (1962, p.127); districts at the sub-city scale; and the city as a whole.

Jan Gehl is a formative urban design thinker whose book, Life Between Buildings: Using Public Space (2012), first published in 1971 addresses the outdoor spaces between buildings. This is written from a Danish context and is part of the same school of thinking as Jacobs and Appleyard. Gehl does not privilege the street but streets are often what comprises this outdoor space. Gehl is also notable for seeking to address a gap he perceived in a lack of focus on the activities and social life of outdoor space including streets noting that this comprises, "the entire spectrum of activities, which combine to make communal spaces in cities and residential areas meaningful and attractive." (2012, p.11) Gehl identifies three types of activities: necessary (e.g. going to school or work), optional (e.g. taking a walk for leisure), and social (e.g. greeting others / conversations). As this thesis will explore the impact of the Covid-19 pandemic had a profound impact on such activities in the street.

The street as a social unit itself is closely linked to the street social environment in this research and the relationship of that to the street physical environment. Whilst there is evidence of the street social environment being addressed in urban design there remains a tension between more deterministic views of its relationship to the street physical environment and an everyday practices perspective where citizens recreate the street space around them through their everyday practices.

Urban design principles applicable at street scale

Urban design characteristics that contribute to place quality including at the street scale are described as: “Places for people… Character… Mixed uses… Continuity and enclosure… Quality of the public realm… Legibility and transparency… Adaptability… Diversity/complexity… Nature and landscape… Human-scaled…” (Black and Sonbli, 2019, pp.27–34) These characteristics are delivered through a range of design elements again all with relevance to the street: “Urban blocks…, Public realm…, Green infrastructure…, Routes…, Movement…, Buildings…, Corners…, Frontage / access and service provision…, Character…, Technical design and detail…” (Black and Sonbli, 2019, pp.111–133) There are many more aspects within each of these, some key concepts for streets are: movement, which should prioritise walking and cycling; public realm, which should support human activity, such as playgrounds, free seating, facilities for young adults, shops, cafes, bars; and street hierarchy.

Street hierarchy defines streets as: major, intermediate, or minor roads (Black and Sonbli, 2019) which is mainly related to the function of the street as a road. The patterning such networks of streets create are part of the urban grain (Black and Sonbli, 2019) which is an area of research in its own right and not the focus of this research, for example space syntax methodology (Al Sayed *et al.*, 2014).

Street in urban design practice

Urban design is both a theoretical and practically oriented discipline. Manual for Streets (Davis and Huxford, 2009) and Manual for Streets 2 (Young *et al.*, 2010) are key references for UK street designers (Black and Sonbli, 2019). A Manual for Streets 3 was due in 2023 (Chartered Institution of Highways & Transportation (CIHT), n.d.), although the UK Department of Transport has decided, “to deprioritise this project” (Department for Transport, 2023). Whilst aiming to shift focus in the street, the existing guidance still places primacy on the street’s role as a highway:

> For the purposes of this document, a street is defined as a highway that has important public realm functions beyond the movement of traffic. Most critically, streets should have a sense of place, which is mainly realised through local distinctiveness and sensitivity in design. They also provide

> direct access to the buildings and the spaces that line them. Most highways in built-up areas can therefore be considered as streets. (Davis and Huxford, 2009, p.12)

Streets are distinguished from *roads* and *highways* and have additional functions beyond movement including: “Place…, Movement…, Access…, Parking…, Drainage, utilities, and street lighting.” (Davis and Huxford, 2009, p.17) The social street environment is recognised within this and “the community function of streets as spaces for social interaction” (Davis and Huxford, 2009, p.13) is stated as one of thirteen main changes this guidance was intended to promote. Health is not entirely absent from this guidance but only appears as a co-benefit of more walking and cycling resulting in reduced motor traffic (Davis and Huxford, 2009). This UK guidance takes a narrower view of health than some newer internationally focused thinking (Global Designing Cities Initiative, 2016).

This research uses a broad urban design definition of the street, “A cluster of dwellings often developed at the same time, with shared identity or character, grouped round a common access (e.g. square, street, cul-de-sac or shared semi-private space)...” (Barton, Grant and Guise, 2010, sec.32).

Detailed design of the street

It is important finally under urban design to highlight the very detailed small scale that urban design addresses in the street. Whilst this may seem like the strict domain of urban designers and other built environment professionals, the next part of this chapter will evidence how 150 years ago these were exactly the level of detail that public health practitioners engaged with.

This literature review is not intended as a design guide, examples of items that would be considered in street detailed design include:

“…street types, parking standards, junctions, height to width ratios, building sizes, set back dimensions, green infrastructure dimensions, open space standards, and typical street furniture and related installations / services.” (Black and Sonbli, 2019, p.109)

In this research, the street environment is considered at this small scale of detail as well as for those more cross-cutting design elements such as character and movement.

To conclude this review of the street in urban design it is notable that many of the challenges identified by earlier thinkers in urban design remain to this day, nearly six decades after emerging as a discipline. It is noted that the key researchers and theorists in this field predominantly have a geographical focus from North America and Europe. These have differing cultures and environmental conditions that affect streets from the conceptual to the detailed scale. They also reflect the socio-economic and cultural conditions within which the discipline has developed. The root-causes of challenges such as climate change and the impact of motor traffic on space can be clearly seen in early urban design thinking. Today these have grown significantly and spread to be issues experienced in many countries. Key conceptual issues remain contested and matters of debate: such as a focus on neighbourhoods or streets. This can be viewed positively as an opportunity that urban design continues to evolve, is not fixed, and there are opportunities to shape future directions with evidence-informed research.

2.1.3 Public health

The socio-ecologic paradigm in public health is central to this research and incorporates a holistic conception of health (World Health Organization, 1946); set on a continuum – a salutogenic approach (Antonovsky, 1996); health as a complex system (Rutter *et al.*, 2017); and a settings-based approach (World Health Organization, 1986).

Population health is a central concern for public health. Definitions of public health are not universally agreed (McClean *et al.*, 2020), one definition is:

> "Public health" refers to all organized measures (whether public or private) to prevent disease, promote health, and prolong life of the population as a whole.
>
> (World Health Organization and World Trade Organization, 2002, p.23)

McClean *et al.* (2020) highlight several critical components that define public health and these link strongly with this research. They include: a focus on the wider determinants of health; a

systems and socio-ecologic conceptualisation of health; the dual aspect of health being related to people and also settings or environments; and finally, a commitment to reducing health inequalities and addressing social justice.

These components also reflect the socio-ecologic paradigm in public health which is identified as a potential transdisciplinary bridging point in this research (Drane and Carmichael, 2018). Public health has developed through four paradigms so far (McMichael, 1999; Susser and Susser, 1996a, 1996b; Krieger, 1994; Weinblatt *et al.*, 1978). Susser and Susser (1996a) identify: 1) sanitary statistics: miasma paradigm; 2) infectious disease epidemiology: germ theory; 3) chronic disease epidemiology: the black box paradigm (indicated by #3 Figure 8); and 4) eco-epidemiology paradigm (indicated by #4 Figure 8).

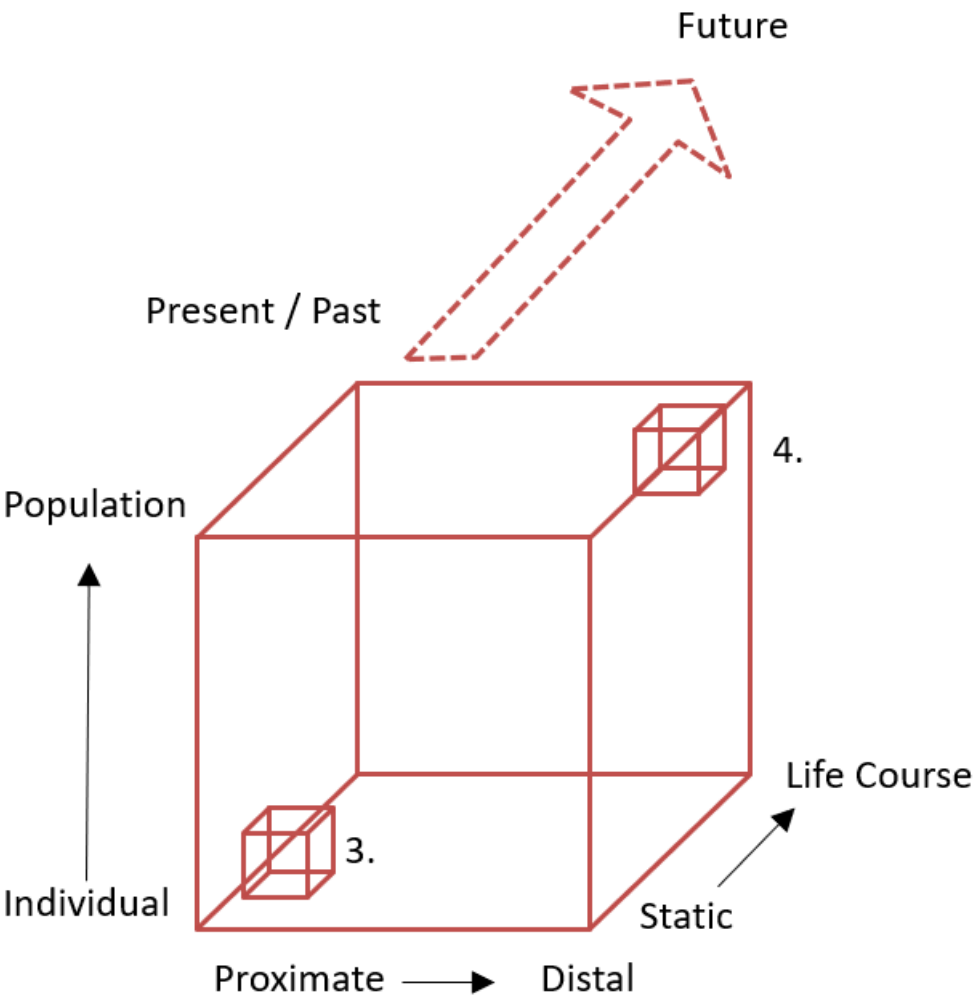


Figure 8: Illustration of shift to socio-ecologic paradigm, redrawn from McMichael (1999)

One driver for a new paradigm was the previous black box paradigm not being able explain empirical findings such as for the link between education and deaths from heart attack (Weinblatt *et al.*, 1978). Krieger argued for a shift from a biomedical focus to an "…ecosocial framework…" (Krieger, 1994, p.899):

> …although the biologic may set the basis for the existence of humans and hence our social life, it is this social life that sets the path along which the biologic may flourish-or wilt. (Krieger, 1994, p.899)

These links have more recently been evidenced to be more complex, with epigenetics evidencing that certain environmental exposures can change human biology (e.g. Cao-Lei *et al.*, 2014).

McMichael called this new paradigm the "social-ecologic systems perspective" (McMichael, 1999, p.887). Ecology is taken, *"liberally to refer to contexts characterized by interdependencies between individuals and groups of humans and their environments."* (McMichael, 1999, p.889) Its four dimensions are best understood as a trajectory from the previous black box paradigm to the socio-ecologic paradigm (as shown in Figure 8). This includes moving: from individual health to population health; beyond proximate risk factors to include distal ones, *"looking upstream for a fuller account of disease causation within a population context…"* (McMichael, 1999, p.891)*;* from life stage to life course; and not just looking backwards at empirical evidence but projecting changes in complex systems to address long term changes that are a risk to whole population health. This new socio-ecologic paradigm also "led naturally to a focus on settings" (Ashton, 1998, p.7) for health promotion.

An orientation in public health to salutogenic and settings based approaches emerged in parallel with the new paradigm in the second half of the 20th century as public health emerged from a "wilderness period" (Ashton, 1998, p.6). A salutogenic perspective considers the need to continually take steps to support health and contrasts this to "curative medicine (downstream) and disease-preventative (upstream)" (Antonovsky, 1996, p.13) approaches. It critiques these as treating health as something that needs treated when it goes wrong or protected from going wrong in the first place. Antonovsky radically contests this proposition and posits human health

as a system that is "*inherently* flawed, subject to unavoidable entropic processes and… death…" (Antonovsky, 1996, p.13). A salutogenic orientation links to settings-based approaches being identified as one of twelve principles for health promoting settings alongside: "…focus on populations, policy and environments; …equity and social justice; …[planetary] sustainability; community participation; …enablement and empowerment; …cooperation; …consensus and mediation; advocacy; … settings as social systems; …sustainable integrative actions; …settings as part of an interdependent ecosystem…". (Dooris *et al.*, 1998, pp.25–27) From this what is important in this research is the position that health is defined as being on a continuum and requiring continual support if it is to thrive. In line with Antonovsky this research does not dismiss downstream and upstream approaches but rather reframes them as methods to be drawn on in support of salutogenesis including "…promotive, preventive, curative and rehabilitative ideas and practices…". (Antonovsky, 1996, p.13)

Public health is also a practiced discipline and previously these theories were rapidly integrated into policy making in a way that can seem bold and innovative today. A policy strategy for England, The Health of the Nation stated:

> Opportunities to work towards… health gains, will be… enhanced if action - above all joint action - is pursued in various discrete "settings" in the places where people live and work. Such settings include: "healthy cities", healthy schools, healthy hospitals, healthy workplaces, healthy homes, healthy environments. They offer between them the potential to involve most people in the country. (Secretary of State for Health, 1992, p.26)

In this research public health approaches means: a socio-ecologic focus on addressing population health; health practices in the street are a lens through which to investigate wider determinants of health; the research investigates health throughout the lifecourse; and supporting future evaluation of health impacts in the street environment. It also means a salutogenic focus on health promotion in the setting of the street environment.

For transdisciplinarity these combined approaches are argued as a potentially valuable bridging point. Public health is already recognised as a multi-disciplinary field with:

> …multiple disciplinary drivers that transcend epidemiology, biomedicine, the social, environmental, human and political sciences, social policy and economics. (McClean *et al.*, 2020, p.xvi)

Whilst approaching the question with critical thinking it needs to also be borne in mind that bringing together different disciplinary perspectives in public health, whilst encouraged, is not necessarily the norm and might be viewed as trying to "subvert convention" (McClean *et al.*, 2020, p.xviii), such arguments therefore requiring justification.

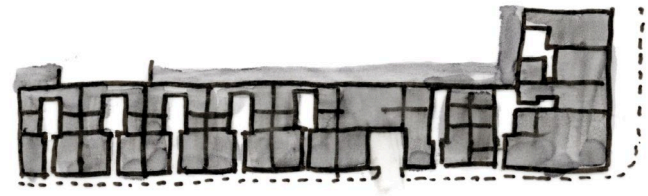
2.1.4 Streets designed by public health

Today the idea of public health practitioners designing a street might seem counterintuitive yet a perspective over time shows this has not always been the case. This section shows how public health has in the past intervened in detailed aspects of street physical environment and how contemporary public health thinking is again embracing the street to address population health. The public health context in Wales is also discussed.

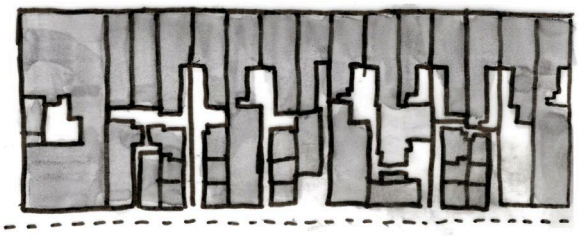
Development planning and public health in the UK were previously closely linked:

> Improvement of the health and well-being of citizens was one of the key factors leading to the development of the planning system before the first World War… (Carmichael *et al.*, 2013, p.260)

A century before this much UK housing in cities comprised courtyard typologies (Figure 9) and these were linked with numerous health problems. Such problems were understood within the sanitary statistics paradigm. At this time John Snow (1855) was investigating cholera deaths in London, an early example of geospatial mapping of disease, and ultimately linking deaths to a water supply, the pump for which he famously removed the handle from. Within a few decades changes to the built environment were mandated led by public health policy makers.



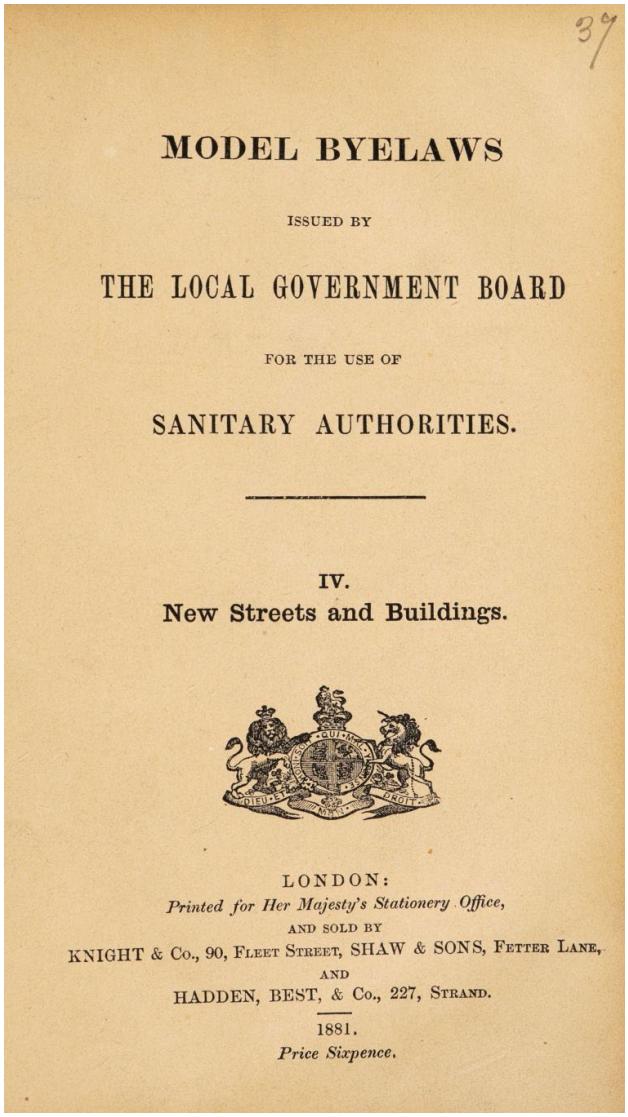
Street pattern: enclosed courts with narrow entries



Street pattern: cottages behind large houses

Figure 9: Illustration of courtyard development, redrawn from Daunton (1983), not to scale

Muthesius (1982) traces the evolution of the terraced house in England outside of London (where changes came earlier) and the significant impact of action by public health. This action included the introduction and subsequent adoption across England and Wales of Model Byelaws (The Local Government Board, 1881) proscribing requirements for streets (Figure 10).



37

MODEL BYELAWS

ISSUED BY

THE LOCAL GOVERNMENT BOARD

FOR THE USE OF

SANITARY AUTHORITIES.

IV.
New Streets and Buildings.

LONDON:
Printed for Her Majesty's Stationery Office,
AND SOLD BY
KNIGHT & Co., 90, FLEET STREET, SHAW & SONS, FETTER LANE,
AND
HADDEN, BEST, & Co., 227, STRAND.
1881.
Price Sixpence.

Figure 10: Model Byelaws for New Streets and Buildings (Source: Wellcome Collection, Public Domain Mark).

These byelaws were detailed including requirements for streets:

- To be level;
- Carriage roads at least 36 feet wide;
- Other streets at least 24 feet wide;
- Streets over 100 feet long to be carriage roads;
- Footways each side 1/6 width of whole street;
- Levels and gradients of falls are defined;
- Kerbs 3 inches minimum - 7 inches maximum; and
- One end of street to have entrance full width of street.

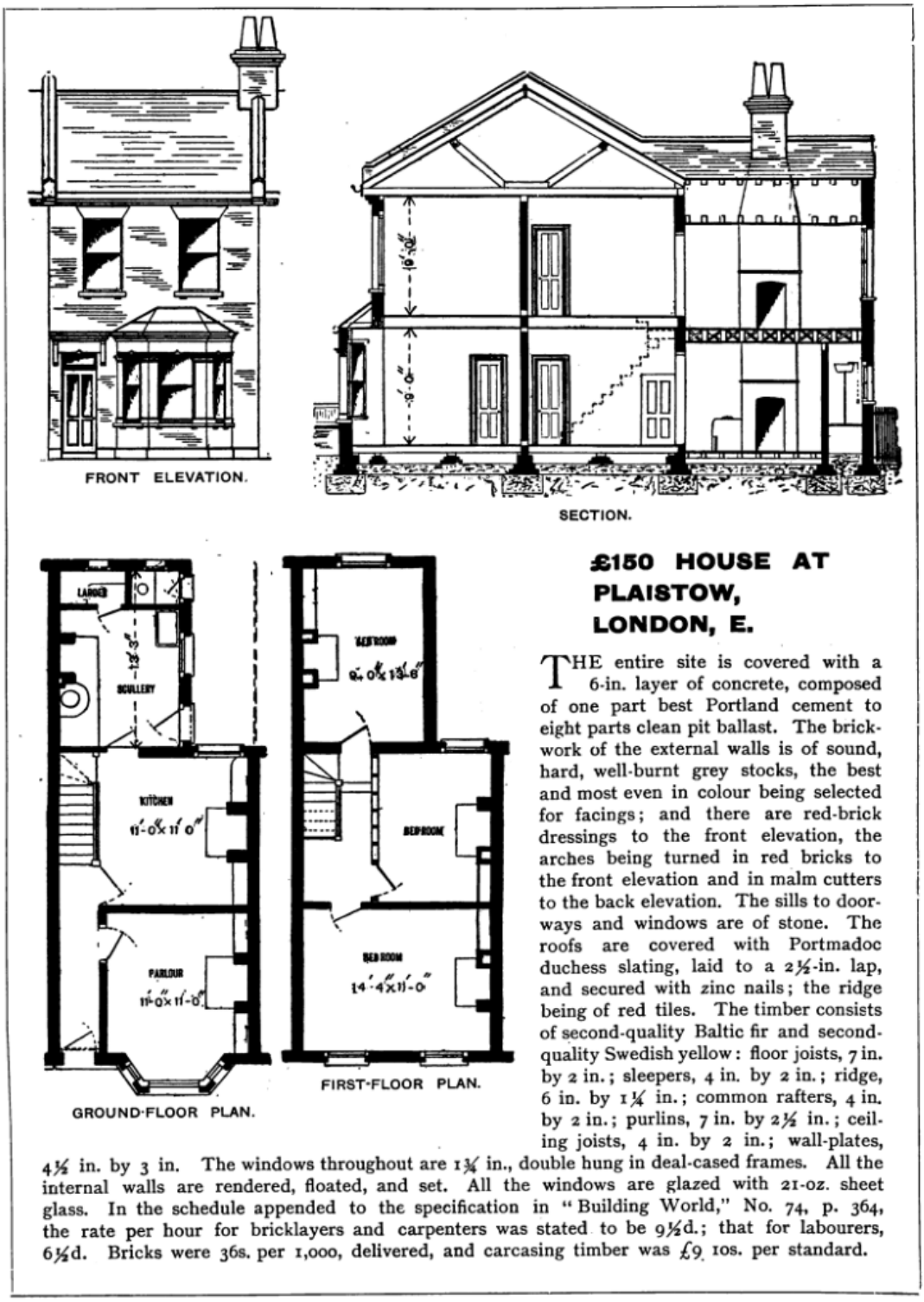
Additional requirements for housing that impact on the street environment included:

- Chimneys 3 feet above highest part of roof;
- 24 feet kept free for ventilation in front of every domestic house;
- Open spaces to be fronted by walls with ‘sufficient’ windows;
- Window required to every habitable room – 1/10th of floor area minimum;
- All windows to be at least half openable.

A simple set of rules created what urban design would call a new *typology*: the bylaw terraced house (Figure 11). Due to the nature of how design rules interact with large scale development this changed city environments with millions of such houses built across the UK. Where the site did not present any obstacles a distinctive street grid pattern (Figure 12) was created. Elsewhere, much land being sold to developers was previously agricultural fields so field boundaries were simply filled with this grid pattern (Figure 13, Figure 14).

These changes were relatively fast, coinciding with the Victorian era, a period of rapid industrialisation including expansion of railways to cities including Cardiff. This period was also one of population growth, political change, expansion of empire, colonisation, and social change. Bylaw housing as a public health intervention should be understood not solely a physical intervention but also an intervention in a complex social context, including for example the “…cult of the home…” (Boardman, 2000, p.159) “…which inserted women into the domestic space and men into the public.” (Boardman, 2000, p.150).

The physical environment of many streets in Cardiff and across the UK today owe their appearance to parameters defined by public health officials in 1881.



£150 HOUSE AT PLAISTOW, LONDON, E.

THE entire site is covered with a 6-in. layer of concrete, composed of one part best Portland cement to eight parts clean pit ballast. The brickwork of the external walls is of sound, hard, well-burnt grey stocks, the best and most even in colour being selected for facings; and there are red-brick dressings to the front elevation, the arches being turned in red bricks to the front elevation and in malm cutters to the back elevation. The sills to doorways and windows are of stone. The roofs are covered with Portmadoc duchess slating, laid to a 2½-in. lap, and secured with zinc nails; the ridge being of red tiles. The timber consists of second-quality Baltic fir and second-quality Swedish yellow: floor joists, 7 in. by 2 in.; sleepers, 4 in. by 2 in.; ridge, 6 in. by 1¼ in.; common rafters, 4 in. by 2 in.; purlins, 7 in. by 2½ in.; ceiling joists, 4 in. by 2 in.; wall-plates, 4½ in. by 3 in. The windows throughout are 1¾ in., double hung in deal-cased frames. All the internal walls are rendered, floated, and set. All the windows are glazed with 21-oz. sheet glass. In the schedule appended to the specification in "Building World," No. 74, p. 364, the rate per hour for bricklayers and carpenters was stated to be 9½d.; that for labourers, 6½d. Bricks were 36s. per 1,000, delivered, and carcasing timber was £9 10s. per standard.

Figure 11: Example of an advert for a bylaw terraced house (Public Domain Mark) (Hasluck, 1908, p.21)

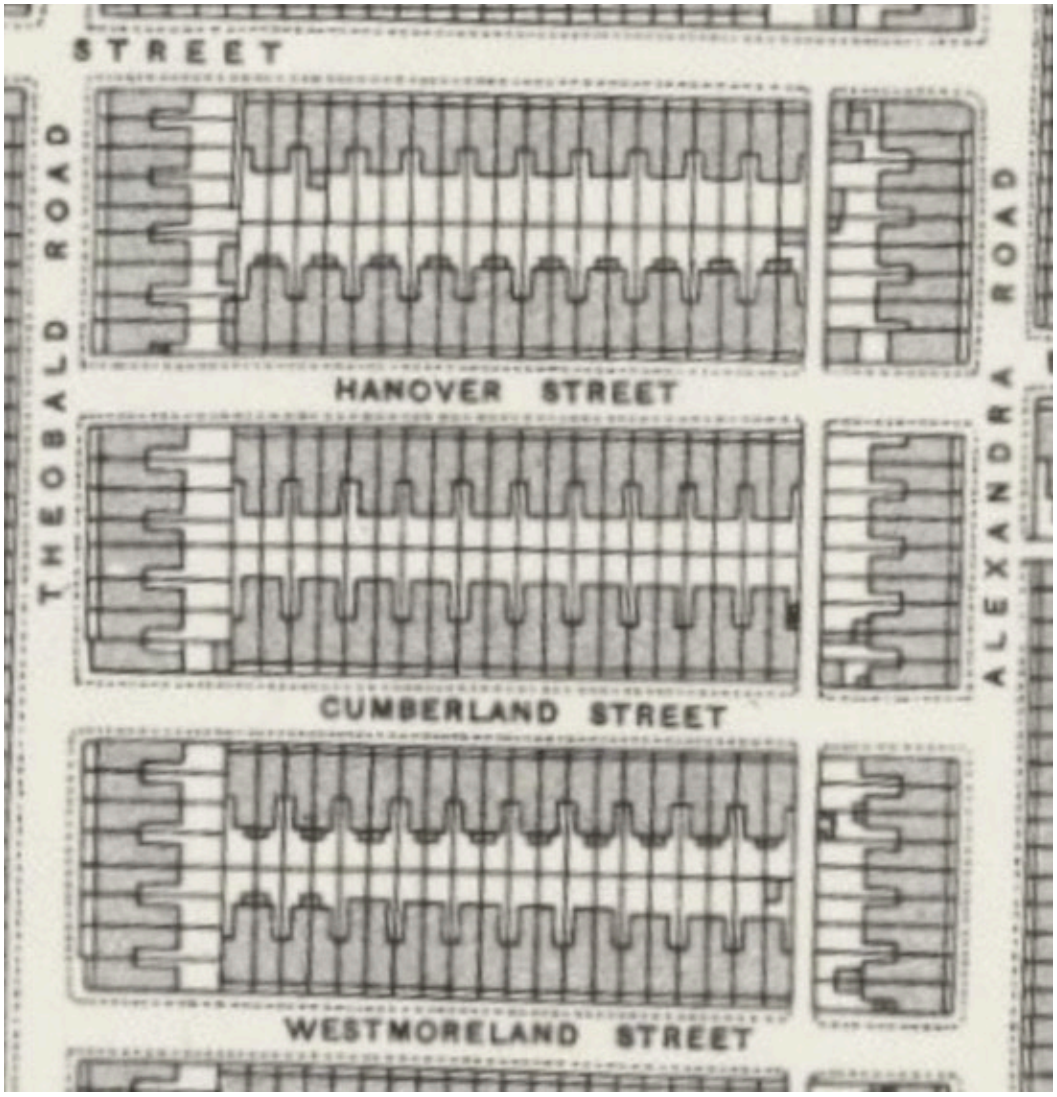


Figure 12: Block layout of bylaw terraced house streets within sample area, Cardiff, 1915. ('Reproduced with the permission of the National Library of Scotland")

Figure 13: Tithe map 1846, Riverside, Cardiff, not to scale (Reproduced with the permission of the National Library of Wales)

Figure 14: Tithe map 1846 (Reproduced with the permission of the National Library of Wales) with 1888-1913 map overlay, Riverside, Cardiff, not to scale (Reproduced with the permission of the National Library of Scotland)

Moving forward in time, during the 21st century, this close integration of urban planning and public health was weakened (Carmichael *et al.*, 2013) leading to calls to reunite them (Carmichael *et al.*, 2016; Petrokofsky, Pinto and Morphet, 2016). This is starting to happen and local environments like streets are increasingly recognised as important health settings globally. The Jakarta Declaration of Leading Health Promotion into the 21st Century identifies that cities, municipalities, and local communities are evidenced to offer "…practical opportunities for the implementation of comprehensive strategies…" (World Health Organization, 2023d).

In Wales, where this research is based, the street has been recognised for its value to public health practice:

> Evidence demonstrates that the built and natural environment (buildings, places, streets, routes, land, watercourses, natural habitats) and the activities undertaken in these (living, working, learning, playing, shopping, travelling, moving) can support physical and mental well-being. (Public Health Wales, 2018, p.4)

The Well-being of Future Generations (Wales) Act (National Assembly for Wales, 2015) places a duty on public bodies to maximise their impact on defined wellbeing goals. The street is recognised by the Future Generations Commissioner for Wales (evidence was contributed during this research to their office) including in guidance for public bodies:

> Consider supporting your communities to redesign their streets to improve their health and wellbeing.
>
> Our streets are public spaces which belong to everyone and they make up 80% of all open space in towns and cities, offering space that can be designed to benefit the whole community. Our streets are more than just a way of getting around, they define and shape our area and have a huge impact on the way we live, how active we can be and how well we know our neighbours. Increased traffic has changed the way our streets are used and too often our streets feel like they're designed exclusively for cars.

> There are many things you can do, with your community, to improve our streets, including; ‘greening’ up the street, organising a planting day, introducing trees, implementing a 20mph default speed limit, creating spaces to play, seating areas or setting up a street library in a disused phone box. (The Future Generations Commissioner for Wales, 2023)

In Cardiff, streets are referenced as important for health in a Director of Public Health’s annual report (Cardiff and Vale University Health Board, 2017) and local authority policy of:

> Rolling out a ‘streets for health’ initiative across the city, to enable all streets to be reclaimed as public spaces and become healthy, green, safe, child friendly, to encourage walking and cycling, with high quality pedestrian crossings, biodiversity, planting and sustainable urban drainage systems (SUDS) and provide improved access for everyone, particularly those with restricted mobility… (Cardiff Council, 2020)

The Well-Being of Future Generations (Wales) Act is cited internationally as a “pioneering example” (Accelerating City Equity Project, 2023, p.31) of policy and mechanisms that bake in long-term thinking however there remain manifest implementation gaps and few examples of policy ambition being delivered at the street scale. The Office of the Future Generations Commissioner for Wales notes of the Act that, “despite increasing good practice, it is not being implemented at the pace and scale needed.” (2023, p.13). Public bodies face a context of austerity and wider pressures on public services all of which conspire to mean that policy impact is not fully realised as health impact for residents of streets.

In conclusion, at first public health and streets might not seem obviously connected. This literature review evidences the two being strongly linked both historically and increasingly today.

2.1.5 Urban health

It is important to link this research to urban health literature and the fieldsite for this research, Cardiff in Wales, is a fieldsite in a city and built-up area (and reiterating that *urban* is not a neutral term in social research). Sclar and Volavka-Close (2011) identify urban health as

developing as a sub-discipline from international public health in the mid-1980s. As such urban health comes not from scaling *up* to the city scale but rather scaling *down* to the city scale. The WHO projects that by 2050, 68% of the global population will live in urban areas with much of this growth being in developing countries (World Health Organization, 2023e). Health inequalities that manifest in urban areas are a focus for urban health. The WHO for example identifies inequalities related to, “noise, water and soil contamination, so-called urban heat islands, and a lack of space for walking, cycling and active living…” which are linked to disease and “…combine to make cities epicentres of a noncommunicable disease epidemic and drivers of climate change.” (World Health Organization, 2023e)

Urban health seeks to leverage the political power of cities and the opportunity to apply a health in all policies approach (HiAP) (World Health Organization, 2014) and integrates agendas for planetary health including the Sustainable Development Goals (United Nations, 2015). The WHO has actively promoted urban health approaches including as part of the Healthy Cities movement (Tsouros, 2015). Examples include, the WHO Europe Healthy Urban Planning Initiative (Barton, Mitcham and Tsourou, 2003), creation of an Urban Health Repository (World Health Organization, 2021); and recently, research priorities for urban health, which are to:

1. “Strengthen links between urban health research findings and actions to promote urban health…
2. Build city-level evidence on the relationship between policy, environmental, economic, and social factors in urban environments and health outcomes…
3. Generate evidence on under-researched thematic areas…
4. Generate evidence on under-researched urban population subgroups”.

   (World Health Organization, 2022b, pp.7–9)

Focusing briefly on healthy cities, bringing health down to the scale of the city focuses on the local but also arguably leaves smaller scales overlooked. The street and other scales like neighbourhoods may be understood implicitly as part of healthy cities but are rarely foregrounded. The local in healthy cities often means the whole city (World Health Organization, 2022c). The WHO European Healthy Cities Network runs in phases and the current

implementation framework identifies streets alongside neighbourhoods, city planning, and transport planning as topics of priority related to the theme of prosperity (World Health Organization, 2019). However, while streets are noted as a priority for action that is different to recognising the street as a setting and arguably overlooks the potential of the street to contribute to other core themes in the framework: “people; …places; …participation; …prosperity; …peace; …planet…” (World Health Organization, 2019, p.6).

As well as a conceptual problem this is a methodological one. For example few health and wellbeing metrics are available at the street scale as opposed to the city scale. The BRE Healthy Cities Index addresses metrics related to the built environment for healthy cities and Pineo, Glonti, and Rutternote, “aggregated data at the city-scale masks the underlying variation within cities regarding environmental exposures and health outcomes. Understanding neighbourhood variation and the scale of deprivation is important to inform funding decisions and regeneration policies to reduce inequalities. At present there is a lack of data at this scale to enable such work…” (2018, p.40). The fieldsite for this research is in Cardiff, Wales and a practical example of the difficultly of addressing health at scales closer to the street is that only two indicators in the Public Health Outcomes Framework (Public Health Wales, n.d.) are measured at the smallest geographic scale (Lower Super Output Area).

Streets and their central role as part of healthy cities were rhetorically recognised in the early ambition for healthy cities to “…mark the point at which the WHO philosophies and frameworks are taken off the shelves and into the streets of European cities.” (Ashton, Grey and Barnard, 1986, p.320) Subsequent critiques of healthy cities have however identified too much of a top-down approach being taken (Dooris, 2013). It is arguable that evidencing streets as a health setting may help respond to calls for a balance to be achieved between top-down and bottom-up approaches (Toyne and Khan, 1998) and this implies linking street settings clearly with healthy cities and other health settings.

Connections between settings have increasingly been highlighted in the literature on health promoting settings. Galea describes links between settings as different levels with “contextual settings” like healthy cites containing within them other “elemental settings” such as schools (2000, p.170). Dooris describes this being like “Russian dolls” and emphasises the need to

"…view individual settings as part of a bigger whole – and work to enhance the synergy between them and to maximise their contribution to the well-being of communities and cities." (2006, p.3)

This research investigates the street for its potential as a health setting, as an integral part of a wider city ecosystem, and as an elemental setting within the city as a contextual setting. This can be considered by scale, for example street, neighbourhood, and city. This inductive research investigates links between settings from the perspective of residents' experiences. It is also logical that streets may also be contextual settings as well as elemental ones, for example being the context for the setting of dwellings. Scale is not the only potential linkage across settings and street settings can logically link to settings such as healthy schools and workplace settings. This could include schools physically within streets but could also be considered related to sequences of settings and that, for example, a school journey may happen across a series of settings: home, street, neighbourhood, school.

The local in healthy cities tends to mean the city scale yet it is questionable how relatable this is to people who live in local areas. The street, the focus of this research, is arguably also a local scale and may be more relatable to the people living there. In urban design addressing strategies at all scales is an important concept. Taking this concept into urban health and in line with the original ambition of healthy cities this research seeks to investigate what it would mean to take health to the city streets.

This research addresses specific items within these priorities including, "…user-centred methodologies for more effective research…, health integration into broader urban agendas…, relationships between neighbourhood factors [argued to include streets] and social determinants of health…, explore how diverse population and stakeholder groups subjectively perceive urban health risks, protective factors and characteristics within specific city contexts…" (World Health Organization, 2022b, pp.7–9)

Complexity and transdisciplinarity link to urban health. Lawrence and Gatzweiler (2017) argue for transdisciplinary knowledge in urban health and highlight that while there are large and increasing data about cities there are not equivalent increases in, "capabilities of processing this data and assigning values and meaning to information…" (Lawrence and Gatzweiler, 2017,

p.595). This research seeks to address developing understanding of meaning underpinned by the constructivist-interpretivist epistemology.

Linking this research to urban health is important as a related discipline. Urban health is conceptualised mainly as linked to cities (World Health Organization, 2023e) and the fieldsite for this study in Cardiff are streets in a city.

2.1.6 Sociology

> …the street remains a social space like no other (Hubbard and Lyon, 2018, p.938)

In public health Krieger (1994) identified the importance of social life for population health. Mclean *et al.* argue that a, "…researcher who is approaching a public health problem should face the problem with an open, critical and reflexive mind-set and endeavour to best fit the research methods and approach to the emerging research question…" (2020, p.xix). It is with this in mind that the research design integrates certain sociological concepts: firstly, the street as a fieldsite, and second, everyday streetlife.

As a fieldsite Hubbard and Lyon (2018) note the importance of explicitly defining the street, something they note as missing in much research. Four conceptual aspects of the street as a fieldsite need considered. First, the street is a reflection of wider society, "In neoliberal Western cities, streets increasingly move in time with the rhythms of consumer capitalism, offering fewer and fewer opportunities for simply 'hanging out' …" (Hubbard and Lyon, 2018, p.938)

Second, is to define whether the focus of the research is about, "the streets, or simply about particular populations on the street." (Hubbard and Lyon, 2018, p.939). Hubbard and Lyon (2018) identify three ways that existing literature has done this: the Chicago School (Whyte, 1943; Reckless, 1933); "Slumdog" studies (Anjaria, 2016; Harms, 2016; Boo, 2013); and a focus on marginal groups or populations (Knowles, 2000; Fleisher, 1995; Miller, 1995; Spradley, 1970). This research links most closely to Chicago School with secondary population layer considering different population groups within the overarching focus on the street.

Third, the research design should detail what is given priority in the street: the socio-cultural (e.g. Sundaram, 2016) or, as this research does, the physical-spatial (e.g. Berman, Marcus and Sclan, 2017; Lefebvre, 2004). This means a focus on materiality of the street, rhythms or patterns of streetlife, and the, "materiality of place and emphasise how social life is caught up in, and transformed by, certain rhythms of streetlife, regarding the street as an inherently social production." (Hubbard and Lyon, 2018, p.940)

Fourth, is to recognise that the street can be both a potential unit of analysis and has multiple socio-cultural meanings. Depending on the research design, the street may not even be a category or social unit as Clarke found in relation to material provisioning (2002). The street can also mean a spatial form, a toponym, the users of the space, a figure of speech for urban life, and an English language word. In this way the street is also linked to economic, social, legal, and sensory structures that change over time (Dines, 2018).

Considering just the item of language and to build on Dines (2018) example, this means that investigating a street in Wales is materially different to researching an Italian *vicolo* or *piazza,* or a *sâha* in an Arab city with implications for transferability of findings in this research to other contexts. The street has an English language dictionary meaning, complex in its own right, it can refer to the space between buildings or to the buildings themselves:

> A road in a city, town, or village, typically comparatively wide (as opposed to a *lane*, *alley*, etc.), and usually running between two lines of houses or other buildings; such a road along with the pavements and buildings on either side.
>
> *street of houses (*also *shops)*: a number of houses or shops built in a double line with a road in the middle, forming a street. (Oxford English Dictionary, 2023)

Other meanings of street show how the English language word is not neutral: to be "…*on / upon the street(s)…"* can mean descriptively to be in the street but it can also mean a prostitute, to be homeless, to be out of prison, buying and selling drugs, or to be unemployed (Oxford English Dictionary, 2023). Figure 15 shows some examples of the word street in English language use which can have positive (a street party) or negative / derogatory (street drug, street crime, street

people) meaning. The next section explores how the street can have different and particular meaning in sociology.

street accident	street language	street robbery	street curb	street chemist	street girl	street room
street art	**street life**	street scuffler	street end	street child	street gossip	street savvy
street artist	street market	street seller	street kerb	street cleaning	street grid	street scene
street band	street meeting	street shoe	street lamp	street coach	street hockey	street-smart
street battle	street merchant	street shrine	street map	street cop	street island	**street smarts**
street beggar	street mob	street singer	street plan	**street crime**	street jewellery	street soil
street beggary	street music	street singing	street post	street dealer	street kid	street-sweeper
street bookie	street musician	street slang	street side	street dealing	street-legal	street sweeping
street bookmaker	street noise	street song	street sign	street directory	street length	street talk
street book-making	street orator	street stall	street skater	street dirt	street level	street-thread
street brawl	street organ	street style	**street cleaner**	street dog	street luge	street tough
street clothes	**street party**	street theatre	street-layer	**street drug**	street luger	street tree
street crier	street patrol	street trade	street lighting	street farer	street manure	street urchin
street cry	street performance	street trader	street-pacing	street fight	street parlour	street value
street culture	street performer	street trading	street-bred	street fighter	**street people**	street village
street decoration	street photographer	street vendor	street-sold	street fighting	street person	street virus
street entertainer	street photography	**street violence**	street wanderer	**street firing**	street porter	street warden
street entertainment	street piano	street warfare	street ballad	street floor	street railway	street web
street fair	street preacher	streetwear	street bike	street food	street-raking	street woman
street game	street riot	street architecture	street boy	street furniture	street refuge	street worker
street gang	street rioter	street corner	street breakfast	street-gadder	street rod	street yarn
street hawker	street robber	street crossing	street-chair	street gas	street rodding	

Figure 15: Image of street terms (developed from Oxford English Dictionary, 2023) with some highlighted

Everyday streetlife

Everydayness and *streetlife* are two important and defined concepts in some social research. This thesis utilises some of these but also diverges from the literature that positions the street as a public space, instead taking an open and inductive approach to investigate the street on a public-private axis.

Jones (2018) breaks down *everyday streetlife* into its component parts, first focusing on *streetlife* which is defined as:

> …the social life of the urban public realm – the streets, squares, plazas and so on "of urban settlements in which individuals in copresence tend to be personally [un]known [sic] or only categorically known to each other" (Jones, 2018, p.1013 citing; Lofland, 1998, p.9)

The typographical misquote from Lofland of known / unknown illuminates an important distinction about the *publicness* of the streets in this research: people in public spaces are not – according to this definition – personally known to each other. Lofland describes three “Realms of City Life” (Lofland, 1998, p.10): private, "the world of the household and friend and kin networks"; “parochial”, "the world of the neighborhood, workplace, or acquaintance networks"; and public, "the world of strangers and the "street"" (Lofland, 1998, p.10). Lofland identifies first, that these are social spaces and second, that they have all been previously overlooked in social research including because they, “contained nothing worth finding…” (Lofland, 1998, pp.xv–xvi). Yet Lofland arguably privileges the public realm over the others as the “city's quintessential social territory” (1998, p.9).

The focus of this research is the street environment. Therefore streetlife in this study is about social territory but where this street social environment is positioned on an axis of private to public is left open for investigation. As a starting point, the streets in this research are residential streets where people live and, *a priori*, are likely to know at least some people as more than strangers suggesting they may be parochial or private spaces, or indeed the axis itself may be brought into question.

Everyday by contrast to *streetlife* has multiple meanings in sociology and Jones identifies three traditions: lay or dictionary meanings; social theory; and “everyday life sociology” (Adler, Adler and Fontana, 1987, p.217). This research is linked to the third group therefore as being an analysis that follows, what Jones (2018) describes as, “…a broad spectrum of micro perspectives…” (Adler, Adler and Fontana, 1987, p.217); a micro-sociology as opposed to macro-sociology; with a focus on “…complexity of the everyday world through an emphasis on empirical work…” (Jones, 2018, p.1005). It is especially focused on “studying people in their *natural context*: the everyday social world”. (Adler, Adler and Fontana, 1987, p.219, emphasis in original)

Whilst discussion of everydayness might appear a point of academic discourse: when Covid-19 happened, and governments-imposed lockdowns were introduced such everydayness became exceptional. Whilst making this manifest it also changed the natural context of the street and created limitations on observing it.

Sociological literature identifies three clusters of study types, this research integrates everyday practices, acknowledging De Certeau's work and health practice literature (Knöll and Roe, 2017; Cohn, 2014). What is important in this research is to draw on sociological thinking to address the street as a fieldsite, as more than a unit of analysis, and for its complex socio-cultural meaning.

2.1.7 Interdisciplinary and transdisciplinary literature

This last section reviews an increasing literature linking health and built environment that has been purposively positioned beyond single disciplinary boundaries. This section also includes a critical appraisal of the Healthy Streets approach and indicators (2024a) as one of the best-known practice-oriented approaches in the UK. Finally, as a cross-cutting theme, definitions of urban-ness are considered in relation to different disciplinary perspectives.

Academic disciplines are defined by Krishnan (2009) as having six general characteristics: a focus or object that is researched; knowledge built up over time; concepts and theories; specific language or terminology; methods; and are manifest in an academic institution. In this research multidisciplinarity, interdisciplinarity, and transdisciplinarity are viewed on a continuum (Choi and Pak, 2007) without fixed boundaries.

Multidisciplinary can be defined as "…different academic traditions focus on a common problem but… not… integrating concepts and methods…" ('Interdisciplinary Research', 2008). This can be clearly seen in the design and control of streets currently which is *barely even* multidisciplinary with disparate specialists exercising their knowledge to address the street.

Interdisciplinary: then integrates "perspectives and methods from two or more disciplines." ('Interdisciplinary Research', 2008)

Transdisciplinarity: within ecological research is: "…different disciplines and a self-reflective process that considers the perspectives and dominant narratives of researchers, citizens, and managers." ('Ecological Research', 2008)

Krishnan argues that the complex phenomena and grand challenges for contemporary society can't be reduced to disciplinary boundaries (2009). In this research health and street environments are such phenomena.

Another reason for critiquing existing disciplinary boundaries is that many are not inclusive. Disciplines frequently exclude groups of people and their knowledges, such as by gender and ethnicity. For example, UK registered architects are 70.4% male and 82.5% white (FAME Collective, 2021). This matters at several levels: for research values and ethics including epistemic justice (Ngwenya, 2021); for representation and inclusion within disciplines; and it matters for rigour, criticality, and research quality. Transdisciplinarity here includes people and knowledges that are currently excluded from disciplines.

Literature positioned across disciplinary boundaries is increasing. Some of this literature links public health and planning (Carmichael *et al.*, 2013, 2016; Barton,H. et al., eds., 2015; Barton, Mitcham and Tsourou, 2003; Barton, 2000). An increasing number of frameworks have been developed including the widely referenced Health Map for the Local Human Habitat (Barton and Grant, 2006). Sarkar, Webster, and Gallacher develop interdisciplinary approaches including methods for big data sets across urban health, environment, planning, and cognitive health (2014, 2015, 2017). Pineo's develops thinking across built environment touching on many different disciplines and has proposed a framework addressing sustainability; equity; and inclusion addressing health at scales of planetary health, ecosystem health, and local health (Pineo, 2020). Roe and McCay focus on the health topic of mental health and wellbeing in Restorative Cities and scale restorative environments thinking up to the scale of the city (2021). They argue not for grand visions but rather a for an evidenced and "'quieter' approach that puts mental health, wellness and quality of life at the forefront of city planning and urban design." (Roe and McCay, 2021, p.2)

Practice-based grey literature that is interdisciplinary includes Healthy Streets for London (Transport for London, 2017) which draws on evidence from transport, urban design, and public health disciplines. This has been developed as practice-oriented tools (Healthy Streets, 2024). Shaping Neighbourhoods (Barton, Grant and Guise, 2021) sets out urban design principles at all

scales of city planning yet draws on an evidence base that spans public health, urban design, and urban health.

An increasing literature that is positioned across and beyond disciplinary boundaries is identified. This is necessary to address societal complex challenges as well as addressing existing disciplinary limitations and for epistemic justice. Transdisciplinarity informs all levels of the research design from methods through to research values.

Healthy Streets Indicators

There is no shortage of street design toolkits including more recently with an explicit focus on health. The Healthy Streets approach and indicators (2024a) is one such example. It is one of the best known related to health and streets in a UK context and relevant to address here including to identify the different approach and focus taken in this thesis.

Healthy Streets is an organisation that has a defined approach supported by a range of tools, mainly with a practitioner-orientation published on a website and in grey literature. The Healthy Streets approach aims to support "taking a holistic approach to improving streets for people." (Healthy Streets, n.d., p.1) Healthy Streets is relatively widely known, particularly in the UK, Europe, Australia, and New Zealand. Often but not exclusively this work is with transport policymakers and this reflects early development of the approach at Transport for London (2017). These tools, training and consultancy are all offered under the Healthy Streets brand which has a figurative trademark in the UK and a number of other countries (World Intellectual Property Organisation, 2024).

The approach is described as a "…human-centred framework for embedding public health in transport, public realm and planning…" (Healthy Streets, 2024a); "…an evidence-based approach to creating fairer, sustainable and attractive urban spaces…"; and in an earlier version "…an evidence-based approach to creating fairer, sustainable and attractive urban spaces." (Transport for London (2017). In addition to health improvement being a driver for change in street environments, the approach also identifies climate change, supporting communities, and reducing inequalities as important drivers (Healthy Streets, n.d.). Healthy Streets also identifies

that there is little data collected on physical street environment interventions and seeks to close this gap.

Ten indicators form the basis of the approach, they are (Healthy Streets, 2024a):

1. “everyone feels welcome;
2. easy to cross;
3. shade and shelter;
4. places to stop and rest;
5. not too noisy;
6. people choose to walk and cycle;
7. people feel safe;
8. things to see and do;
9. people feel relaxed; and
10. clean air.”

Quantifiable assessment is primarily focused on street physical environment characteristics. The Healthy Streets approach is intended to be widely applied and states that it can be “applied to any streets, anywhere in the world.” (2024b) Further development includes collaborations to develop a Healthy Streets Index (_STREETS, 2023). The approach has also been incorporated into policy, notably in London through transport policy (Mayor of London, 2018) and planning policy (Mayor of London, 2021).

Strengths of the Healthy Streets approach include that it is increasingly widely recognised in some geographies and a clear brand supports this. Healthy Streets has had policy impact; puts a firm focus on streets with clearly communicated methods; and is supported by a suite of tools and capacity building programmes. Methodological strengths include in-person survey methods and surveys undertaken at different times of day including after sunset.

Some limitations are identified and it should be noted that these are not unique to Healthy Streets and some reflect limitations in wider practice and research evidence base. Limitations include a global North geographic orientation: claims to be applicable to all streets and all contexts globally are not clearly evidenced. An aim for broad international comparability risks

leading to broad indicators that exclude culture and context and therefore also exclude potentially important aspects of the street environment that impact on health in different contexts. The approach tends to privilege practitioner and researcher knowledge over local knowledge. Whilst holistic health is acknowledged, similar to gaps identified elsewhere in the literature, there is a greater emphasis on physical health than mental or social wellbeing. For example, policy implementation in London acknowledges impacts on mental and social wellbeing but these are primarily limited to the pathway of physical activity (Transport for London, 2017). This focus on physical activity is a limitation noted in wider literature in the systematic review (Chapter Section 2.2). The focus of this thesis is not intellectual property rights which is important for practitioners, researchers, and policymakers, however it is arguable that in addition to the Healthy Streets brand being a strength this could also have complex effects in its uptake by others.

As well as these general points the development of the Healthy Streets approach at larger scales such as cities and its implementation in policy are relevant to critically appraise. Strengths of the Healthy Streets Index are stated to include the ability to score streets across large areas such as a whole city; that this can be cost-effective; and support “strategic decision makers identify what measures are needed and where, to make the whole place healthier and reduce inequalities within that place.” (_STREETS, 2023) Whilst noting city level decision makers may be the focus for The Healthy Streets Index, the explicit focus here is on these decision makers and not community members taking decisions about their streets. This arguably risks the same limitations identified within Healthy Cities: a focus on top-down solutions and gaps in grassroots approaches addressing community need. A strength is that the Index aims to address data that overlap spatial scales such as connectivity and characteristics that cross scales such as air quality. A stated limitation is that factors such as cleanliness are excluded “because there is no live dataset available” (_STREETS, 2023). This reinforces and confirms one gap that this thesis identifies: the need to go beyond existing routine data and understand a broader range of characteristics of street environment that are important for residents’ health.

Healthy Streets has been integrated into policy including in The London Plan (Mayor of London, 2021). This is a strategic planning policy that seeks to address population health including through the wider determinants of health. Healthy Streets has clearly had policy impact and The London Plan includes a Healthy Streets policy (Mayor of London, 2021, no.T2). This is included under the transport policy area (Mayor of London, 2021, no.T1) and referenced as part of wider policy in the plan that contributes to population health.

The London Plan recognises sickness and ill health as linking to "social and environmental causes" that are "numerous and complex" (Mayor of London, 2021, p.18). However the policies to address these identified health needs are relatively siloed. Healthy Streets, for example, is primarily linked to transport. Other tools are treated similarly: Health Impact Assessment is mentioned primarily within economy, related to healthy food environment; wider determinants of health are linked to social infrastructure, such as healthcare facilities and health prevention measures. This lack of integration of tools across policy areas limits their potential benefit for health and is not obviously well structured to deliver a Health in All Policies (HiAP) approach (World Health Organization, 2014).

In summary, Healthy Streets has evolved from a particular context with specific aims and audiences which affect the strengths and limitations of this approach. It is recognised increasingly widely; has increased capacity with practitioners and policymakers; and impacted policy. At the same time, the approach, particularly its subsequent implementation in policy, can be argued to replicate limitations seen more widely in street-health research and practice. This substantiates the gaps identified elsewhere in the literature and goes on to inform the research design presented in this thesis. This thesis incorporates healthy streets in the plain English use of the words, the use of 'Healthy Streetlife' throughout emphasises the quite different orientation of this thesis from Healthy Streets approach appraised here.

Defining the urban in relation to streets

This research is focused on the street as a physical and social environment and not *a priori* as an urban space. This has particular relevance in the context of this research in Wales where 33% of the population live in rural areas, compared to 21% in England (House of Lords, 2020). In sociology the word street has been identified as not being a neutral term and similarly the

word urban is not a neutral term, for example often being racialised. In Wales an urban-rural definition is not solely a technical definition but also can be understood as closely related to culture and Welsh language. Some further definitional challenges are critically considered from different disciplinary perspectives.

Urban health is less interested in the nature of urban-ness in the way that urban designers or sociologists are, but rather in the population trends and issues arising. One definition uses the word ‘urban’ interchangeably with ‘cities’ (World Health Organization, 2023e); global research priorities for urban health do not define urban health (World Health Organization, 2022b). Sclar and Volavka-Close (2011) note that definitions of urban vary but the clear shift is that global populations are mainly urban despite variation in definitions.

Such variation and arguable lack of methodological precision is evident for example in the UK. For statistical and governmental research purposes the Rural-Urban Classification system is used (Bibby and Brindley, 2013). It is, “designed to assist examination of social and economic variation with respect to the physical character of the settlements in which residents typically live and to population sparsity. Its prime motivation is to assist exploration of the particularities of rural areas.” (Bibby and Brindley, 2013, p.9) Therefore arguably this method that underpins certain UK urban health analysis and research has as its conceptual basis rurality and not urban-ness. This method defines all settlements with a population of 10,000 people as urban, which is described as, “easy to understand… the main problem is that the threshold is essentially arbitrary.” (Statistical Directorate, Welsh Asssembly Government, 2008).

In this research the focus is on the street as a social and physical environment: defining the urban in urban health and other disciplines would benefit from being further refined and this is a further argument for extending disciplinary boundaries.

2.1.8 Conclusion

This chapter section has situated the street from disciplinary perspectives in urban design, public health, urban health, and sociology. The need and benefits of going beyond single disciplinary

boundaries have been identified too. The next chapter section presents the findings of a systematic review that takes a different methodological approach to the literature and was undertaken at the start of this research to inform the research question and design.

2.2 Systematic Review: The Quantifiable Effect of Residential Street Scale Environment on Non-communicable Diseases and Their Risk Factors

2.2.1 Introduction and rationale

The main aim of this review of the evidence was to systematically collate and assess the strength of the quantifiable evidence for non-communicable disease outcomes and their risk factors at the street environment scale.

This review was undertaken during an early phase of the research and to inform the subsequent research design. As well as presenting the review findings this chapter section highlights the shift in thinking that happened during the research. This includes for example, from a pathogenic perspective focused on non-communicable diseases to a salutogenic one, and from a narrower focus on the street physical environment to include the street social environment. An important starting point nevertheless was to review the existing evidence base systematically. The terminology *street design* used in this review was subsequently refined in the overall research design to refer *street physical environment*.

Street environment as a wider determinant of health

As set out in Chapter 1.0, public health research and practice has for some time recognised the role of wider determinants of health, a socio-ecologic paradigm has emerged, and a focus on recognising this as a complex system has developed. This priority is also reflected at both local and global policy levels.

The environment includes the built environment: not only buildings or infrastructure but also the outdoor spaces between buildings and in this review specifically, residential streets. The built environment itself is increasingly recognised as being an important wider determinant of human health and accounts for a large burden disease (WHO Regional Office for Europe, 2015).

Chapter 1.4 has set out the argument for the street as an important scale to address for human health including the role of practitioners in relation to this. This review defines the street broadly in line with the definition previously given, following Barton *et al.*: *"A cluster of dwellings often developed at the same time, with shared identity or character, grouped round a common access..."* (2010, sec.32). However the review also aimed to identify how previous studies have addressed the definition of street scale.

Role of design practise

With the aim of informing design practice this review considers the role and potential actions of design practitioners in the street and how their actions can influence the built environment and therefore have an impact on health. This systematic review takes a broad definition of designer including: design practitioners (such as engineers, urban designers, landscape architects, architects; transport planners); decision-taker designers (those who commission, fund, or control the former group); and designers in use (those who maintain and regulate the built environment) (Drane and Carmichael, 2018). In developing the design of this review two important features of design practise were considered: scale; and the concept of holistic design quality. Scale is important as it is used to conceptualise the built environment by certain design practises ranging from the micro to the macro, for example: home; street or home patch; neighbourhood; settlement or city. (Barton, *Grant and Guise*, 2010). Holistic design quality recognises that designers use a wide range of design strategies and that how these are brought together in design practice is important. Design quality therefore is a holistic concept and should be understood as objective not subjective (Commission for Architecture and the Built Environment, 2002) and distinct from concepts seen in much literature such as aesthetics (Saelens *et al.*, 2003) or incivilities (Dunstan *et al.*, 2005). These are often largely beyond the scope of design practise. This review therefore focuses on the street scale and street design as involving the complex integration of features not just singular aspects or characteristics. These considerations relate to methods as well as to topic or focus.

These methodological issues are considered briefly here. Taking scale first, density of street trees for example (Sarkar, Webster, and Gallacher, 2015) has been found to be associated with walking and distance walked. However, as this is measured with average tree density per 1km

sq, this does not differentiate between whether living on a street with trees increases walking or whether it is access to street trees in the wider area that is important. Sarkar, Webster and Gallacher's (2014, p.50) health niche-based model of the healthy city includes scales of: individual; household; neighbourhood; city; and region system. Whilst arguably the street is not specifically excluded from this, the method applying buffers at larger scales prevents identification of the scale, or scales, at which an intervention is effective. This is similar to methodological issues evidenced at the neighbourhood scale. Mavoa *et al.* (2019) identify that at the neighbourhood scale 800m and 1000m network buffers are those definitions of neighbourhood that most commonly show association with physical activity outcomes compared for example to 500m which arguably may be better defined as the street scale than the neighbourhood scale. This review seeks to identify evidence of the feasibility of the street as a unit of analysis with ecological validity.

The second challenge for design practice is that studies do not commonly differentiate between design and non-design characteristics, in other words the aspects of the street environment that designers can modify. For example studies using tools such as REAT (Dunstan *et al.*, 2005); NEWS (Saelens *et al.*, 2003); and PANES (Sallis *et al.*, 2010) which amalgamate design and non-design characteristics in some domains. This is important for design practitioners given their practise is specific to design characteristics.

2.2.2 Existing literature and gaps

An umbrella review identifies evidence of variable quality related to planning principles of neighbourhood design, housing, healthier food environment, natural and sustainable environment, and transport (Bird *et al.*, 2017). High quality evidence at the neighbourhood scale was reported in this review for improvements to walking and cycling infrastructure reducing BMI in adults; increased access to facilities and amenities linked to increased physical activity in adults; and improved street connectivity linked to increased physical activity in adults.

Cerin et al. (2017) found positive associations between active travel in older adults and residential density; walkability; street connectivity; overall access to destinations and services; land use mix / diversity; access to shops / commercial, food outlet, business / government /

institutional / industrial, public transport, parks / open space / recreation destinations, but not health / aged-care or religious destinations; pedestrian friendly features; benches / sitting facilities; street lights; volume of human or motorised traffic. Yen et al. (2009) supports items related to more accessible neighbourhood design reporting associations in five studies with greater levels of walking in older adults. Cerin et al. (2017) did not find significant association for greenery, aesthetically pleasing scenery, litter, decay, pollution, pedestrian safety, and personal safety. An example of amalgamation of design with non-design characteristics in this review is the combination of aesthetics and cleanliness or order. With the smallest buffer of 400-500m (n=9 of 42 included studies) most studies included in Cerin et al. (2017) investigate scales larger than might conceivably relate to a single street.

Sugiyama *et al.* (2012) report utilitarian walking associated most consistently with presence of and proximity to utilitarian destinations such as shops, services, and public transport stops; street connectivity and the presence or maintenance of pavements was also relevant. Aesthetics, traffic, and personal safety were not found important albeit notably for the focus of this review the domain of aesthetics amalgamated non-design with design characteristics. For recreational walking associations were reported with presence and proximity utilitarian destinations; attributes of recreational walking; route aesthetics; and street connectivity: pavements, traffic, and safety were not found important.

Bagnall et al. (2018) found moderate evidence of neighbourhood design positively associated with proxy measures of wellbeing and moderate evidence of green and blue space interventions positively associated with physical activity, healthy eating, as well as social capital outcomes and community members' skills and knowledge.

Several reviews conceptualise the neighbourhood environment through "neighbourhood disorder" which amalgamates both built environment and other elements: Jackson et al. (2014) report that two out of five scientifically weak studies found significant associations with adolescent alcohol use and neighbourhood disorder. Beyer et al. (2015) report some evidence of association between intimate partner violence and perceived neighbourhood disorder, but no evidence of association with external physical disorder.

Previous reviews also report a range of associations for built, physical, and urban environment with health in young people and adolescents (Audrey and Batista-Ferrer, 2015); physical activity in adults (McCormack and Shiell, 2011) and in older adults (Barnett *et al.*, 2017; Van Cauwenberg *et al.*, 2011); moderate to vigorous physical activity (MVPA) in young people (McGrath, Hopkins and Hinckson, 2015); mental health & wellbeing in adults (Moore *et al.*, 2018); cardiovascular disease and risk factors (Malambo *et al.*, 2016); and cardiometabolic health (Chandrabose *et al.*, 2019) and risk factors (Leal and Chaix, 2011).

In summary, existing systematic reviews of built environment: health interactions do not differentiate consistently between design and non-design characteristics; and no reviews were identified that sought to isolate the street scale environment. Reported evidence provides valuable overarching principles but lacks the granularity of scale and focus on design characteristics that design practitioners need.

Health outcomes: non-communicable disease

This review focuses on non-communicable disease (NCD) which accounted for 68% of all deaths worldwide in 2012 (World Health Organisation, 2016, p.36) and has been the leading cause of death and ill health globally since 1992 (Institute for Health Metrics and Evaluation (IHME), 2016). Definitions of population health and wellbeing are diverse and there have been calls such as by Knöll and Roe (2017) to move from more fixed definitions (World Health Organization, 1946) toward dynamic conceptualisations of wellbeing (Huber *et al.*, 2011; World Health Organization, 1986). However a recent study aiming to develop an assessment tool for wellbeing or “positive health” failed to find consensus on content validity of a tool for doing so (Prinsen and Terwee, 2019). Tamber and Kelly (2017) also raise the ethical concern that few definitions of wellbeing have been tested in non-white populations. This review was interested in identifying the quantifiable and broad ranging effect of street design characteristics on health. This informed the focus of this review on health outcomes of NCDs and risk factors for NCDs, for which there are currently frameworks that are more widely agreed on and validated and reliable tools for measurement of these outcomes.

2.2.3 Aims

The primary aim of this review was to systematically collate and assess the strength of the evidence around the potential measurable contribution of street scale characteristics through the following research question: what is the evidence of measurable effect of residential street level design characteristics on chronic and non-communicable disease including key risk factors such as physical activity and obesity?

Secondary objectives were to synthesise the existing evidence base to inform practice; to better describe and rigorously delineate the previously identified gaps in the existing literature; and to inform the development of research questions and the subsequent research design. The review sought to identify characteristics that professional designers could address which was identified as a challenge in some previous studies which amalgamate such characteristics with other factors (Sallis *et al.*, 2010; Dunstan *et al.*, 2005; Saelens *et al.*, 2003).

The review also aimed to deploy a review question as a disciplinary bridging point between urban design and public health (Drane and Carmichael, 2018) and thereby contribute to interdisciplinary understanding and working toward a "…transdisciplinary knowledge domain…" (Lawrence and Gatzweiler, 2017, p.597).

2.2.4 Methods

A protocol was developed in line with the PRISMA workflow (Moher *et al.*, 2015). The aims are as reported above; objectives for this systematic review were undertaken using the methodological steps after Glasziou *et al.* (2004): develop a protocol; question formulation; finding studies; appraisal and selection of studies; summary and synthesis of relevant studies; determining the applicability of results.

Search strategy

Information sources were searches of the following electronic bibliographic databases: Cochrane Central Register of Controlled Trials, MEDLINE (Ovid interface); Scopus. Searches were conducted for quantitative studies in English from January 2003 to December 2017. Hand searches of reference lists of included studies were also made.

Experts in the field were consulted to identify grey literature. Seventeen organisations representing professional bodies; practitioners; non-governmental organisations, and the UK healthcare service were contacted directly with a call for evidence. This call was also publicly available online and promoted through social media.

Search terms (see Appendix 2, Supplementary Material S1) were developed under headings of population, intervention / exposure, comparison, and outcomes (PICO). No restriction was placed on population or comparison. Intervention or exposure terms were developed from the design literature and by reference to experts in the field.

Outcome search terms comprised those for NCDs and as a development of other reviews, the full list of NCDs from the list of GHE cause codes and ICD-10 codes (World Health Organization, 2017). Key NCD risk factors plus terms from a recent umbrella review (Bird *et al.*, 2017) were also included.

Eligibility

In line with the aims of this review to identify quantified evidence relevant to design practice eligibility criteria were developed to identify studies of street scale; design characteristics; and holistic street design. The following section summarises eligibility criteria and the full checklist used by reviewers is appended (see Appendix 2, Supplementary Material S2). Study design was limited to quantitative studies and those with mixed design. Qualitative studies were excluded. Studies included in the review were those investigating as intervention or exposure:

- street design characteristics;
- investigating a holistic range of characteristics (n>2 with at least one non-geographic information system (GIS) based measure): therefore studies based solely on GIS measures such as street connectivity were excluded as not meeting the criteria of addressing holistic street design;
- of built environment interventions (behaviour change or social capital interventions excluded);
- in the external environment (mixed studies of external and internal environment were included);

- of residential streets (mixed use with residential included);
- at the street scale (neighbourhood, city, or region scale excluded).

During piloting of these criteria a further criterion was added as the focus of this review was design characteristics,

- studies conducting analysis by amalgamating non-design characteristics (≥33%) with design characteristics in analysis were excluded.

Where design characteristics investigated were not reported reference was made to the original published tool, where not available it was requested from the authors. Scale of investigation was similarly assessed by actual methods employed.

Outcomes included were those meeting the search terms:

- chronic or NCD incidence (frequency) or prevalence (rate) and key risk factors. Both direct and indirect impacts were included.
- Studies published from January 2003 to December 2017 were included, this restriction was based on the field of built environment impacts on human health having developed significantly in the last decade (Rodgers *et al.*, 2012, 2017; Sarkar and Webster, 2017; Jones *et al.*, 2014) and to reflect studies using an underlying eco-epidemiologic paradigm that had emerged by this time (McMichael, 1999; Susser and Susser, 1996a, 1996b; Krieger, 1994).
- Qualitative studies were excluded as the aim of this review was to identify the quantifiable impact of street design characteristics on population health.

Quality

Risk of bias in individual studies is assessed to establish: whether sampling bias had been minimised; adequate adjustments made for confounding; outcomes adequately ascertained; and measurement or misclassification bias minimised (Glasziou *et al.*, 2004, p.28). Tool selection was based on identifying a tool with domain based risk of bias assessment not weighted summary score which is “explicitly discouraged” by Cochrane guidance (Higgins, 2011, chap.8.33); recognised in practice across public health and built environment disciplines;

covering a range of internal validity domains; and that could be operationalised within the resources of this review.

It has been questioned whether tools are capable of differentiating between valid concerns about risk of bias on the one hand and practical limitations of study design on the other (Humphreys, Panter and Ogilvie, 2017). Limitations of tools have also been noted in relation to built environment studies such as considering confounding of self-selection into areas (Cerin *et al.*, 2017) and prioritising randomisation which can be challenging to achieve in built environment studies (Audrey and Batista-Ferrer, 2015). Deeks *et al.*, having developed a framework to assess such tools, identified six as "potentially useful for systematic reviews" (2003, p.36) which met three out of four core internal validity domains. One of these, the Effective Public Health Practice Project Quality Assessment Tool (EPHPP) (Jackson and Waters, 2005) has been used in recent systematic reviews of environment and transport correlates of health (Ige *et al.*, 2018; Jackson, Denny and Ameratunga, 2014; Larouche *et al.*, 2014).

At protocol stage Deeks *et al.'s* (2003) framework was used to assess four more recent tools, three of which meet all four core domains (Sterne *et al.*, 2016; NICE, 2012; Kmet, Lee and Cook, 2004) and one was assessed as meeting two domains (Cerin *et al.*, 2017). Two use weighted scores (Cerin *et al.*, 2017; Kmet, Lee and Cook, 2004); and two assess risk of bias by domain (Sterne *et al.*, 2016; NICE, 2012). Ease of use, a factor assessed by Deeks *et al.* (2003), was considered for all, notably Sterne *et al.* (2016) is onerous requiring each outcome assessed separately. Considering all these factors plus use on recent similar reviews the EPHPP tool was selected for this review.

Studies were given a global rating of strong (no weak domains); moderate (one weak domain), or weak (two or more weak domains). Consistent with Audrey et al. (2015) risk of bias was not used as a criteria for eligibility. The rating is used in narrative synthesis to investigate perceived challenges in applying risk of bias tools to built environment studies and inform understanding disciplinary differences between public health and design practice.

Two-stage selection was undertaken with removal of duplicates and initial screening of title and abstract against eligibility criteria using a checklist (Supplementary Material S2). This was

completed by a first reviewer (MD, the candidate) with a representative sample (10%) validated by the second reviewer (LC, supervisor), in line with a previous published protocol (Pineo *et al.*, 2017), with any disagreement resolved reference to the third reviewer (JP, second supervisor). This method was repeated at full text eligibility stage.

Data extraction for included studies was undertaken using a form piloted on a sample and developed to include the necessary items to assess risk of bias with the EPHPP tool. Extraction was undertaken into a tabular format by one reviewer (MD), risk of bias was assessed by the first reviewer (MD) and validated by the second reviewer (LC) with any disagreements referred to the third reviewer (JP).

Key characteristics of each study are reported, and a narrative synthesis was undertaken due to the heterogeneity of: methods of measurement of both exposures and interventions; definitions of street or built environment scale within each study; study outcomes meeting inclusion criteria including method of measurement; and populations of included studies. In order to present findings in a relevant way for design practise studies are grouped according to the way in which they conceptualise the topic of holistic street design.

2.2.5 Results

Thirteen studies were identified that met the inclusion criteria (Figure 16: PRISMA Flow Diagram). Key features including study design are tabulated in Table 2, key concepts and main findings are tabulated in Table 3.

Studies were categorised through a lens of design practice into three broad groups according to their conceptualisation of street design characteristics. First, holistic street design, those attempting to measure the widest possible range of characteristics (n=3) (Sallis *et al.*, 2015; Cain *et al.*, 2014; Boarnet *et al.*, 2011); second, complex interventions, one an intervention study, focussed less on measuring the street design characteristics but rather on assessing the outcomes related to an intervention or exposure that had an impact on the wider street environment (n=2) (Curl, Ward Thompson and Aspinall, 2015; Kosaka *et al.*, 2014); and third, other broad ranging studies (n=8), less holistic but still considering a varied range of design characteristics. The first and third categories are therefore studies that, through the use of

varied tools, attempt to quantitatively measure street design characteristics but to differing extents. The second group treats the street design as a complex intervention without seeking to describe the intervention itself in detail.

Across all included studies 244 characteristics of street design were investigated, these characteristics were categorised *a priori* as: land use & mix; micro-climate (including orientation and design to prevailing weather patterns); green infrastructure; identity (including signage, artistic works, and features related to cultural, heritage, and local identity); public transport; walking & cycling; motor vehicles; facilities in the street (such as benches, water fountains, and absence of negative features like refuse storage) ; and security and safety (including surveillance and lighting). These categories are tabulated against outcome and population in Table 1. Included studies varied in their use of objective measures (n=8); subjective and objective measures combined (n=1); and subjective measures (n=4) of street design characteristics.

Outcomes investigated were risk factors of NCD rather than disease outcomes with most emphasising physical activity: walking or bicycling for transport (n=5); walking or bicycling or physical activity for leisure (n=5); walking for all purposes (n=4); all physical activity (n=6); moderate to vigorous physical activity (n=2). Body mass index of children (n=1) and sedentary time in adults (n=1) were each investigated by one study. Curl et al. (2015) also investigated change in unhealthy days and broad health measures (EUROQOL EQ-5D, CASP-19). The search strategy of including all ICD-10 definitions of NCDs does not appear to have resulted in additional studies being identified and all included outcomes were risk factors.

Adults and older adults were the most studied groups: populations were children (n=1); adult (n=3); adult and older adult (n=5); older adult (n=2); and children, adolescents, adults, older adults (n=2); and all were in built up or urban areas of high-income countries (USA, UK, Netherlands, Belgium, Japan, Australia). Two included studies used prospective cohort design (Curl, Ward Thompson and Aspinall, 2015; Schmidt *et al.*, 2015), one was quasi-longitudinal (Handy, Cao and Mokhtarian, 2008), and the remaining ten were cross-sectional studies.

All studies, as a result of having two or more domains assessed as weak within the EPHPP quality tool, were rated weak for quality. Only Bentley, Jolley and Kavanagh (2010) had two weak domains, the remaining studies had three or four weak domains including both with longitudinal study designs. This key finding is a basis for recommendations for future research considered in the discussion.

Where stated, studies used an ecologic or social ecologic framework (Compernolle *et al.*, 2017; Curl, Ward Thompson and Aspinall, 2015; Cain *et al.*, 2014; Wang and Lee, 2010; Pikora *et al.*, 2006) with a particular focus on behavioural pathways linking health and environment. Cain *et al.* (2014) referenced behavioural specificity and eleven studies explicitly referenced the role of environment in changing human behaviour.

To define the street, five studies made use of street segments, “the section of a road between two intersections” (Bentley, Jolley and Kavanagh, 2010, p.1808); three investigated a 0.25m/400m scale around residential addresses (Sallis *et al.*, 2015; Cain *et al.*, 2014; Bentley, Jolley and Kavanagh, 2010); one used a 0.5m/800m scale combined with sampling of streets in a study area (Boarnet *et al.*, 2011); one used local administrative boundaries with mean areas of 1.2-1.4km^2. Two defined the street scale by the specific design intervention investigated (Curl, Ward Thompson and Aspinall, 2015; Kosaka *et al.*, 2014). Finally two studies allowed the scale to be defined by the participants themselves (Lee *et al.*, 2007) or left the definition open to interpretation as “The streets…” or “Most streets…” (Zuniga-Teran *et al.*, 2017, p.67).

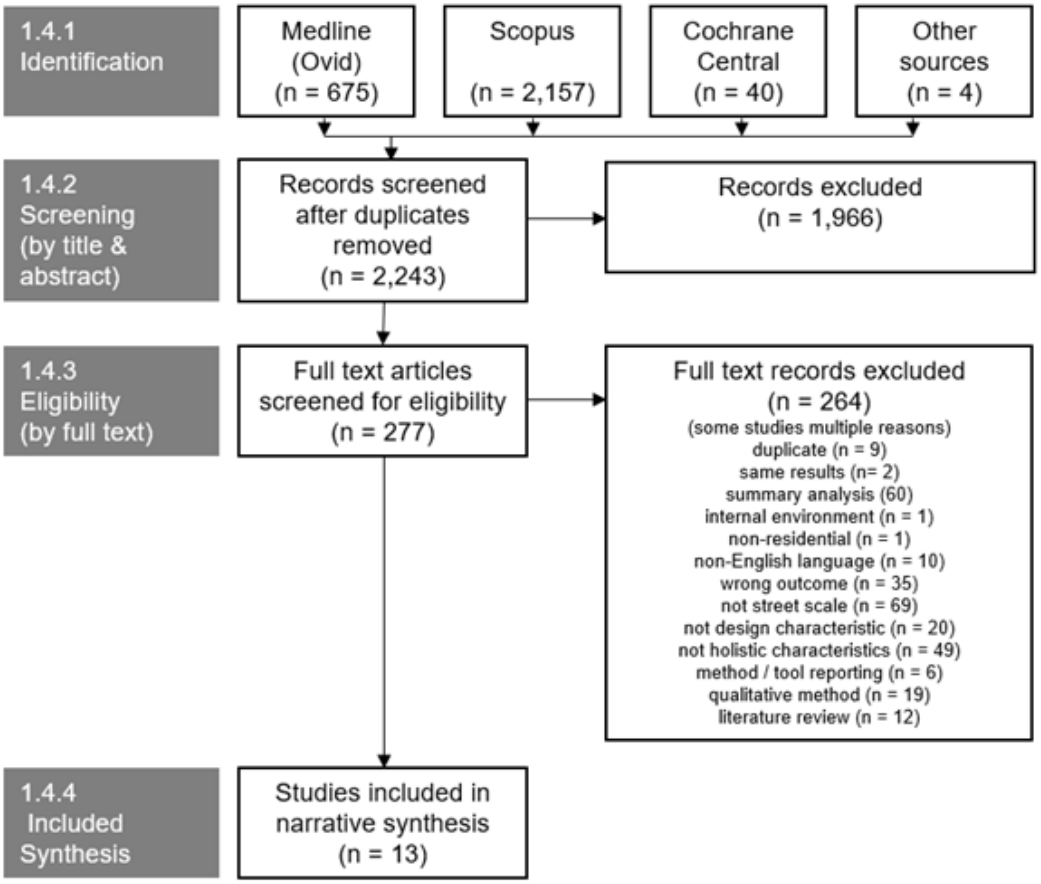


Figure 16: PRISMA Flow Diagram

Table 1: Summary of findings by study and presence of street scale design characteristic (all outcomes; all populations)

Author (Publication Year)		Study Outcomes								Categories of street scale design characteristics investigated by included studies																																							
Key: Ø nil association P +ve association p≤0.05 N -ve association p≤0.05 V both +ve / -ve reported Physical activity (PA) Body Mass Index (BMI) Moderate-vigorous physical activity (MVPA) Children (C) Adolescents (E) Adults (A) Older Adults (O)	Population	Transport walking / biking	Leisure walking / biking / PA	Walking for all purposes	Physical activity	MVPA	BMI	Sedentary time	General health	All land use and mix	Land use non-residential	Density within street	Housing / building typology	All urban and housing design	Street aspect: height, street	Woonerf / home zone /	Housing / street design feature	Connectivity within street	Environment and topography	Micro-climate / orientation	All green infrastructure	Trees	Nature other than trees	Private gardens	All identity	Identity: signage / other	Artistic, historic, cultural features	All public transport	Public transport infrastructure	All walking and cycling	Pavements, all aspects	Bicycle lanes.	Road crossings	Other bicycle infrastructure.	All motor vehicles	Traffic calming / control (not	Traffic lanes / direction	Speed limits (lower)	Parking	Motor traffic signage (must	All facilities	Benches and seating, gathering	Drinking fountain	-ve features (absent)	Non-motor traffic / other signage,	All security and safety	Street lights	Surveillance from buildings	Security features
Boarnet, *et al.* (2011)	AO	V	V	V	V					N	N	ø	N	ø	ø	ø	ø				ø	ø	ø		P	P	ø	ø	ø	V	V	N	P	ø	V	P	N	V	V		N	ø		N		ø	ø		ø
Cain, *et al.* (2014)	CEAO	V	V			V				V	V	V	V	V	V		V	V			V	V	V	V	V		V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
Sallis, *et al.* (2015)	CEAO	P	P[1]			P[2]															P	P						P	P	P	P		P								P	P				P	P		
Kosaka, *et al.* (2014)	AO				P									P			P													P	P																		
Curl, Ward Thompson, and Aspinall (2015)	O				ø				ø					ø		ø	ø				ø	ø	ø		ø	ø	ø			ø	ø	ø	ø	ø	ø	ø		ø	ø		ø	ø		ø					
Pikora, *et al.* (2006)	A	P	P											ø				ø			ø	ø								P	P		ø		ø	ø										ø	ø	ø	
Lee, *et al.* (2007)	AO			P																										P	P															ø	ø		
Handy, Cao, and Mokhtarian (2008)	A				P	P				P			P	P			P				P	P		ø											ø				ø										
Wang and Lee (2010)	O			ø						ø			ø	ø	ø		ø		ø	ø	ø			ø						ø	ø										ø	ø				ø	ø		
Bentley, Jolley, and Kavanagh (2010)	AO			P																	ø	ø								P	P		ø		P				P							ø	ø	ø	
Schmidt, *et al.* (2015)	C						ø																							ø	ø	ø														ø	ø	ø	
Compernolle, *et al.* (2017)	A							ø													ø	ø	ø	ø						ø	ø	ø	ø		ø	ø													
Zuniga-Teran, *et al.* (2017)	AO	P	P		P									P	P		P													P	P	P			P	P		P								P	P		
No. of studies investigating each characteristic	-	-	-	-	-	-	-	-	-	4	2	2	4	8	4	2	7	2	1	1	9	8	4	4	3	2	3	3	3	12	12	6	7	3	8	6	2	4	5	1	5	5	1	3	1	9	9	4	2

Notes to Table:

Note 1: In child and adolescent population only.

Note 2: In child population only.

Generally: except as noted, positive associations are relative to the presence of a characteristic. Exceptions are speed (lower speed) and negative features such as obstructions, waste storage (absence of feature). Where two studies differed in analysis of direction of effect (e.g., wider streets positively associated / narrower streets positively associated) one has been reversed for consistency of reporting.

Table 2: Main characteristics of studies and quality rating

Author (Publication Year)	Data collected	Location	Population	Objectives	Analysis	Study design	Health related outcome(s)	Quality rating*
Holistic street design: studies using tools to investigate a wide range of characteristic groups * Global risk of bias rating using EPHPP tool (number of weak sub-domains)								
Boarnet, *et al.* (2011)	2004	USA; Twin Cities Walking Study areas: Minneapolis and St Paul, Minnesota	Adults & older adults (25-75+)	Assess association between physical activity, walking, and the Irvine Minnesota Inventory (IMI)	Tobit / censored regression	Cross sectional	Accelerometer mean counts per day; accelerometer median counts per day; IPAQ total PA in METs.	WEAK (3)
Cain, *et al.* (2014)	2009 - 2010	USA: San Diego, Seattle, Baltimore	Children (6-11), adolescents (12-16), adults (parents of children & adolescents), older adults	Examine associations of microscale attributes with multiple physical activity measures across four age groups.	Mixed linear regression	Cross sectional	i) walking, biking for transport ii) walking, biking for leisure iii) objective physical activity measured with: i, ii) Children (parent-reported, Grow et al., 2008) Adolescent (self-reported, Grow et al., 2008)	WEAK (3)

							Adult (GPAQ) Older Adult (CHAMPS) iii) Accelerometer	
Sallis, *et al.* (2015)	2009 - 2010	USA; Seattle, Washington; San Diego, California; Baltimore, Washington DC	Children (6-11), adolescents (12-16), adults (parents of children & adolescents), older adults	Evaluating a short version of MAPS tool, MAPS-mini, and identifying association of variables to physical activity in four age groups.	Mixed linear regression	Cross sectional	As Cain et al. (2014) i) walking, biking for transport ii) walking, biking for leisure iii) objective physical activity	WEAK (3)
Complex design interventions: studies investigating specific complex design interventions or features								
Kosaka, *et al.* (2014)	2012	Japan; streets with and without gangi-dori (covered street walkways) in Joetsu	Adults (35-79)	Investigate association between physical activity (PA) and built environment by focussing on gangi-dori.	Linear regression; multilevel	Cross sectional	Physical activity, Physical Activity Energy Expenditure (PAEE)	WEAK (4)
Curl, Ward Thompson, and Aspinall (2015)	T1: 2008; T2:	UK; nine sites planned for intervention in	Adults ≥65; residents of intervention	1 Does a shared space project in residential streets result in environments where	Correlated component	Prospective cohort	General health; quality of life Also: time spent outdoors; frequency of outdoors in	WEAK (4)

	2010-2011	England, Wales, and Scotland	& control street	older people: a. Have better health or quality of life? b. Go out more often or spend more time outside in the local environment? c. Have better social networks? 2 Do the shared space environmental interventions enhance perceptions of the environment that might explain any observed change in these measures?	regressio n (CCR)		summer / winter - taken as an indicator of outdoor activity; social networks.	
Other broad ranging studies: investigating fewer categories of characteristics								
Pikora, *et al.* (2006)	1995-1996	Australia; areas within wider study SPACES study	Adults (18-59)	Investigate correlations between physical environmental factors and self-reported walking for recreation and transport within	Logistic regressio n	Cross sectional	self-reported walking for recreation and transport near home	WEAK (3)

				400m radius of respondent's homes.				
Lee, *et al.* (2007)	~2002-2007	Japan; low and high walkable regions	Adult and older adult participants in a health promotion programme focussed on walking.	Investigate association between perception of neighbourhood environment and walking time in objectively different regions in Japan.	General linear regression (two-tailed ANCOVA)	Cross sectional	Time spent walking for all purposes in the neighbourhood (minutes per week)	WEAK (4)
Handy, Cao, and Mokhtarian (2008)	2003	USA; traditional and suburban neighbourhoods in Northern California	Adults (age not reported), moved within 1year and non-movers	Test for causal relationship between neighbourhood design and physical activity within neighbourhood and control for self-selection.	Principal component analysis; Zero-inflated Poisson regression (cross-sectional); ordered probit model (quasi-	Cross sectional, quasi-longitudinal	Self-reported number of days in last 7 days of MVPA; self-reported change in PA prior to moving (for movers) or from 1 year ago (non-movers)	WEAK (3)

					longitudinal)			
Wang and Lee (2010)	not reported	USA; Houston	Older adults (61-100)	Investigate associations between neighbourhood and site-level environments and walking in older adults.	Multivariate logistic regression	Cross sectional	Walking once per day; walking ten or more minutes per occurrence	WEAK (3)
Bentley, Jolley, and Kavanagh (2010)	2003	Australia; Melbourne	Adults & older adults (18-74)	Investigate association between walking time and environmental factors.	Multi-level ordered logistic regression. Missing data was also imputed.	Cross sectional	Time walking	WEAK (2)
Schmidt, *et al.* (2015)	not reported	Netherlands	Children (4-5 at baseline)	Investigate association between perceived social, physical, and safety related characteristics of neighbourhood and BMI in children.	Cross sectional: linear regression Longitudinal: linear regression with	Prospective cohort	BMI	WEAK (4)

					generalised estimating equations (GEE)			
Compernolle, *et al.* (2017)	March-August 2014	Belgium & The Netherlands; Ghent and suburbs; The Randstad (Amsterdam, Rotterdam, The Hague, Utrecht)	Adults (not reported)	Investigate objectively measured physical environmental neighbourhood factors and accelerometer-determined total sedentary time in adults.	Mixed linear regression	Cross sectional	Total sedentary time	WEAK (4)
Zuniga-Teran, *et al.* (2017)	Jan - Mar 2014	USA; Tucson, Arizona	Adults & older adults (18-70+)	Test the Walkability Framework as a model to measure effectiveness of built environment in relation to physical activity and wellbeing.	Bivariate correlation	Cross sectional	Physical activity: walking for recreation; walking for transportation.	WEAK (4)

Table 3: Study physical environment measures, street scale utilised, exposures / interventions, and key findings

Author (publication year)	PE tool; objective / subjective measure	Scale of study	Street scale exposures / intervention of interest (in this study)	Key findings for items & outcomes meeting inclusion criteria
Holistic street design: studies using tools to investigate a wide range of characteristic groups				
Boarnet, *et al.* (2011)	Irvine Minnesota Inventory (IMI) (Day *et al.*, 2005); Objective	Street segments	154 / 178 items within survey meet inclusion criteria organised by: neighbourhood identification; street crossing; street characteristics; land uses; barriers; pavements; bicycle lanes; mid-block crossings; pavement amenities; street trees; buildings; windows; other features of buildings; garages; maintenance; traffic features; architecture / design; other features of the segment.	Total Physical Activity significant adjusted coefficients given here: Accelerometer mean counts per day (1,000s): mean 223.9, SD 100.3 Presence of traffic signal: -106.1* Presence of pedestrian activated signal: -140.3* Some restaurants on segment: -88.4* Bicycle lanes on segment: -136.5* Parking structure visible: 493.0* Parking at ground level visible: 246.5* No posted speed limit: 565.3* Billboards on segment: 248.7* Accelerometer median counts per day (1,000s): mean 228.9, SD 108.8 Presence of traffic signal: -100.2* Presence of pedestrian activated signal: -134.1* Strip mall / row of shops: 345.2* All buildings have garage doors facing street: -226.1*

				Parking structure visible: 440.0* Parking at ground level visible: 220.0* No posted speed limit: 598.4* Billboards on segment: 227.4 Total PA in METs (IPAQ): mean 4,223.6, SD 4,469.2 No pedestrian crossing points marked: -3,463.7* Zebra striped cross walks: 6,334.4* Few buildings with vertical mixed-use: 42,216.5* Drive through restaurant present: 21,900.6* Railroad track barrier: 32.1* *p<0.05 The study also assesses the same characteristics against six measures for total walking (22 significant associations); walking for leisure (11 significant associations); walking for transport (25 significant associations).
Cain, *et al.* (2014)	Microscale Audit of Pedestrian Streetscapes (MAPS) (Millstein *et al.*, 2013) Objective	0.25 mile, from residence walking toward a destination	56 items within survey meet inclusion criteria amalgamated into analysis across domains of: destinations & land use; streetscape; segment; crossings; cul-de-sac. Plus analysis of: Route: Land Use / Destinations: What parking facilities are present; what types of residential uses; how many of the following types of non-residential destinations are present? Route:	Walking and cycling for transport: 88 significant associations with MAPS scores across all age groups. Leisure and neighbourhood physical activity: 38 significant associations with MAPS scores across all age groups. MVPA: 27 associations across children, adolescents, older adults (no adult data). Overall grand scores: T statistics, adjusted for macro-level walkability: Walking & biking for transport: children 5.543***, adolescents 2.304*, adults 4.906***, older adults 4.063***

			Streetscape: Number of public transit stops? Segment: building height-setback; building height-road width ratio; buffer; bike infrastructure; trees; building aesthetics / design; pavement; pavement obstructions; wide one-way street design; slope. Crossings: crosswalk amenities; curb quality; intersection control; road width; impediments.	Leisure and neighbourhood PA: children - not significant, adolescents -2.297*, adults - not significant, older adults - not significant Objective MVPA: children 2.863**, adolescents - not significant, adults - not significant, older adults 2.218*. *p≤0.05, ** p≤0.01, *** p≤0.001
Sallis, *et al.* (2015)	MAPS-Mini (this study) Objective	0.25 mile route from residence	Streetscape characteristics: transit stops; street lights; benches. Crossings / intersections: crosswalk; curb cuts; crossing signal. Street segments: pavement; pavement buffer; trees and overhead coverage.	Overall total scores: T statistics, adjusted for macro-level walkability: Walking & biking for transport: children 5.22***, adolescents 2.47**, adults 5.59***, older adults 2.15* 28 significant other associations with MAPS-mini scores across all age groups. Leisure and neighbourhood PA: children 2.43 *, adolescents -1.69 - not significant, adults 0.32 - not significant, older adults 0.80 - not significant. 14 significant other associations (p≤0.05) with MAPS-mini scores across all age groups. Objective MVPA: children 2.69**, adolescents 0.28 - not significant, adults 1.19 - not significant, older adults 1.48 - not significant. 3 significant associations (p≤0.05): presence of sidewalk,

				curb cut, total score with MAPS-mini scores for children. *p≤0.05, ** p≤0.01, *** p≤0.001 Active travel effect size, positive, lowest vs. highest MAPS-mini score: children 33%; adolescents +43%; adults +243%; older adults +242%.
Complex design interventions: studies investigating specific complex design interventions or features				
Kosaka, *et al.* (2014)	N/A Intervention study. Objective (binary presence / absence of feature)	Extent of gangi dori	Gangi dori present or absent: integrated structure of gangi; a deep eave facing the street; usually wood; individual eaves connected to adjoining eaves; walking space along street; accessible to public; usually privately owned.	Correlation to a reference of non-snowfall season and no Gangi Dori present (Naoetsu location): Step counts β = 0.50 (p<0.01) Physical Activity Energy Expenditure (PAEE) β = 0.32 (p<0.01) Residents of area with Gangi Dori (Takada) had higher step count and PAEE in snowfall season.
Curl, Ward Thompson, and Aspinall (2015)	N/A Intervention study. Neighbourhood Open Space tool (Curl, Ward Thompson and Aspinall, 2015) used but not for outcomes	Individual streets within the study	DIY Streets Intervention present or absent: ranged from comprehensive transformations to 'glorified traffic calming' including: raised table; road markings; planters; road narrowing and one way; planted build outs; road markings, planters, and bike racks.	T-test results (narrative synthesis, p-values only reported) Intervention group: Perceived more active post intervention (p=0.04) 'It is easy for me to walk on my street' increased (p=0.03) - this factor was the strongest predictor in component analysis. Both groups (i.e. not significantly different): Outdoor activity in summer, no significant increase Outdoor activity in winter, decrease (p=0.05)

	meeting inclusion criteria. Objective (binary: intervention / non-intervention)			CASP-19, decline (p=0.04) Unhealthy days, increase (p=0.006) 'the paths to get to the local open space are easy to walk on', increase (p=0.02) 'there is an attractive fountain or water feature in the local open space', increase (p=0.05) CCR results identify strongest predictor as: Q5 'it is easy for me to walk on my street' R-squared 0.04, accuracy 53%, present on 791 of 1200 regression runs. Change in unhealthy days: do not discriminate between groups. EUROQOL: do not discriminate between groups.
Other broad ranging studies: investigating fewer categories of characteristics				
Pikora, *et al.* (2006)	Systematic Pedestrian and Cycling Environmental Scan (SPACES) (Pikora *et al.*, 2002) Objective	400m of residence (correlated with 5 min walk)	Functional: Walking surface: path type; surface type; continuity. Functional: Streets: width (walking for rec only). Functional: Traffic: Traffic control devices Functional: Permeability: Street design. Safety: Personal: lighting; surveillance. Safety: Traffic: Crossings; crossing aids; verge width. Aesthetic: Streetscape:	Main results aggregated factor averages (excluded), some disaggregation reported: Walking surface element (comprised of path suitable for walking, path surface, path maintenance, direct route, path continuity): recreation walking, high vs low: adjusted OR 2.04 (95% CI: 1.43-2.91, P<0.005) Walking surface element: transport walking, high vs low: adjusted OR 2.13 (95% CI: 1.53-2.56, P<0.005) Street element (comprised of street width): transport /

			Trees (walking for rec only); architecture (walking for rec only).	recreation walking: high vs low: not significant, not reported Safety element (including lighting over path, surveillance, crossings, crossing aids, verge width): transport / recreation: not correlated Aesthetic elements (including trees and architecture): transport / recreation: not correlated
Lee, *et al.* (2007)	Developed from previous (Humpel, *et al.*, 2002, 2004) Subjective	Neighbourhood defined by residents' perceptions.	Accessibility: there are pavements suitable for walking in the neighbourhood; Safety: it is easy to cross streets; the pavement is well lit even at night; Convenience: the pavements have few inclines and are easy to walk on; the pavements are wide enough to walk on.	Correlations between perception / time spent walking (mins/week): Sidewalk suitable for walking: High Walkable / Low Perception 191.7 SD200.6 n=60 * High Walkable / High Perception 302.9 SD 279.7 n=177 * Low walkable / low perception 125.9 SD 182.1 n=91 * Low walkable / high perception 211.3 SD 234.5 n=104 * It is easy to cross streets: High Walkable / Low Perception 282.0 SD288.9 n=124 - not significant High Walkable / High Perception 269.8 SD 241.9 n=113 - not significant Low walkable / low perception 145.1 SD 162.7 n=116* Low walkable / high perception 214.6 SD 270.2 n=79* Sidewalk well lit: not significant Sidewalks few inclines & easy to walk on: High Walkable / Low Perception 273.6 SD296.8 n=65 - not significant High Walkable / High Perception 278.1 SD 255.4 n=172 -

				not significant Low walkable / low perception 89.7 SD 88.2 n=64 ** Low walkable / high perception 215.6 SD 245.9 n=131 ** Sidewalks wide enough to walk on: High Walkable / Low Perception 264.3 SD 264.0 n=170 - not significant High Walkable / High Perception 302.5 SD 273.7 n=67 - not significant Low walkable / low perception 132.2 SD 138.8 n=116 ** Low walkable / high perception 232.8 SD 284.5 n=79 ** * p<0.05,** p<0.01
Handy, Cao, and Mokhtarian (2008)	34 item survey from Handy *et al.* (2004) Subjective	Survey not stated; elsewhere 400m from residence	Attractiveness (3/4*) attractive appearance of neighbourhood; variety in housing styles; big street trees. Outdoor spaciousness (3/4*) large front yards lots of off-street parking (garages or driveways); big street trees.	Cross-sectional: Perceived attractiveness of neighbourhood factor (comprising appearance, variety in housing styles, big street trees, and upkeep) related to exercise frequency β 0.0866 p=0.000 Quasi-longitudinal: Ordered probit model for changes in exercise: Changes in perceived attractiveness factor (attractive appearance of neighbourhood; high level of upkeep in neighbourhood (not design); variety in housing styles; big street trees): β 0.151 p=0.000 Changes in outdoor spaciousness factor (large backyards (not street scale); large front yards; lots of off-street parking; big street trees): no significant relationship.

Wang and Lee (2010)	18 item environmental variable tool; 14 item GIS measures Subjective (survey) and objective (GIS)	Individual residential lots; 0.25, 0.5, 1.0, 2.0 miles	Site level: building type; building height; entrance structure type; landscaping; canopy shading. Neighbourhood level: pavement availability; lighting conditions; road side benches or seating. GIS site level: building orientation toward frontage street; frontage street orientation towards the sun; width of side-areas / yards	Walking once a day or more: no street scale characteristics significantly associated in fully adjusted model. Walking at least 10 minutes per occurrence: no street scale characteristics significantly associated in fully adjusted model.
Bentley, Jolley, and Kavanagh (2010)	Adapted Systematic Pedestrian and Cycling Environmental Scan (SPACES) (Pikora *et al.*, 2002) Objective	Street segments within 400m of residence	Design: Walking Surface: walking / cycling path present; slope [of street gradient]; path location [relative to road]. Safety: Personal: lighting present; surveillance [from buildings]. Safety: Traffic: Crossing aids [presence of]; absence of driveway crossovers. Aesthetics: Streetscapes: absence of trees	Time spent walking vs reference group low (≤10min walking in last week) adjusted, Model 2 adjusted: OR (95% CI) Walk path 1.42 (0.63-3.22) Slope 0.65 (0.41-1.01) Path location 0.8 (0.69-0.92)* Lighting 1.11 (0.22-5.57) Surveillance from buildings 0.77 (0.57-1.03) Crossing aids 1.33 (0.49-3.63) Absence of driveway crossovers 1.68 (1.39-2.04)* Absence of trees 0.92 (0.71-1.18) *p<0.05, p values not generally reported
Schmidt, *et al.* (2015)	48 item survey developed from previous including	not reported - neighbourhood study	Perceived safety: the street has good street lighting at night; pedestrians / cyclists can easily be seen from houses. Functionality (5/6): availability of	No significant relationships once adjusted for other Physical Environment attributes (Model 3) both cross-sectionally and longitudinally. Perceived safety:

	(Brownson *et al.*, 2010) Subjective (parent perception)		footpaths and stairs; separation of footpaths from streets; availability of cycle paths; separation of cycle paths from streets.	Good visibility of pedestrians and cyclists from houses β = 0.035 (CI -0.009, 0.079) Good street lighting at night β = -0.042 (CI -0.085, 0.001) Physical environment: Functionality: β = 0.035 (CI -0.073, 0.003)
Compernolle, *et al.* (2017)	SPOTLIGHT Virtual Audit Tool (SPOTLIGHT VAT) (Bethlehem *et al.*, 2014) Objective	street segment level; NB: data aggregated to neighbourhood average for each feature	Aesthetics: green/water area; residential gardens. Presence of cycling-related items: presence of bicycle lanes; traffic calming devices. Presence of walking-related items: pedestrian crossings; presence of pavements.	No significant associations were identified in a the adjusted model. There was significant co-linearity in the single regression. Association between sedentary time / physical environment factors adjusted for age, gender, educational level, household composition (n=329) β = increase in sedentary minutes / day with one unit (1%) increase in physical environment factors: Green/water area b=-0.02(SE B 0.27); p=0.93 Residential gardens b= no association found Presence of bicycle lanes b= no association found Traffic calming devices b=0.59(SE B 0.37) p=0.14 Pedestrian crossings b=0.28(SE B 0.48) p=0.59 Presence of sidewalks b= -0.19(SE B 0.24) p=0.45
Zuniga-Teran, *et al.* (2017)	Survey tool developed from a range of previous studies.	'the streets'; 'most of the streets'	Traffic safety (7/8): there are bike lanes on most of the streets; there are pavements on most of the streets; pavements are separated from the road / traffic by parked cars; there is a grass /	Physical activity: Traffic safety: r=0.641 (p=0.000, n=485) Surveillance: r= 0.309 (p=0.000, n=380) Walking for recreation: Traffic safety: r=0.602 (p=0.000)

	Subjective		dirt strip that separates the streets from the pavement; there are dirt trails on most of the streets; the streets have speed bumps; the speed limit is 25mph or less on most of the streets. Surveillance (4/5): my neighbourhood streets are well lit at night; most units have front porches; the buildings are located close to the street; most dwellings have front garage doors.	Surveillance: r= 0.193 (p=0.000) Walking for transportation: Traffic safety: r=0.211 (p=0.000) Surveillance: r= 0.264 (p=0.000) Moderate correlation = 0.3 < r < 0.7

This review sought studies investigating street design in the holistic sense and this synthesis therefore considers groups of studies according to how they investigate this holistic aspect of street design: studies of holistic street design; complex design interventions; and other broad ranging studies.

Holistic street design

Three included studies (Sallis *et al.*, 2015; Cain *et al.*, 2014; Boarnet *et al.*, 2011) used three tools (respectively IMI; MAPS; and MAPS-Mini) to measure a broad variety of design characteristics at the street scale reporting significant although scientifically weak cross-sectional findings within nine (Cain *et al.*, 2014), six (Boarnet *et al.*, 2011), and five (Sallis *et al.*, 2015) categories.

Boarnet et al. (2011) investigated total physical activity measured by METs per week (MET); median accelerometer counts (1'000s) per day (median); and mean accelerometer counts (1'000s) per day (mean). Cross sectional, significant ($p<0.05$) associations in the expected direction were identified for: a lack of marked pedestrian crossings (β-3,463.7 MET); provision of zebra striped crossings (β=6,334.4 MET); rows of shops or strip malls (β=345.2 median); buildings with garage doors facing the street (β=-226.1 median). There were also findings in the unexpected direction and the study also investigated walking measures as an outcome. Cain et al. (2014) found for an overall grand summary score of the MAPS tool: associations between walking and biking for transport (reported as t-statistics; children 5.543 $p\leq0.001$; adolescents 2.304 $p\leq0.05$; adults 4.906 $p\leq0.001$; older adults 4.063 $p\leq0.001$); leisure physical activity (in adolescents only and negatively correlated -2.297 $p\leq0.05$); and MVPA (children 2.863 $p\leq0.01$; older adults 2.218 $p\leq0.05$). Sallis et al. (2015) total summary score amalgamated design with non-design criteria and therefore does not fit the criteria for this review: at the item level associations were found with walking and biking for transport with public transport stops; street lights, benches, pedestrian crossings, dropped kerbs, crossing signals, pavements, pavement buffers, trees and overhead coverage. Associations were not found in all age groups but there was a spread across all populations. For leisure and neighbourhood physical activity associations were found with public transport stops, dropped kerbs, and pavements in children;

and benches and pedestrian crossings in adolescents. For MVPA per day only dropped kerbs and pavements were associated with the outcome and only in children.

Within the scope of the EPHPP risk of bias tool, all three studies were globally weak for risk of bias with all being assessed weak in three domains: weakness in more than one domain results in a globally weak assessment. As cross-sectional designs, all three studies could only identify correlation not causation between street design characteristics and NCD risk factors. A longitudinal study would help strengthen these designs by potentially controlling for more confounding factors and providing stronger evidence of any cause-and-effect relationships. All three were weak for selection bias. Boarnet *et al.* (2011) was the only included study rated strong for controlling confounders notably controlling for all main confounders extracted (race, sex, marital status / family, age, socio-economic status, education, existing health status) plus others whereas Cain *et al.* (2014) and Sallis *et al.* (2015) were rated weak in this domain.

Boarnet *et al.* (2011) investigated adults and older adult populations. Cain *et al.* (2014) and Sallis *et al.* (2015) investigated children, adolescents, adults, and older adults. All were in urban areas in the USA.

All three identified significant although scientifically weak associations between measures of street design and physical activity outcomes under categories of green infrastructure; walking and cycling infrastructure; and facilities in the street (such as benches and gathering places). Boarnet *et al.* (2011) and Cain *et al.* (2014) found significant associations within land use and mix; street identity (such as signage or cultural, artistic, historic features); motor vehicle related infrastructure (traffic calming, lanes, speed limits, parking, signage); and security and safety features. Cain *et al.* (2014) found significant association with urban and housing design items.

Some of Boarnet *et al.'s* (2011) scientifically weak evidence provides support for the hypothesis in the literature that active travel in adults is particularly supported by functional types of features in the street such as street character, pavements, and walking destinations (Dishman *et al.*, 2017; Giles-Corti *et al.*, 2015; Forsyth *et al.*, 2008). That study also reported some findings in the unexpected direction: four lanes of traffic having a greater positive association with walking for travel measured by diary ($\beta=13.5$ $p<0.05$) than two lanes ($\beta=-12.1$ $p<0.05$); and presence of

drive through restaurants (β=21,900.6 p<0.05) having a positive association with total physical activity (METs per week). Whilst this study comments on the direction of the drive through restaurant finding no comment is made on the seemingly large coefficient value.

Cain *et al.* (2014) found scientifically weak but promising evidence that features such as buffers; street aspect design; pavements; trees; and cycle lanes have a significant positive association with physical activity for both leisure and travel in adults and highlights that for children and older adults presence and design of street crossings are of more importance for these outcomes than for adults or adolescents. Similarity of associations between street design characteristics and NCD risk factors in children and older adults has face validity in the literature but few included studies investigated a child population: Schmidt *et al.* (2015) despite being a prospective cohort design was methodologically weak and found no significant relationships with children's BMI. The implications for future research are considered in the discussion.

All three studies in this holistic group found weak evidence for a smaller number of significant associations related to leisure time physical activity: Boarnet *et al.* (2011) found significant associations between street design characteristics and leisure time physical activity in the hypothesised direction for presence of identity banners for neighbourhood; presence of coffee shops; presence of a row of shops or strip mall; a posted 25mph speed limit; garage doors not being visible or not very visible; the absence of a motorway over / underpass; and presence of rumble strips or bumps. Other findings were in the unexpected direction were: negative association to leisure walking of the presence of some marked pedestrian crossings and presence of greenbelt paths, but a positive association between the presence of commercial waste bins; and presence of overhead electrical wiring overhead. Cain *et al.* (2014) found significant, though scientifically weak, positive associations in adults for presence of parking and street slope steepness with leisure physical activity; in older adults for presence of parking (negatively associated), street aspect, building design and aesthetics. Residential mix, shops, institutional services, transit stops, crossing impediments, pavement obstructions, and slope were all negatively associated for children. Cul-de-sac presence was positively associated for leisure physical activity in adolescents and children.

Cain *et al.* (2014) further found scientifically weak but promising evidence that street level characteristics were independently associated with neighbourhood walkability and also found that a group of microscale features may collectively be of more value than the sum of individual ones. Albeit in one study rated as scientifically weak, these are promising indications of the validity of investigating NCD risk factors at the street scale and the potential benefits of a basket of multiple small design changes.

Sallis *et al.* (2015) developed a short version of the 120 item MAPS tool (the 15 item MAPS-mini) with the aim of developing a shorter form. The study found significant associations for active travel in all age groups; fewer for leisure physical activity and then only amongst children and adolescents; and only curb cuts and pavements were significant for MVPA and only in children. Comparing the MAPS-Mini tool to the full MAPS tool (Cain *et al.*, 2014) some effect sizes were reduced in the shorter version and detail of sub-scales was reduced which may reduce its usefulness to practitioners and researchers however the short form may be valuable for non-expert community members to use (Sallis *et al.*, 2015, p.6). This systematic review considers characteristics from design practice: potentially tools measuring a broad range of characteristics rather than a reduced short form may be more readily translated into design practice.

This group of holistic studies found scientifically weak but significant associations across items in categories of land use and mix; urban and housing design; green infrastructure; identity; public transport; walking and cycling; motor vehicles; facilities; and security and safety. Associations varied by population: similarities between what works for children and older adults were reported.

Overall, the evidence is methodologically weak and should be interpreted with caution. Due to cross sectional design it is not possible to determine causality through these studies which could be affected by other determinants. Use of detailed assessment tools rather than summary ones appear to be of greatest use to design practice. Longitudinal study design would strengthen future studies.

Complex design interventions

What differentiates Curl *et al.* (2015) and Kosaka *et al.* (2014) from the first group of holistic studies is the way in which they conceptualise the street, not as a subject to be measured itself but rather a single complex intervention in relation to which outcomes were investigated. Design characteristics were not assessed in detail (whilst noting Ward Thompson *et al.* (2014) assessed neighbourhood scale characteristics in the DIY Streets study) but objectively through binary absence or presence of a specific design feature (Kosaka *et al.*, 2014) and intervention compared to no intervention (Curl, Ward Thompson and Aspinall, 2015).

Curl *et al.* (2015) is the only included study with an experimental design, it investigated health in adults over 65 years old in the UK. Kosaka *et al.* (2014) is a cross-sectional study of partially covered streets of Gangi-dori in Japan (pavements covered with eaves – typically timber; and privately owned / maintained though publicly accessible) and association to physical activity energy expenditure in adults. This second study was rated weak across four sub-domains (selection, design, confounders, blinding) using the EPHPP tool meaning findings need to be interpreted with caution and are of limited generalisability in this review.

Curl *et al.* (2015) was one of two included studies to be scored moderate rather than weak for study design quality. The study assessed seven sites that received home zone improvements based on the concept of the Dutch Woonerf and tailored to the needs of each location. As a result the street designs were diverse, in part this was due to the nature of each project being informed by local need, and the authors noted the study was an under powered sample (n=36). The NCD outcomes and risk factors of interest to this systematic review (which were general health, quality of life, time spent outdoors, and frequency of being outdoors in summer and winter) were not found to differ between intervention and comparison groups.

Kosaka *et al.* (2014) whilst scientifically weak provides a good example of how a seemingly simple design feature such as gangi-dori is in fact a complex combination of design characteristics influencing a number of design characteristic categories.

Curl *et al.* (2015) provides the only example of an experimental design and the strongest study design being a prospective cohort with a comparison group. This study may have been under-

powered, nonetheless the study design offers the ability account for more of the very wide range of confounding factors in built environment studies.

Other broad ranging studies

The remaining eight studies (Compernolle *et al.*, 2017; Zuniga-Teran *et al.*, 2017; Schmidt *et al.*, 2015; Bentley, Jolley and Kavanagh, 2010; Wang and Lee, 2010; Handy, Cao and Mokhtarian, 2008; Lee *et al.*, 2007; Pikora *et al.*, 2006) are more similar in design to the first group of holistic studies but investigated a more limited range of characteristics. Adult and older adult populations were the focus of all studies except Schmidt, *et al.* (2015) investigating links with parental measured BMI in children with environmental variables measured subjectively by parental perception.

Although seven out of ten design categories were investigated few significant associations were found. Zuniga-Teran *et al.* (2017) report scientifically weak evidence of significant associations of physical activity, walking for recreation, and walking for transportation to design categories of: urban and housing design; walking and cycling; motor vehicles; and security and safety. Pikora *et al.* (2006) and Lee *et al.* (2007) report weak evidence of significant associations with walking and cycling category specifically for pavement design. Handy *et al.* (2008) found significant associations for land use mix and green infrastructure categories and MVPA but again the study was scientifically weak. The remaining studies found no significant associations. Micro-climate design (such as for wind patterns and solar angles) is an important design category (Barton, Grant and Guise, 2010, p.173) yet Wang and Lee (2010) was the only study to assess micro-climate and found no significant association. However – consistent with all included studies –the study was rated as weak and therefore the lack of a finding is not strong evidence of there being no effect.

Summary

A group of three holistic studies found weak evidence of significant associations across ten design characteristic categories. Associations varied by population and there were similarities between what works for children and older adults. Implications for future research are considered in discussion.

Cain *et al.* (2014) gives the clearest indication that street design characteristics are associated with health risk factors and that these can be differentiated by type of physical activity such as travel and leisure. This is broadly supported by two other studies (Sallis *et al.*, 2015; Boarnet *et al.*, 2011). Curl *et al.* (2015) is the only experimental design and strongest rated study, even though it was rated as weak and was under powered. A final group of broad but less holistic studies complete the small and emerging evidence base identified through this systematic review. Few significant associations were found. All included studies were methodologically weak however there were examples of strong or moderate study design in domains of study design, controlling for confounding, and data collection. No study was rated strong for selection bias or blinding and these are key weaknesses across studies that inform recommendations for future research.

2.2.6 Discussion

The role of the built environment for health is increasingly recognised and design practitioners have an important role in shaping it yet much evidence is not framed through a lens of design practice. Two aspects of design practise are the development of strategies at various scales including the street and the concept of holistic design quality. This systematic review has identified some scientifically weak evidence for residential street design characteristics and their effect on NCD risk factors, yet compared to other reviews of neighbourhood environment correlates of health, relatively few studies were met inclusion criteria. This is primarily driven by the intervention eligibility (residential street design) as no restriction was placed on population and NCD outcomes and risk factors were defined broadly compared to other reviews.

Design characteristics as a lens and the street as a unit of analysis have been relatively overlooked in the literature, or at least amalgamated with non-design characteristics and other scales such as the neighbourhood thereby limiting their use in design practice. There are promising indications of links between health and street design although included studies do not demonstrate good evidence of a causal link either with NCDs or their risk factors and there are both methodological and epistemological challenges to be addressed in future research.

Populations

Cain *et al.* (2014) reported differences for which street design characteristics are important to various age groups, for example, what is helpful for children is sometimes similar for older adults. Only three studies considered a population of children. Given the life course implications future research should address this gap in the field to address the potential to support healthy childhood. Further research of the adolescent population is needed: McGrath *et al.* have observed, “Built environments are mostly designed to meet the commercial and societal needs of adults…” (2015, p.862) and Knöll and Roe suggest that conceptual frameworks for adolescent health related to urban environment need to be rethought as they fail to take into account factors important to this age group (2017).

Defining the street

As Appleyard identified, “Nearly everyone in the world lives on a street.” (1981, p.1) and yet included studies have no consistent definition of what a street is. Such a definition is not just about street morphometrics or buffer size: Boarnet et al.’s (2011) street segment approach appears closest to that of design practise definitions but there were a range of conceptualisations and Cerin *et al.* (2017, p.17) have suggested that time walking may be a more appropriate parameter for older adults with variable functional mobility. The implications should be considered for all age groups: two studies (Sallis *et al.*, 2015; Cain *et al.*, 2014) identify varying relationships of street design characteristics to physical activity across all age groups and apply the same 0.25 mile buffer to each when children, adolescents, adults, and older adults may experience the street in very different ways. For designers a holistic approach is important and micro-climate and design quality are two relatively overlooked characteristics – it is particularly important that design quality is treated as distinct from non-design aesthetics. Future research should conceptualise and define the street not solely for its morphometric design characteristics but also its climatic, social, cultural, and historical ones. A previous study (Lin and Moudon, 2010) identified some objective measures having stronger associations with walking than subjective measures but also reported combining both objective and subjective measures being of potential value. Future studies should standardise approaches with tools, such as MAPS for objective measures, that would support future meta-analysis.

Reducing risk of bias

All studies were rated weak for risk of bias using the EPHPP tool, this is a key finding. This is consistent with Audrey et al.'s (2015) systematic review of urban environments for children and young people which found most studies (n=24, 80%) to be at serious risk of bias and the balance (n=6, 20%) at moderate risk of bias. Ige et al.'s (2018) systematic review of the relationship between buildings and health found a majority (n=23, 59%) to be of poor quality but a greater proportion of moderate (n=12, 31%) and high quality (n=4, 10%).

Risk of bias assessment of built environment correlates could be strengthened and clarified in existing domain-based tools by extending them to address specific methodological concerns including: stratification by key environmental attributes; controlling for self-selection into neighbourhoods; and explicit reference to analytical methods addressing area-level clustering and categorisation of continuous environmental exposures (Barnett *et al.*, 2017; Cerin *et al.*, 2017; Lamb and White, 2015; Ewing and Cervero, 2010; Ogilvie *et al.*, 2007). In this review inclusion of such additional risk of bias criteria would not have affected the overall risk of bias assessment as all were rated weak.

Future studies should seek to address methodological weaknesses. Considering life course impacts, and concurring with Curl, Ward Thompson and Aspinall (2015, p.124), longitudinal study design should also seek to be longer: follow up of a few years is insufficient for some health outcomes to manifest. Longitudinal design combined with adequate selection; confounding; and data collection would significantly support reducing risk of bias: most included studies for example described education status but did not control for it. Bentley *et al.* (2010) demonstrate that selection and confounding can be rated moderate with strong data collection. As Audrey et al. (2015) highlight future interventions could consider experimental design with randomised control at the site level. Investigating street scale design characteristics would also potentially better address limitations of identifying individual exposures and receiving the correct intervention which have been noted as a limitation at the neighbourhood scale (White *et al.*, 2017). Longitudinal designs combined with large data sets of population health (Rodgers *et al.*, 2017; Sarkar, Gallacher and Webster, 2013), may further strengthen study design.

The epistemological differences between design practise and public health hierarchies of evidence should not be overlooked (Drane and Carmichael, 2018): methods for risk of bias assessment are developed on underlying positions toward knowledge creation. Public health practitioners have a professional duty to use best available evidence (Faculty of Public Health, 2016) but existing hierarchies of evidence rate much built environment studies including those included here as weak. Future interdisciplinary research that frames its aims with a lens of design practice, as in this systematic review, may help to bridge these differences between design and public health practise.

A theory of health in the street

Where stated, studies identified themselves as using a socio-ecologic framework. There appeared to be a ready adoption of such frameworks without clarity over the specific theories being relied on in a number of cases. On the evidence available, a theory of the street linked to human health in the socio-ecologic paradigm is needed including evidence on how different populations relate to and experience the street scale. This informed the subsequent research design and a recommendation that future research should develop theoretical pathways of how design impacts health to underpin methodological approaches.

Informing the research design

The review was undertaken at an early stage to inform the research question and this is reflected in subsequent refinement of concepts and definitions. The focus on *street design* was refined to *street environment* to encompass a broader definition. Firstly, to include residents among the wider range of actors in the street. Secondly, to be explicit that the street environment includes both street physical and social environment dimensions. Behaviour change and social capital interventions were excluded which is a limitation of the review. The reason for this was due to practical resource constraints as well as because such interventions are rarely undertaken by built environment design practitioners. In subsequent reflection, this can also be viewed as a limitation of the disciplinary lens of urban design as well as the researcher’s own background as a design practitioner. This limitation reflects the emphasis of built environment disciplines on the physical environment over the social environment. This

learning was reflexively addressed in the subsequent research design by expanding these definitions and linking to sociological definitions of the street.

Included studies used heterogenous definitions of what a street is. A number focused on street morphometrics or geospatial buffer sizes. The systematic review concluded that future research should include definitions of the street that go beyond spatial characteristics to include climatic, social, cultural, and historical dimensions. The Microscale Audit of Pedestrian Streetscapes (MAPS) tool (Millstein *et al.*, 2013; Sallis, 2010) in one included study (Cain *et al.*, 2014) and the 400m buffer used therein was assessed to be closest to the focus of this research and was included as part of fieldwork street observation methods in an adapted form.

2.2.7 Limitations

Recognised limitations in this review include: database bias – Scopus for example is over-representative of natural, engineering, and biomedical studies and those from publishers based in The Netherlands, UK, and USA (Mongeon and Paul-Hus, 2016). Limitations also include English language bias; limits of blinding of reviewers; exclusion of qualitative studies; and inclusion of amalgamated results for non-design factors making up less than a third of the overall score. The use of a 10% validation sample by the second reviewer at screening stage is a limitation of this systematic review and lower compared to those undertaking complete dual validation. The field of study has developed over the last decade but with a focus primarily on neighbourhood and larger scale not the street, in the current eco-epidemiology paradigm the street has only recently started to be considered in research questions.

Three included studies used amalgamated scores with one non-design item included in the score (Zuniga-Teran *et al.*, 2017; Schmidt *et al.*, 2015; Handy, Cao and Mokhtarian, 2008). Similarly Cain *et al.* (2014) grand totals and sub-total scores included some non-design items making up less than a third of the score.

2.2.8 Conclusion

This systematic review found the street scale, as part of the wider built environment, to be a unit of analysis with ecological validity for human health and a small but scientifically weak

quantitative evidence base has been identified. Results show promising indications that a range of street design characteristics across ten categories of land use and mix; urban and housing design; micro-climate; green infrastructure; identity; public transport; walking and cycling; motor vehicles; facilities; and security and safety have significant associations with key NCD risk factors, notably physical activity. One study (Cain *et al.*, 2014) found street scale associations to be independent of neighbourhood associations and also that the cumulative effect of small design characteristics has a greater effect than the sum of the individual parts. Failure to implement designs comprehensively is also thought (Curl, Ward Thompson and Aspinall, 2015) to contribute to a failure to positively impact on human health.

Future research should seek to cover a wider range of the ten categories identified in this review, especially micro-climate and design quality. Risk of bias should be addressed however a balanced approach to hierarchy of evidence is needed that recognises methods seeking to evaluate built environment correlates within a complex system of health. The key focus and recommendation for future research that informed the subsequent research design is the need to conceptualise a socio-ecologic framework to examine a wide range of design characteristics at the street scale and operationalise pathways to health impact.

2.2.9 Chapter Conclusion

This chapter has situated the research and outlined the current state of knowledge. Chapter 3.0 Methodology now describes how the research was conceptualised, designed and implemented for "…the generation of new knowledge at the forefront of the discipline or field of practice.." (UWE Bristol, 2023) as well as a critical understanding of that methodology. The unexpected Covid-19 pandemic during this stage of the research provided ample opportunity to demonstrate the researcher's capacity to adapt to changing circumstances.

Chapter 3.0 Methodology

This chapter contains two sections, the first addresses the overarching methodology used in this research and the second is about the specific methods used for fieldwork and analysis.

3.1 Methodology

3.1.1 Introduction

This section describes an integrated methodology comprising: a socio-ecologic theoretical perspective, a relativist ontology, a constructivist-interpretivist epistemology, and research values that are formative in the research. It continues to address how these are applied in the research, “methodology on ‘the street’”, and concludes with consideration of substantiation and quality..

The design of this qualitative research is developed from Mason’s approach (2018) and Lincoln, Lynham, and Guba’s framework as a constructivist-interpretivist methodology (2018). This methodological coherence is also a quality criterion. Figure 3 in Chapter 1 has provided an overview of these parts in this research, Figure 17 below provides a visual overview of this chapter section which addresses methodology.

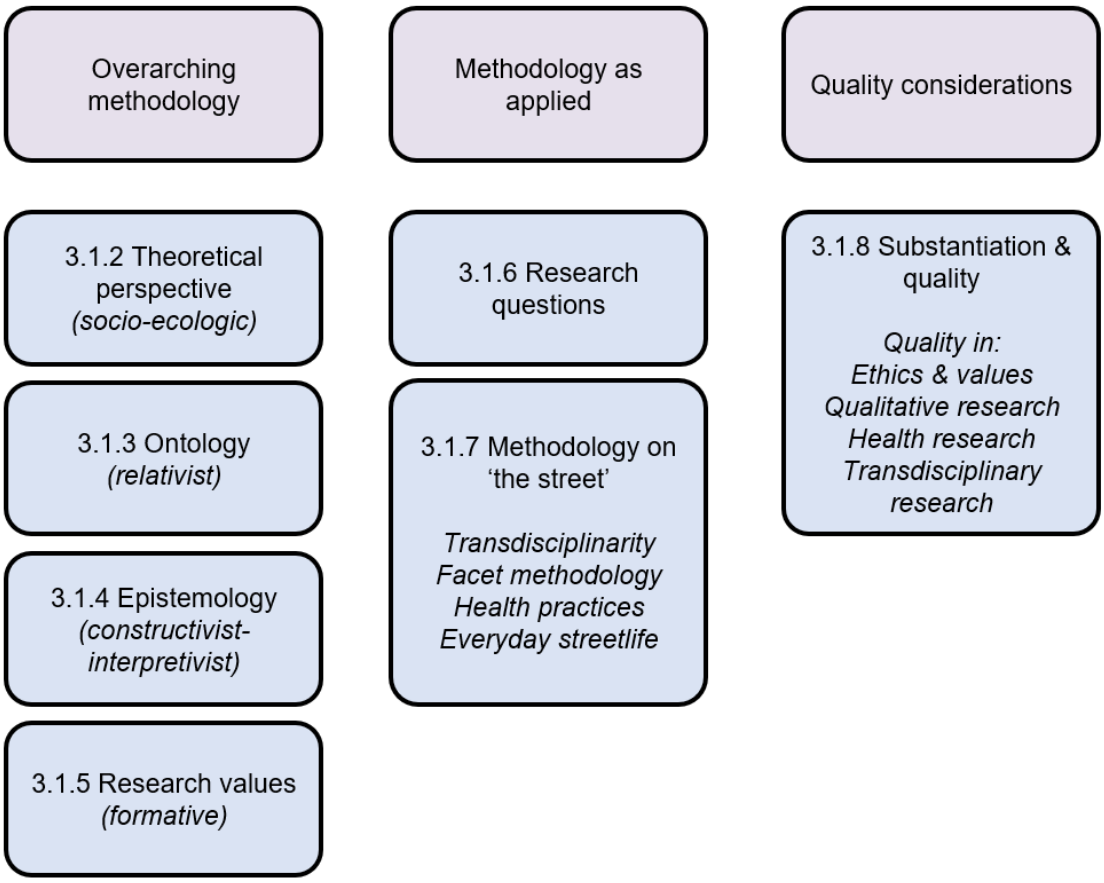


Figure 17: Chapter section visual outline

3.1.2 Theoretical perspective

This research is framed within the socio-ecologic paradigm in public health (see also chapter sections 1.14 and 2.1.3). This includes: a salutogenic conception of health; a focus on the wider determinants of health; a complex systems and socio-ecologic conceptualisation of health; the dual aspect of health being related to people and also settings or environments; and a commitment to reducing health inequalities and addressing social justice.

For clarity, the use of the term paradigm here refers to the socio-ecologic orientation toward health and not the ontological and epistemological paradigms that are sometimes discussed in relation to qualitative research.

3.1.3 Ontology

Ontology is concerned with belief and in the context of this research, whether the arguments within this thesis are believable. This research sought to understand ecological meaning and mechanisms. It uses a constructivist-interpretivist epistemology which is most aligned with a relativist ontology (Lincoln, Lynham and Guba, 2018). The phenomenon of health practices is understood as a social construction and the street environment was investigated through participants' experiences of the street. The data about health practices are interpretations of the world and these interpretations are jointly constructed by participants and the researcher.

3.1.4 Epistemology

Epistemology is concerned with a "position or attitude *towards* knowledge… a theory of knowledge…" (Jones, *et al.*, 2016, p.3, emphasis in original) . The position toward knowledge in this research is a constructivist-interpretivist epistemology (Denzin and Lincoln, eds., 2018) adopted for its interpretative strength and the need to create "understanding by interpreting subject perceptions…" (Lincoln, Lynham and Guba, 2018, p114).

Other epistemologies such as critical realism (Denzin and Lincoln, eds., 2018; Pawson and Tilley, 2004) or hybrid approaches (Rice, 2015) were considered and discounted. Key considerations in this assessment were: what is necessary to address the research questions; an inductive research design; health practices as a "partial, situated and contextual" (Braun and Clarke, 2021a, p.39) phenomenon; the interpretation of meaning being constructed from participant's experiences; and methodological coherence with reflexive thematic analysis. Critical realism (Denzin and Lincoln, eds., 2018; Pawson and Tilley, 2004) was considered for its ability to address "…what works for whom and in what circumstances and in what respects." (Pawson and Tilley, 2004, p.11) which offers important potential insights in population health research. However, what makes this research constructivist is the aim to explore the topic inductively starting with participant experiences and not as in critical realism to "…produce a tested theory…" (Pawson and Tilley, 2004, p.15). A blurring of boundaries between realist and relativist such as Williams' use of critical realism (2014) or other hybrid ontology (Rice, 2015) was also discounted because this was not necessary to address the research questions. The

selection of epistemology also responds to the need for methodological coherence in the overall methodology. Reflexive thematic analysis (Braun and Clarke, 2021a) is described at Chapter section 3.2.5 and with its ability to support a high level of interpretation and in contrast to coding reliability or codebook methods is more closely aligned with a relativist epistemology than a realist one.

Taken together these factors informed the selection of a constructivist-interpretivist epistemology as most appropriate to the research question(s). Epistemology is identified as an area of weakness in some design disciplines (Jones *et al.*, 2016) and situating the research epistemology within the socio-ecologic paradigm has been argued to be a potential bridging point between disciplines (Appendix 14: Drane and Carmichael, 2018).

A "constructivist-interpretivist" (Denzin and Lincoln, 2018, p.19) epistemology is the term used in this research and is further defined here. It draws on Denzin and Lincoln's term as one of the major paradigms in contemporary qualitative research, those being: "positivist and postpositivist, critical, feminist, constructivist-interpretivist, and participatory-postmodern-poststructural." (Denzin and Lincoln, 2018, p.19)

Within contemporary qualitative research paradigms the "general constructivist paradigm" (Given, 2008, p.7) has become less clear due to transformative shifts in qualitative research. The paradigms described by Denzin and Lincoln are one representation of these shifts. The constructivist-interpretivist epistemology can be viewed as developing out of a more general constructivism but also going beyond it. At the same time a difficulty identified by several authors (Braun and Clarke, 2022; Chen, Shek, and Bu, 2011) is the interchangeable use of terms including constructivism, interpretivism, and constructionism.

This constructivist-interpretivist epistemology in this research seeks to "Gain understanding by interpreting subject perceptions." (Lincoln, Lynham and Guba, 2018, p114). This is both a paradigmatic aim as well as an epistemological position toward knowledge creation. It contrasts with constructivist accounts that are closer to critical realism and is firmly within the relativist ontology. It also contrasts with constructivist approaches that have a greater focus on psychological factors and the individual. Here the focus is on social meaning making. Braun

and Clarke (2022) make this same distinction within reflexive thematic analysis methodology, their preferred term is constructionism to demonstrate that this epistemology goes beyond constructivism. This research takes a similar epistemological position but draws on Denzin and Lincoln's term of constructivist-interpretivist to position the research more broadly within its paradigm.

It is important to note that in line with Lincoln, Lynham, and Guba's framework (2018) epistemology is closely related to many other dimensions of methodology and issues such as inquiry aim, action, validity, and voice. Within the broader qualitative research paradigm the inquiry aim, validity, and voice can be viewed as arguably linked more with general constructivist approaches and certainly more than participatory epistemologies. The action domain however is closer to an interpretivist than a general constructivist approach. The inquiry aim is "To understand and interpret through meaning of phenomena… such understanding is sought to inform praxis..." (Lincoln, Lynham and Guba, 2018, p.119). This can be viewed as closely related to a general constructivist approach. Research validity clearly builds on constructivism seeking "intersubjective agreement and reasoning among actors" (Lincoln, Lynham and Guba, 2018, p.122) and considers validity criteria such as credibility, transferability, dependability, and confirmability (Guba and Lincoln, 2005). The researcher voice is predominantly a constructivist one, a "passionate participant" (Guba and Lincoln, 2005, p.194), in this research the voices of researcher and participants are mixed and participants' voices are "sometimes dominant" (Guba and Lincoln, 2005, p.199). By contrast, action is more about an interpretivist approach of developing knowledge than action within the research. The demand for research to be a "catalyst for action" is not a validity criterion as it would often be in constructivism (Guba and Lincoln, 2005, p196).

In this research what is important is that health practices (the phenomenon of interest) are not themselves 'real' but rather a lens for interpretation and understanding. The knowledge created about health practices is "partial, situated and contextual" (Braun and Clarke, 2021a, p.39), being identified through the combined perspectives, experiences, and efforts of the participants and researcher.

3.1.5 Research values

The research values are included and formative and this is coherent with the epistemology (Lincoln, Lynham and Guba, 2018).

The research values cut through different levels of the research. For example, the research has a health promotion orientation and observing participants was a practical necessity. As Antonovsky states: “The health promoter, irrespective of her personal bent, is pressured to be concerned with the person.” (1996, p.14)

Chapter 1 identified evidence for systemic unethical practice in the UK built environment sector and the resultant harm to health from this. The values underpinning this research have been stated as rights based values (World Health Organization, 1946, 1986), practice based values (Royal Institute of British Architects, 2021; Faculty of Public Health, 2016), and posit residents’ voices and lived experiences as an integral value in the research which is a partial right (Department of Health & Social Care, 2015; National Assembly for Wales, 2015; United Nations, 1990). These values are also aligned with the goal of Health Impact Assessment (HIA) to maximise population health and the Gothenburg values of “democracy, equity, sustainable development, and ethical use of evidence.” (European Centre for Health Policy, 1999, p.4)

Drawing on these different sources the values in this research are: good health as a human right; addressing population and community health; working toward health equity and reducing health inequalities; being evidence informed and using the best available evidence in any given situation; the right of people to have their lived experience and views heard and taken account of; and the right of communities to control and develop their collective knowledge.

3.1.6 Research questions

The research questions can be characterised as primarily ecologic ones with aspects of causal / predictive; processual; and comparative questioning (Mason, 2018). They are ecologic in seeking to address issues of: layering, interrelationships, and how things are connected. They are also ecologic in the specific sense of addressing a socio-ecologic problem. The research questions are also comparative in relation to horizontal comparisons across participants and

streets; causal / predictive in that they seek to illuminate pathways to health impact; and processual with a focus on underlying processual mechanisms and how things operate.

My central research question was:

> What are people's everyday health practices in their residential street environment; which street environment characteristics impact those practices; and how are these both to be understood within a socio-ecologic paradigm of population health?

This was broken down into the following prerequisite questions:

- What are residents' everyday practices in the residential street environment;
- do these practices relate to residents' health and if so how;
- do street physical environment characteristics impact on health practices and if so, which ones and how; and
- how can any pathways to health impact linking health practices and street environment be understood within the socio-ecologic paradigm of population health?

During the research design the following questions were identified as important to include:

- How do residents define 'My Street', their perceived boundaries of the street where they live?
- Describe sampled participants from a range of perspectives including demographics and current health status.
- Describe the physical environment characteristics of sampled streets from a range of perspectives including a range of visual and design practice approaches.

In asking participants about their street it was logical and important to understand how they actually conceived of 'My Street' as I have termed this concept. To support the rigor, identifying patterns, and comparative analysis detailed descriptions of participants and the streets themselves were needed. With Covid-19 there was a potentially unique and time limited opportunity to collect the data in a structured way.

The research questions address the research aims as they are open; inductive; recognise complexity; recognise wider determinants of health and the socio-ecologic paradigm in public health. They centre the actions of residents'; recognise a holistic and broad definition of health; and link these to the street environment.

The questions also address methodological quality and rigour criteria described by Mason (Mason, 2018, pp.13–14) being: developed from existing literature and identified gaps; they are justifiably original and important; they allow investigation of the various facets of the research aim; they link together in a logical manner.

3.1.7 "Methodology on 'the street'"

This chapter section outlines the methodological aims followed by key methodological concepts used in the research: transdisciplinarity; facet methodology; health practices; and everyday streetlife. This section is informed by Clarke's "methodology on 'the street'" (2002, p.12) and the need to define methodology for the street setting. It also describes the observational approach to methods, which was changed by Covid-19 restrictions, but nevertheless this way of thinking in the field was maintained as a form of "ethnographic reconnaissance" (Wolcott, 1999, p.210).

The methodological aims respond to the overall research aims which were stated in Chapter 1.0, to evidence the residential street environment as a health setting. Within this the sub-aims included: to answer the research question; to meet the UWE Doctoral Descriptors (UWE Bristol, 2023); to increase understanding of the research topic through a contribution to new and original knowledge; to address gaps identified; to address the research values; and to inform and make recommendations for future research, policy and practice including my own personal professional practice.

Methodological aims

In response to the research aims the methodological aims are summarised as:

- To answer the research question: by investigating residents' practices in the street; whether and how these practices link to health; and how these are impacted by the street physical environment;

- To undertake enabling activities to address: how participants define the street; to find out about all types of practices not just health practices, as participants might not immediately draw links to health; and an empirical assessment of the street environment;
- To do this in a rigorous way: using an integrated methodology; identifying a diverse range of practices;
- To address the research values and epistemology: at all levels of methods; incorporating a broad definition of health; incorporating ethically participant's lived experiences and perceptions; including participants from a range of groups including a mix of women and men and different ethnic identities;
- To obtain UWE ethics committee approval whilst also viewing ethics as an ongoing process throughout the research;
- To address the UWE doctoral descriptors including the creation of new knowledge (UWE Bristol, 2023) and to be practically deliverable within the scope of a PhD and the resources available; and
- To address researcher reflexivity and contribute to my development as a researcher: seeking out participants who are not like me; in participant sampling; in street sampling; leveraging existing skills and knowledge whilst gaining new ones; and supporting an opportunity for me to be creative both in methods and as well as intellectually.

Based on the critical consideration of the urban-ness of streets (Chapter Section 2.1.7), this research is focused on the street as a physical and social environment and not *a priori* as an urban space. The fieldsite for this research is in the city of Cardiff but streets are understood to be a feature of built-up places which could range from villages to towns to suburbs to cities. Rather than rely on arbitrary definitions of urban-ness, and to maintain focus, this research focuses on streets as previously defined, this research was conducted in Cardiff which is a city, an urban place.

Transdisciplinarity

Transdisciplinarity as methodology relates to the research topic itself being a problem that is beyond the scope of any one discipline to address. This section introduces transdisciplinarity in

this research which is argued to be transdisciplinary in five ways. Transdisciplinarity was not used wilfully but rather for practical reasons to address the research questions.

A transdisciplinary approach should be an integrative one which in the context of this PhD was undertaken as a “one-person project” (Tress, Tress and Fry, 2009, p.2922), not in a research team. This was a valid approach to integrative research but with limitations for what could be achieved and created challenges to be addressed in the research, such as the task of integration of different disciplinary knowledges rested with one researcher (Tress, Tress and Fry, 2009).

In this research, varied disciplinary perspectives and methods including from urban design, public health, urban health, and sociology were drawn together in varying combinations to address different parts of the research question. These disciplines are quite different to each other with a material “inter-discipline distance” (Choi and Pak, 2008, p.E41) between them. Choi and Pak argue that this combination of disciplinary perspectives can support creating novel insights (2008) whilst also cautioning that this should only be done to the extent needed to address the research question, as was done in this research design.

Healthy streetlife as a research topic is transdisciplinary, existing between and beyond disciplines. It is argued to be so in five ways.

First, the research is focused on the real-world problem of healthy street environments. This is a complex problem that does not “…stay within the artificial academic disciplinary boundaries…” (Choi and Pak, 2008, p.E42). Transdisciplinarity here also relates to, and positions the research within wider shifts in science toward team science (Cooke and Hilton, eds., 2015) and transdisciplinarity addressing *complex* or *wicked* problems (Moore *et al.*, 2021). It responds to calls for transdisciplinary urban health research (Lawrence and Gatzweiler, 2017) and the need for ecological research (‘Ecological Research’, 2008).

Second, it has involved myself as researcher becoming immersed through training and self-reflection across several different disciplines. This is in line with what Given describes as, “an endeavor that involves researchers trained in different disciplines and a self-reflective process that considers the perspectives and dominant narratives of researchers...”. (‘Ecological

Research', 2008) My immersion and training are evidenced in several ways. In this research I have been supported by a supervisory team purposively drawn from different disciplines. The systematic review in this thesis was undertaken as a masters-level module in health psychology. As the researcher I already had a background as a built environment practitioner and professional architect. My training has included immersion in two separate interdisciplinary research centres (the Centres for i) Sustainable Planning and Environments and ii) Public Health and Wellbeing) and the activities of the WHO Collaborating Centre for Healthy Urban Environments. Members of these include different disciplines as well as researchers, policy makers, and practitioners. Reflective learning methods (Race, 2006) have been applied and recorded at a masters-level.

Third, this research integrates knowledge beyond academic disciplines across wider stakeholders, institutions, and actors in the street as has been argued for at the city scale (Lawrence and Gatzweiler, 2017). Beyond this this research extends this to include residents as active participants in knowledge creation.

Fourth, transdisciplinarity in this research encompasses the concept of epistemic justice outlined by Ngwenya (2021) and the necessary response of inclusion and diversity in knowledge creation. Knowledge creators excluded from disciplines currently are argued to be central to addressing healthy streetlife. This definition recognises the wide range of characteristics of people who are forced to occupy the space outside disciplines and that these characteristics intersect (FAME Collective, 2021; Crenshaw, 1990).

Fifth, between and beyond disciplines is a meaning captured, for this research based in Wales, through the Welsh language word *rhyngddisgyblaethol*. In this research *rhyngddisgyblaethol* applied to transdisciplinarity includes: spatial, scalar, and temporal differences; relationships and conversations between disciplines. It holds in tension *both* difference even disagreement *and* similarity between disciplines. It includes having two or more options in any situation, such as having multiple methods available within the research. Finally, related to the previous item, it denotes inclusion. (developed from Geiriadur Prifysgol Cymru, 2021)

Inherent difficulties, barriers, and challenges in transdisciplinary research are identified (Moore *et al.*, 2021; Pineo *et al.*, 2021). Transdisciplinarity was not used wilfully in this research but rather as a practical and interesting way to investigate the challenges identified with good potential to create new knowledge.

Facet methodology: mixing methods not epistemologies

Facet methodology (Mason, 2018) provided a methodological basis to bring several different methods together consistent with epistemology and ontology. Facet methodology is based on the metaphor of the research being a precious stone like a diamond: the facets are the different "methodological-substantive planes and surfaces, which are designed to be capable of casting and refracting light in a variety of ways that help to define the overall object of concern." (Mason, 2018, p.43) The key facets in this research are the four pre-requisite research questions that break down the main research question.

Facet methodology in this research supported the creation of a "...meaningful and strategically illuminating set of facets in relation to specific research concerns and questions..." (Mason, 2018, p.43). Facet methodology is based on six principles (Mason, 2018), three were applicable to this research, hence a modified use. The first, is that each facet provide insights into the research topic but is not a comprehensive description of it; second is that when viewed through a facet the phenomenon, health practices, is not the totality of what there is or the ‘truth’; and the third principle is to create shifts and disruptions to existing knowledge and assumptions which makes facet methodology well suited to this research topic.

Strategically facet methodology captures the essence of qualitative research without being absolutist in terms of approach. It is cognisant of ontological concerns of commensurability and accommodation whilst at the same time providing a practical framework to explore the research question from different directions and using a range of methods. It was used with the aim of creating transdisciplinary knowledge in a methodologically coherent way whilst supporting the use of “…a broad, multidisciplinary suite of methods…” (Rutter *et al.*, 2017, p.2).

Tactically, in this research it was beneficial to be able within the methodological framework to identify at the outset a range of methods. It also opened up the possibility to make use of the

available resources such as my pre-existing skills in visual architectural methods as well as new ones gained through the research like qualitative interviewing. In the face of Covid-19 this approach provided a methodologically coherent way to adapt to changed circumstances in response to restrictions such as lockdowns due to the pandemic.

Facet methodology provided an ontologically and epistemologically coherent way to bring together different concepts and methods in the research. The key facets are the pre-requisite research questions.

Health Practices

Health practices were and are the main phenomenon of interest in this research. This is a composite definition comprising three strands: everyday practices, health practices, and urban practices. It is linked to practice theory literature.

Practice theory, emerging as part of social theory in the 1980s was developed by theorists including Anthony Giddens, Pierre Bourdieu, and Michel de Certeau (‘“practice theory”’, 2008). Williams notes, “…there is no single unified theory of practices.” (2014, p.33). Three broad concerns of practice theory are identified (‘“practice theory”’, 2008):

- An interest in all activities: the everyday, the unusual, the routine.
- That activities are situated within “fields of practice” which are reliant on people’s common understandings, use of language, technology, skills, and so on.
- Investigating the unspoken or tacit knowledge, skills, and actions that people leverage in their practices.

From a social theory perspective this last point is taken to mean that people’s practices are not caused or dictated by social structures: instead it is through these practices that social structures are themselves created, reinforced and “enacted by skilled and reflexive performers.”(‘“practice theory”’, 2008, p.2). This research integrates specific aspects of practice theory: everyday practices, health practices, and urban practices.

Everyday practices from de Certeau’s concept of the practice of everyday life (1984) addresses how people, through these, transform and create urban space such as the street environment.

In addition to the strategic concept of everyday practices de Certeau's argument also provides a tactical way into the street that helped me as the researcher to extend my focus beyond the physical design of the street to what people are doing there. As de Certeau highlights this can powerfully shake the assumptions a designer might hold:

> The childhood experience that determines spatial practices later develops its effects, proliferates, floods private and public spaces, undoes their readable surfaces, and creates within the planned city a "metaphorical" or mobile city, like the one Kandinsky dreamed of: "a great city built according to all the rules of architecture and then suddenly shaken by a force that defies all calculation."[1] (De Certeau, 1984, p.110)

The force that this research sought to illuminate was people's everyday practices.

Everyday practices in this research turned on its head the idea that streets are just created by designers and then experienced in some way directly by residents. It is argued that everyday practices don't just modify that street environment (physical and social) but go further and recreate the street environment: through their everyday practices, residents change and create a new reality of the street space (De Certeau, 1984). This research does not focus on the urban fabric as a text yet what De Certeau says illuminates the broader point:

> The mutation makes the text habitable, like a rented apartment. It transforms another person's property into a space borrowed for a moment by a transient. Renters make comparable changes in an apartment they furnish with their acts and memories;... as do pedestrians, in the streets they fill with the forests of their desires and goals. (1984, p.xxi)

This had implications for methods, the nature of practices meant certain methods were more appropriate to identify them. Mapping, and recording methods used by designers, could have

[1] Translations of Kandinsky from German directly to English vary from this quote, "…as a city built on the most correct architectural plan may be shaken by the uncontrollable force of nature…" (1947, p.31) and similar to Kandinsky (2021).

obscured everyday practice whereas this research aimed to illuminate them. De Certeau highlights this issue:

> It is true that the operations of walking can be traced on city maps in such a way as to transcribe their paths…. Surveys of routes miss what was: the act itself of passing by. …They allow us to grasp only a relic set in the nowhen of a surface of projection. Itself visible, it has the effect of making invisible the operation that made it possible. These fixations constitute procedures for forgetting. The place left behind is substituted for the practice. It exhibits the (voracious) property that the geographical system has of being able to transform action into legibility, but in doing so it causes away being in the world to be forgotten. (1984, p.97)

In this research the physical environment of the street is present, but it is not the phenomenon of interest; it is the everyday practices of people in the street that is the focus and how the street physical environment links to these. Practice theory helped to frame this as everyday practices are not viewed as separate from the street physical environment but rather a further level of creation, here by the residents, of their street environment through their everyday practices. In other words, "…space is a practiced place… the street geometrically designed by urban planning is transformed into a space by walkers." (De Certeau, 1984, p.117)

These practices are not epistemologically real, they are situated and contextual. That is not to frustrate the act of writing about them but rather to actively acknowledge these limits within the research: it is recognised that for participants the meaning in an everyday practice may be very much obtained simply through the practice itself in a way that is hard to describe in words. There is a limit to how close the participant and researcher can get to that meaning:

> "When someone asked him about the meaning of a sonata, it is said, Beethoven merely played it over." (De Certeau, 1984, p.80)

> "A practice does not exist, but is a means of interpreting observable actions that are often repeated by practitioners. Practices are bound by a system of internal and external influences that influence how they are performed which

> adds a layer of complexity for anyone trying to interpret observable actions." (Williams, 2014, p.34)

Health practices in this research are those everyday practices that have an impact on health. Health, as outlined in Chapter 1.0 is defined broadly and holistically. The impact could be positive or negative and it was not presumed that participants did the practice primarily for reasons of health. What was sought were plausible pathways to health impact: plausibility being one criterion through which to consider causality and as used in HIA (Chadderton *et al.*, 2012), not the narrower focus of biological plausibility (Hill, 1965).

The selection of health practices positioned the research as critically appraising, and different from, health behaviour approaches which are widely used in health research. This research has responded to Cohn's (2014) critique that there is a need to move away from deterministic health behaviours where the individual is the focus and health behaviours are viewed as the outcome of an individual, their social and environmental context. This also links back to the problem highlighted by Krieger and the shift to the socio-ecologic paradigm in public health:

> It is more than a misnomer, for example, to imply that it is simply a persons's [sic] freely-chosen 'lifestyle' to eat poorly when supermarkets have fled the neighborhood, or to have a child early or late in life or not at all, without considering economic circumstances and job demands. An ecosocial framework would thus require situating the social context of such health 'behaviors' if they are to be comprehended, let alone changed. And, with regard to prevention, it would encourage research on not only those factors deemed amenable to intervention through the medical care system, the work of public health departments, or the effort of solo individuals, but also on the broader determinants of health that can be changed only through more widespread social action. (Krieger, 1994, p.899)

Health practice theory in this research was used to define the phenomenon of interest and respond at the paradigm level too. Health practices provide a widened focus to include social aspects, reduce the focus on individual determinants, and refocus on wider systems and a "whole variety of social and material factors." (Cohn, 2014, p.160)

Finally, the concept of urban practices links health practices to the urban setting. The street has been the setting of interest in this research, it is part of the built environment and, as detailed in Chapter 1.0, it is one scale of the built environment. Part of the nature of the street scale therefore is that it is linked to not separate from other scales such the home scale or the neighbourhood. In this way the research links to Knöll and Roe's concept, in adolescents, of "health-related everyday urban practices":

> We understand adolescent everyday urban practices as dynamic patterns of actions (travelling, learning, eating, working, hanging out with friends and family, etc.) manifesting in sequences of settings (home, school, open spaces, etc.). (Knöll and Roe, 2017, p.502)

Health practices as they are referred in this thesis can also be described as health-related everyday street practices. The concept brings together three strands: everyday practices, health practices, and urban practices.

Everyday streetlife

Everydayness forms part of the methodological approach on the street. The literature on everyday streetlife has been addressed at Chapter 2.1, this section explains how this was developed and conceptualised in this research. Seven separate methodological implications are detailed as follows.

First, the research responds to critiques that everydayness and streetlife are insufficiently defined in many studies (Hubbard and Lyon, 2018; Jones, 2018). Jones builds on Ingold arguing for more "definitional 'precision'" (Jones, 2018, p.1011; Ingold, 2014, p.384). Summarising definitions from Chapter 2.1, streetlife in this research is the "...social life of... the streets" (Jones, 2018, p.1013) and everyday is, "Everyday life sociology… [taking] …a broad spectrum of micro perspectives…" (Adler, Adler and Fontana, 1987, p.217). Methodologically in this research the street environment has been recognised as a social environment as well as a physical environment. For methods it meant that these were selected to address fine-grained micro-perspectives and everyday practices.

Second, the street is the setting of interest in this research so in that sense the street is prioritised. Methodologically the research does not ascribe any privilege to the street as an idealised setting however that is in any way better or the best for investigating social practices (Hubbard and Lyon, 2018). Therefore methods needed to interrogate definitions of the street and the street could not be assumed to be a single site: even a single street can be argued to be multi-sited due to the diversity within one street (Clarke, 2002). This has implications for methods of analysis as well as being an area of interest to investigate differences between participants and streets.

A third methodological implication is related to everydayness and it's opposite, the exceptional. For analysis this meant: being clear about how exceptional cases were analysed; being "…attentive to the ways that… episodes punctuate individual's experiences of everyday life." (Jones, 2018, p.1012). Using the public health concept of population groups it was also considered that what is exceptional for one population group might be found to be everyday for others and visa versa.

The fourth, fifth, and sixth points link public health concepts to everyday streetlife. The fourth item uses the concept of lifecourse as an interpretive lens on the social life of the street. Lifecourse has a dual aspect of how health changes for people over time and second how health impacts from past events, including from health practices, might manifest at a future date. This was used to open up thinking about: participants' lifecourse; how the street populations may change over time; and how street populations may go through stages of life, for example when residents all have moved into a newly built street at the same time and their children grow up together. Fifth, again as an interpretive frame the understanding that health impacts are differentially distributed within populations and between population groups was used to interpret health impacts on everyday streetlife. This is also important to address the research values as it is a key concept to support reducing health inequalities. Sixth, the public health and impact assessment concept of exposure is linked to everyday streetlife. Particularly of interest is the potentially large health impact of such exposure repeatedly and/or cumulatively over time and/or at the population scale.

Seventh and finally, everyday streetlife methodologically aligns with the research values in centring people's lived experience and the importance and value of the everyday.

This chapter section first set out the research ontology, epistemology, values, questions, and aims and has then gone on to define a "methodology on the 'street'" outlining key methodological concepts of facet methodology; health practices; and everyday streetlife.

3.1.8 Substantiation and quality

Research quality includes both research process and product and is considered at the levels of quality in relation to: ethics and values; qualitative research; health research; and transdisciplinary research. The following sections detail each of these. The research has also been critically appraised at Appendix 3 using appropriate frameworks consistent with the methodology to address qualitative health research (Critical Appraisal Skills Programme, 2018), reflexive thematic analysis (Braun and Clarke, 2022), and transdisciplinarity (Jahn and Keil, 2015).

Quality considerations of ethics and values

Values are formative to this research and therefore integral to research quality. In this research, and considering my wider development as a researcher, this goes beyond the arguably limited consideration of ethics and values within the Vitae Researcher Development Framework (RDF) (Careers Research and Advisory Centre, 2017) where researcher values are not treated as cutting across all domains. For example, topics of Equality and Diversity, Society and culture, and Global citizenship form part of the RDF but only in the limited context of Engagement, influence, and impact. The formative research values in this research require a methodologically consistent fit through all aspects of the research. This thesis seeks to demonstrate a cross-cutting integration of research values and a commitment to ethical research at all levels and at all stages. This is central to the overall research quality.

Quality in qualitative research

This research demonstrates quality through the applicable and relevant considerations for research of this type. Cohesive methodology is one part of this. The research design was

selected to be cohesive at the levels of: "…paradigm, …ontology, …epistemology, …methodology, …inquiry aim, …axiology, …accommodation and commensurability, …action, …control, …foundations of truth, …voice…" (Lincoln, Lynham and Guba, 2018). Quality and validity is therefore treated as a process throughout the research, not an outcome at the end (Leitch, Hill and Harrison, 2010).

Beyond these philosophical criteria the research draws on available tools to address quality in line with what Seale outlines as, "careful scholarship, commitment to rigorous argument, attending to the links between claims and evidence, consideration of all viewpoints…, asking and answering important… research questions." (Seale, 2004, p.3) Quality is also demonstrated through the validity of data collection and analysis (Mason, 2018), for example by being able to rigorously describe and provide an evidence trail of what was done. To this, Lincoln, Lynham, and Guba (2018, p.22) add "goodness" criteria of "Intersubjective agreement, …trustworthiness and authenticity… Credibility, transferability, dependability, and confirmability."

Quality in health research

The CASP Qualitative Checklist (Critical Appraisal Skills Programme, 2018) is the preferred tool in a UK context (National Institute for Health and Care Excellence, 2023) to address quality and validity. That checklist has been used to critically appraise the research in Appendix 3. HIA is also a methodology used to assess wider determinants of health including environmental impacts and the quality criteria from Public Health Wales' HIA quality assurance framework (Green, Parry-Williams and Edmonds, 2017) were used in developing the study design.

Causality is an important concern in much health research. This research is not intended to demonstrate causality, but it does aim to investigate causal mechanisms such as processual links along a pathway to health impact in the street. This is both a limitation of what the research can address about causality but also a strength of qualitative research in addressing mechanisms related to causation "…precisely because of its attention to detail, complexity and contextuality, and because it does not expect to find a cause and an effect in any straight forward fashion." (Mason, 2018, p.222)

Quality in transdisciplinary research

Disciplinary standards often relate to the quality of the output or product and these standards are not readily applied to transdisciplinary approaches, Jahn and Keil (2015) propose a nine-item framework for quality in transdisciplinary research which has some applicability to this research and a critical appraisal using this is included at Appendix 3. This highlights the boundaries and limitations of solo as opposed to team transdisciplinary research such as: funder objectives (self-funded), research team (one researcher), and impact orientation (the nature of a PhD thesis has opportunities and limitations for impact).

3.1.9 Conclusion

Chapter 3.1 has focused on the overall methodology for the research design. Chapter 3.2 focuses more on what I did in the research. It links the research questions to the specific methods used for data collection and analysis as well as the impact of Covid-19 restrictions which happened just as fieldwork was about to get underway.

3.2 Methods

3.2.1 Introduction

This chapter section focuses on the methods used in the context of methodology to investigate the research question. Methods were selected to address each of the facets of the main research question. At the analysis stage the facets were refined as: street social environment / health practices; street physical environment; health and wellbeing-related outcomes; and ecologic pathways to health impact.

Field methods described here address sampling, data collection, and analysis. Agility was needed in response to the Covid-19 pandemic which presented both a challenge and an opportunity for the research. Ethics were addressed both for institutional compliance and as formative to the research.

Analysis used methods of modified reflexive thematic analysis; a new method for My Street analysis; and street environment visual data analysis. Visual data were used primarily illustratively in the synthesis. The overall synthesis addressed the research question and used a reflexive and interpretive approach.

Methods were selected and combined in response to the research questions. Data collection methods comprised:

- Desktop data: computer aided design (CAD) mapping data; historic mapping data; and deprivation data;
- Participant observation: semi-structured interviews; and
- Street observation: a variety of tools ranging from a survey tool to hand drawn sketches and photographs.

These were carried out as three steps for every participant and every street, Figure 18 summarises the order of these steps and what the output from each was. Each data output is also classified as being related to a primary method, an embellishing method, or classification data.

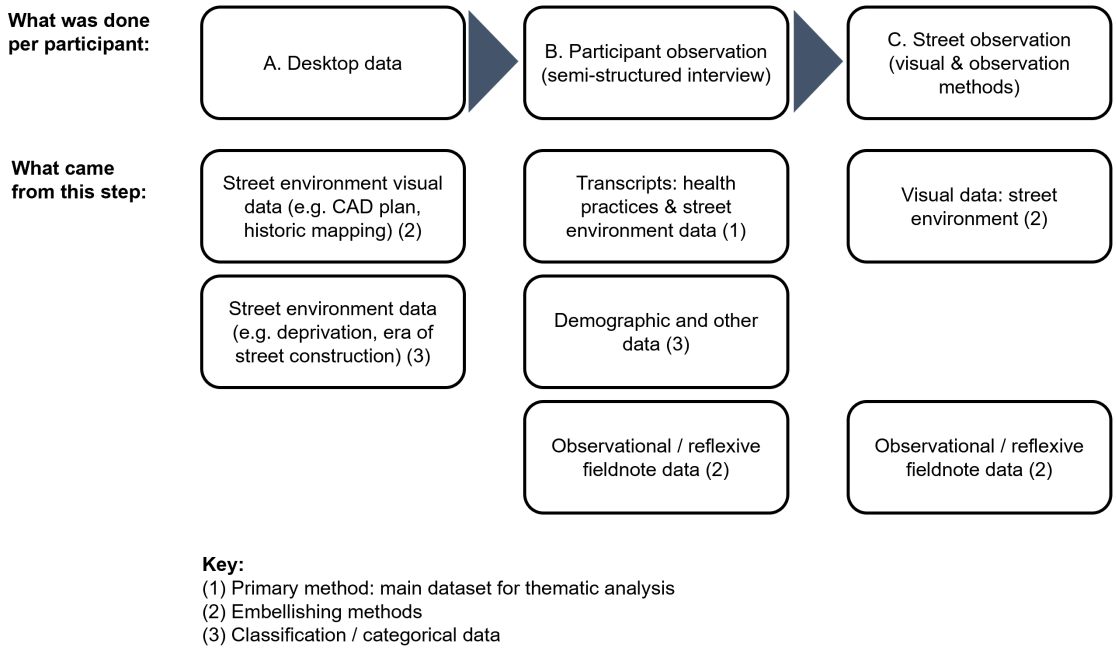


Figure 18: Fieldwork methods and outputs

Data collection and analysis methods were developed systematically from Mason's (2018) approach. The logic for the use and combination of these methods was to respond to the different facets of the research question. Covid-19 had a practical impact, the timing and government response to Covid-19 including stay at home lockdowns was unexpected. There was a risk of severe impact on the progress of fieldwork. Collecting data in several ways was a practical response as well as an opportunistic one, securing potentially important data in a context that only existed during this time.

Methods were combined using a dialogical approach with each method adding to different parts of the research. Mason describes this as producing "…intersecting explanations which are based on the dynamic relation of more than one way of seeing, of asking questions and of researching. …the different methods and approaches can be conceptualized as being in dialogue with each other." (Mason, 2018, p.42) The combination of methods was a methodologically coherent and practical approach to investigate the research question.

Methods were ethnographically informed, in data collection and analysis there was an approach of "ethnographic reconnaissance" (Wolcott, 1999, p210) used to support an open and inductive

approach. Whilst it would be accurate to describe data collection methods as semi-structured interviews using telephone and online methods, in this thesis the term ‘participant observation’ or ‘observations’ is used to reflect how I positioned myself as a researcher and how I approached the fieldsites in relation to the data collection and analysis. A further critical reflection on this is included later (see 3.2.3).

Analysis methods were organised as a series of stages as below and illustrated in Figure 19:

- Stage 1 interpretative analysis: data extraction and collation
- Stage 2 interpretative analysis: further level of analysis such as reflexive thematic coding
- Stage 3 interpretative analysis: comparative interpretation across facets and overall synthesis.

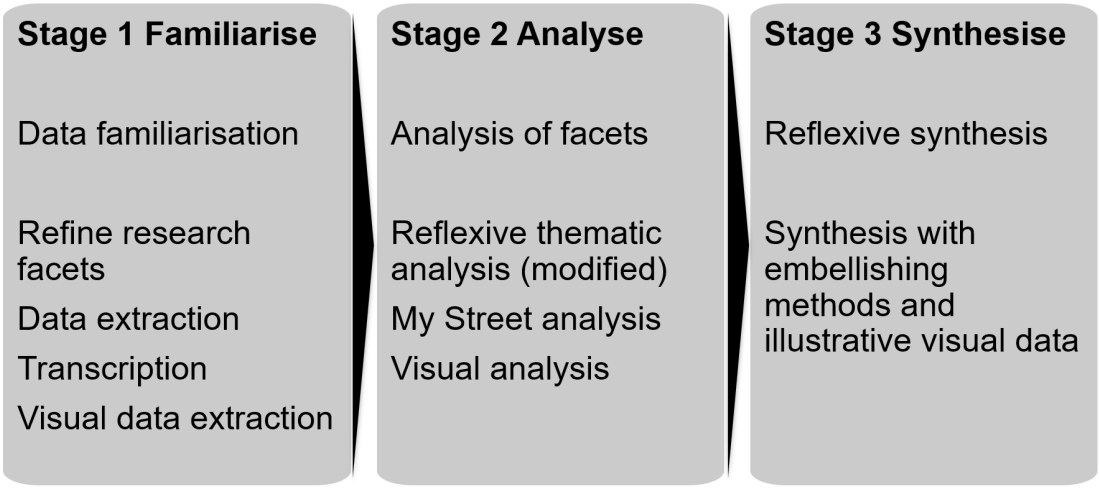


Figure 19: Stages of Analysis

The tabulated detail of methods is included at Appendix 4 linking methods to research questions. This is summarised here and then detailed in following sections. Fieldwork methods were developed from the research questions and addressing Mason’s (2018) criteria: sources of data and methods for collection, what these data could generate, practicality, how to gain access to the sources of data, the researcher’s ability to corral the applicable and required resources, benefits and costs of different methods – including both practical and epistemological ones, and research ethics.

As described in chapter 3.1 the overarching research question was broken down into four pre-requisite questions and three related co-requisite questions. Data collection methods were developed to address each part (see Appendix 4, Table 27: Fieldwork Methods Summary Table).

Participant observation was used to address the first three pre-requisite questions – health practices, links between these practices and health, and links between street physical environment and health practices. These observations were semi-structured interviews (Brinkmann, 2018) using a protocol (see Appendix 7) and were recorded in audio with supporting field notes (Fetterman, 1998). The aim of this was to gain ""telling" examples" and "flashes of insight" (Mason, 2018, p.71). The data addressing these first three questions provided the data for the fourth pre-requisite question focused on ecologic pathways to health impact. Approaches to access and reciprocation were developed and methods adjusted to the situation of the Covid-19 pandemic.

For the first co-requisite question, participant observation was also used. This investigated how residents define 'My Street' (developed from: Barton, Grant and Guise, 2010; Appleyard, 1981) and their perceived boundaries of their street space. The second co-requisite question was addressed with structured survey questions to support describing participant demographics plus including the how long they had lived on their street, and current health status (Tinkler and Hicks, 2011). The third co-requisite question was to describe the street physical environment. Methods were selected that aimed to drive the researcher to observe the street in several different ways with heterogenous methods. These included desktop mapping data, street observations by the researcher using a survey tool (Millstein et al., 2013), photography, and hand drawn sketches in an open air setting (Chilvers, 1996). Visual methods were also used including architectural plan and sectional drawings.

Methods of analysis were similarly developed (Appendix 4, Table 28: Analysis Methods Summary Table) linking back to the research questions and using a three-phased approach as described above. A modified reflexive thematic analysis (Braun and Clarke, 2020) was undertaken to address the first three pre-requisite questions. The fourth pre-requisite question relating to socio-ecologic pathways to health impact was analysed through the synthesis of the analyses of these preceding questions.

Analysis for co-requisite questions required development and refinement of methods in new combinations. The first was an analysis that combined architectural drawn method with participant observation data to produce a drawn map of 'My Street', these were produced for each participant as well as being extracted for comparative illustrative purposes. Second, descriptive data of participants was tabulated into a detailed description of the sample (see Chapter 3.3) and linked to the reflexive thematic analysis allowing comparative analyses to be made, for example by gender. Third and finally the analysis of street physical environment was analysed to provide a sample description and an illustrative and detailed description of the street sample.

The following sections provide more detail and explanation of data collection and analysis including the significant complexities and recursive refinement in response to the Covid-19 pandemic. The topics addressed are sampling, data collection methods, ethical considerations, and analysis. Finally, a description of the sample is presented.

3.2.2 Sampling

The first step before collecting data was to identify potential participants, through whom health practices could be identified. The overall aim of sampling sought to identify examples of health practices that would provide "…"telling" examples…" (Mason, 2018, p.71) of the phenomenon. The sample sought was representational (not representative) and what it needed to achieve was to support analysis to illustrate the emerging understanding, to generate insights, and support a deeper understanding of health practices in the street environment (Mason, 2018).

Sampling had three aims. First was to access data on heterogenous health practices. Practices could not be sampled directly, therefore sampling of participants for observation was instrumental to sampling of practices. Second, was to include participants from population groups that may experience negative health inequalities. Given the privileges I have in my role as the researcher (see Chapter 4.8, Figure 71), by implication this meant identifying participants who were mostly not like me. The third aim was to ensure a heterogenous sample of streets in relation to the type of street physical environment. As a practical result of the Covid-19

pandemic a greater emphasis was placed on identifying participants through gatekeepers and then applying sampling criteria to their streets once identified.

The size of the sample was based on it providing "…access to enough data, and with the right focus, to enable…" (Mason, 2018, p.70) the research questions to be addressed. The sample size needed to be sufficiently generative to investigate health practices and also sufficient to allow theories and arguments to be tested including, for example, negative or contradictory cases to be investigated (Mason, 2018, p.70). Sample saturation, for example, was not used as a sampling criteria, being inconsistent with the chosen methodology (Braun and Clarke, 2021b). A target sample size at planning stage of 18 participants was assessed as a practical target.

Recruitment

Recruitment was planned as snowballing from key actors (Fetterman, 1998) with some use of gatekeeper organisations however following a pilot, more reliance was placed on gatekeepers. This was firstly due to Covid-19 restrictions which made it hard to contact potential participants and secondly, at pilot stage it was found that participants mainly proposed snowballed contacts of people who lived near to them, often on similar street types. Thirdly, linked to this, areas of the city tended to have similar street types depending on their era of development (e.g., with Victorian terraced houses). Therefore, it was necessary to look at different areas and purposively identifying gatekeepers in those places.

Preparation and refinement of recruitment approaches under Covid-19 was resource-intensive and time-consuming. For example, a protocol was written for social media advertisement however this was not found to be an effective recruitment approach. A protocol for leafleting streets was prepared but this coincided with controversy over political leafleting in the sample area, one such example of which led to an unsuccessful prosecution of a politician (BBC News, 2021). Whilst leafleting for research may have been legal and capable of being done safely it was important when building trust with participants to be seen to take a responsible approach. Determining what a responsible approach might be was difficult when so much was unknown about Covid-19. This shows how methods that might have been well established and normal in the past needed to be used and reconceived in this different context of the pandemic.

Cardiff as a fieldsite

The selection of Cardiff as a fieldsite was initially pragmatic, then in the context of Covid-19 essential to the research happening without major redesign or significant delay.

Cardiff is a specific context, it is Wales' largest and capital city with a population of 359,500 (Office for National Statistics, 2022a). It is a small city population in UK terms however and in common with many UK cities, the age profile of Cardiff is younger than the Wales or UK average. Healthy life expectancy in Cardiff is higher than the Wales average for men and lower for women. The Wales average and Cardiff average healthy life expectancy are materially lower than the UK average. Within these averages however there are over 22 years difference in healthy life expectancy between areas in Cardiff. Many of those with the lowest healthy life expectancy are in an area called the Southern Arc of Cardiff which was the fieldsite for this research.

Table 4: Healthy Life Expectancy (HLE) at birth (Office for National Statistics, 2013, 2019)

Healthy Life Expectancy	Female	Male
Cardiff (2016-2018)	61.7	61.7
Wales (2016-2018)	62.0	61.4
UK (2016-2018)	63.6	63.1
Cardiff Inequality (2013)	22.5	22.4

Cardiff is a coastal city situated on the Severn Estuary and developed as an industrial port city particularly related to the coal industry in South Wales' during the 19th century.

Practically as the researcher I was based in Cardiff and had existing networks and contacts here including with potential gatekeeper organisations. Following Covid-19 these practical reasons became central to the research proceeding: as well as national stay at home lockdowns in Wales

there were also local restrictions that prevented crossing out of the Cardiff local authority area, such as from 27 September 2020 to 23 October 2020.

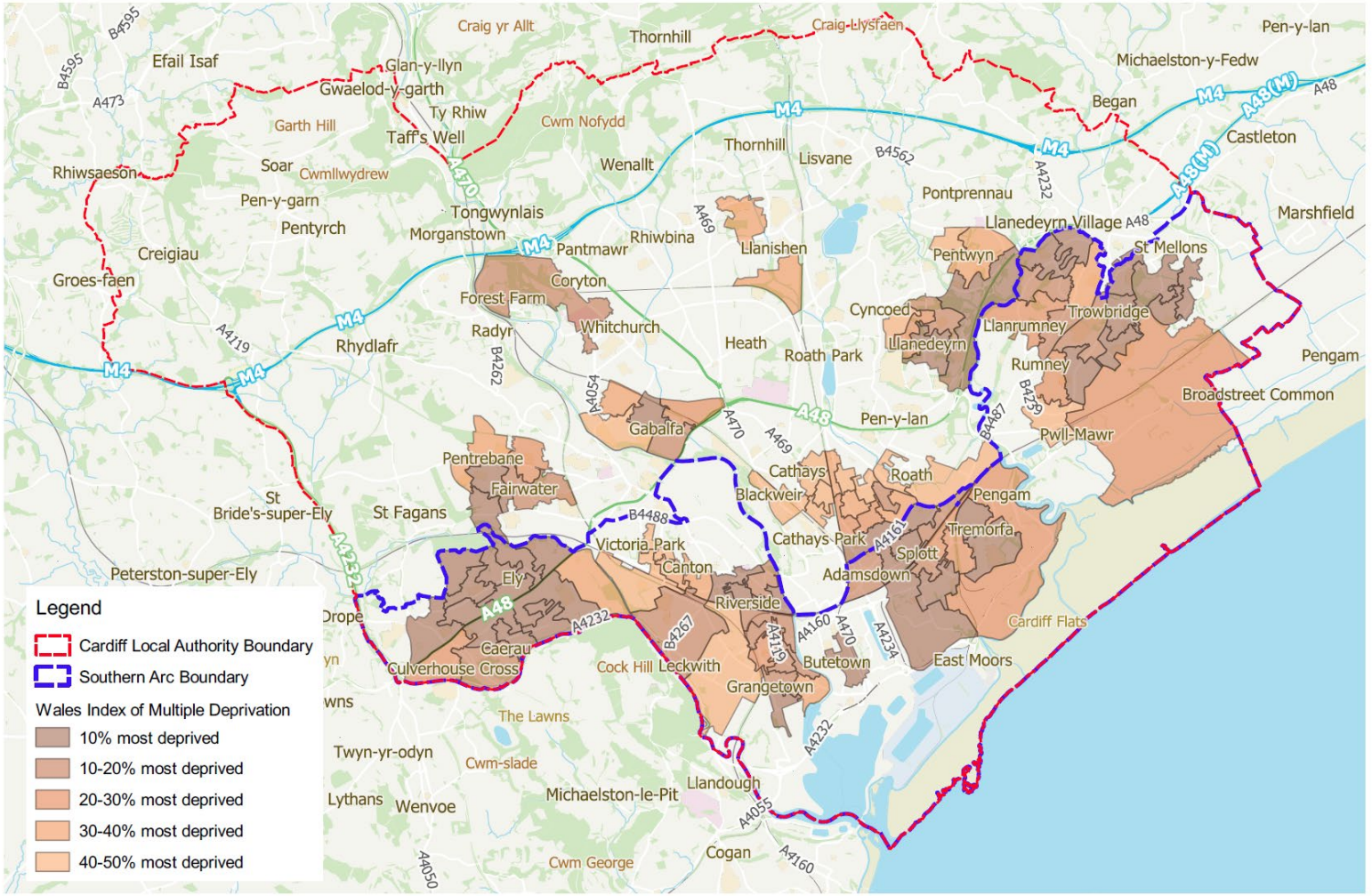
Participant sampling

Participants were adults 18 and over in line with the ethical approval. Sampling criteria for participants included gender, age, and ethnic group or identity. For gender a sampling quota was used: ≥ 30% women; ≥ 30% men; gender-diverse, no minimum. For age and ethnic identity, a quota was not appropriate and the range of these characteristics was monitored throughout recruitment.

Street sampling

Street sampling criteria included: deprivation index, street environment type, street era of construction, and practical considerations.

Deprivation index: the sampling aimed to identify streets for whose population there would be the most to gain from improving health. This derived from the research value to reduce health inequalities (Faculty of Public Health, 2016). The Southern Arc of Cardiff (Cardiff Council, 2021) is a crescent shaped geography of electoral wards in the south of the city many of which are ranked low in the Welsh Index of Multiple Deprivation (WIMD) (Welsh Government, 2019). This area is a priority for local authority policymakers. Sampling was undertaken of areas within the Southern Arc and areas outside the Southern Arc in lower super output areas (LSOA) ranked 50% most deprived in the overall domain of the WIMD.



Sampling Criteria - WIMD 50% Most Deprived by LSOA and Southern Arc Policy Boundary

Data Sources: Ordnance Survey Open Zoomstack, Boundary Line, LSOA Areas, WIMD 2019.

Figure 20: Map with sampling criteria illustrated

Street types: a diverse range was sought that were both normal and containing major environmental features. *Normal* streets were defined as “nondescript” after Clarke (2002), meaning a street without any one single major environmental feature that dominated. Streets with major environmental features were sampled with a quota of at least one each of: a major environmental characteristic such as a train line, industrial site, or adverse topography; and a Home Zone or street closer to healthy design principles.

Street era: again a quota sought at least one example by each of: 1880-1918, 1918-1945, 1945-1960, 1960-2000, 2000-2020.

Practical criteria: for practical reasons including in the context of Covid-19 streets were selected within a manageable cycling time and distance for the researcher. This related not only to effort getting to streets but also, protecting myself as researcher from exposure to Covid-19, and, for example, few public toilet facilities were open during fieldwork.

3.2.3 Fieldwork data collection methods

Adjusting to a global pandemic

Participant recruitment was targeted to start in March 2020 after university ethics approval was granted on 30th January 2020. Three weeks after completing this on 22nd March 2020 a stay-at-home order was announced by the Welsh Government (Senedd Cymru, 2020) in response to the Covid-19 pandemic. At this time less was known about Covid-19, for example, it was designated as a high consequence infectious disease (HCID) in the UK (UK Health Security Agency, 2020). Until being downgraded during March 2020 Covid-19 was therefore classed in the same category as Ebola, MERS, SARS, and pneumonic plague.

There was risk of the researcher contracting or spreading Covid-19. This included a risk in fieldwork and also any physical printed materials. The simple act of being present in the street became potentially illegal as the law in Wales was changed to limit the reasons persons could legally be present in the street. It was initially unclear for example whether meeting a participant outdoors was legal and as was subsequently reported widely the interpretation of the law by enforcement authorities was variable.

There was uncertainty about health risks, what was legal, and additional stress and pressure on all potential participants. It was important therefore to act within both the spirit and letter of health protection regulations. Trust, reliability, and integrity was important in gaining access with participants. This mattered for data quality as some potential participants might have been less likely to participate due to Covid-19 concerns. Potential perceived risks related to ethnic identity, pre-existing health conditions, and age began to be evidenced during fieldwork plus other factors such as population density, and obesity (e.g. Bray, Gibson and White, 2020; First Minister's BAME COVID-19 Advisory Group, 2020).

Methods were adjusted within the scope of the existing ethical approval. Originally face-to-face participant observations were planned in participants' streets. This changed to street observations being made by me as the researcher on my own with participant observations by phone or web calls.

Risk assessments and a Fieldwork Protocol During Covid-19 were developed (see Appendix 4 and Appendix 5) including for lone working. This was resource intensive and challenging as guidance did not initially exist. Third sector organisations supporting the most vulnerable people were some of the first to develop safe working protocols which were incorporated into the fieldwork methods (QueerCare, 2020), I was also able to apply my own practical experience of volunteering for a mutual aid group.

It became clear the situation resulting from Covid-19 was a challenge yet also a significant opportunity for the research. The fieldwork was happening at a time when I could gather data in a specific setting during Covid-19. I aimed to maximise the opportunity in line with Wolcott's argument that there is "... no length of time too short to derive some insight from even the briefest effort at ethnographic reconnaissance." (Wolcott, 1999, p210). The aim was to provide an "intensive immersion" (McLean, *et al*, 2020, p95) in the setting of the street and the participants' experiences of these.

Methods were adjusted and refined in response to Covid-19 while maintaining the original aim to seek a holistic understanding and not predetermine the issues of interest (McLean, et al, 2020)

but rather invest time in "…trying to figure out what the right questions are." (Wolcott, 1999, pp213-214)

Desktop data

Desktop data collection and extraction based on protocols developed for the process comprised:

- Architectural drawings (plan, section) of street (Ordnance Survey, 2021b).
- Historic maps (Ordnance Survey, 2021a).
- Health related data: Welsh Index of Multiple Deprivation (WIMD) (Welsh Government, 2019)

One protocol addressed extraction of Ordnance Survey mapping data and the creation of computer aided design (CAD) architectural plans and sections of streets which are presented in Appendix 1. Dimensional information about the street physical environment was extracted to a spreadsheet, this comprised: carriageway width, public street width, and house to house width. These architectural plans also provided the base plan for My Street verbal descriptions to be subsequently overlaid onto. In most cases where streets did not have a large change of ground levels, point levels from Ordnance Survey were sufficient to generate street sections. At Hoggan Street, to reflect the large cross-sectional ground level change, height data were extracted from Ordnance Survey height data and interpolated in CAD software. These CAD data were practical to anonymise as street and place names are stored in a structured layering system and these layers were able to be turned off which was set in the template.

A second protocol addressed the download and collation of historic map data. These data were used to categorise streets by era of construction. Ordnance Survey historic maps are not available prior to 1880s and coverage within archives was not always complete so not all years were available for all streets. These data were not practically able to be anonymised and this was not required in any case for the research, however it means these data are not presented within the thesis. For some participants historic maps of their own streets were used as part of reciprocation, this was appreciated by some participants with an interest in these as digital historic maps are not freely available to the general public and during Covid-19 these could be shared electronically, reducing risks for participant and researcher.

Data were extracted for the Welsh Index of Multiple Deprivation (WIMD) (Welsh Government, 2019) to support an understanding of relative overall health in the locality of the street. Most public health data are not available at this scale (only low birth weight and children living in poverty are routinely collected by the Public Health Wales Observatory at LSOA level). WIMD, including the health domain, therefore were selected as appropriate to inform an understanding of the broad health of the population in the locality of streets whilst noting that LSOA and street boundaries are different geographies. These data were extracted manually for the LSOA each participant was in. At first this characteristic was treated as a street level characteristic however in Simpson Street the two participants at opposite ends of the street are in different LSOAs meaning this needed to be recorded as a characteristic of the participant and not the street.

Overall the collection of desktop data supported aims of providing a detailed, rigorous, and varied understanding of the street environment. It provided data allowing identification of street typologies and other characteristics such as dimensional characteristics supporting subsequent comparative analysis. Practically the desktop data also made use of some of my existing skills as the researcher, such as the use of CAD software and knowledge of mapping tools.

Covid-19 did not impact on the collection of the data planned but it would have limited the use of other potential desktop data, for example the Glamorgan Archives were closed for most of the data collection stage. As noted, digital historic map copies as reciprocation could be shared without the risks potentially associated with hard copies: it should be remembered that at this time the transmission of Covid-19 was not well understood and it was initially also classed in the same category of risk as Ebola.

Participant observation

This section describes the field method of participant observation which in this research and in the context of Covid-19 was primarily based on semi-structured interviews conducted by telephone or online. The term participant observation has been retained throughout both as a practical prompt to the researcher in the field and to clearly link to methodology and research ethics.

Participant observation in this thesis refers to the methodological approach to the fieldsites as a form of “ethnographic reconnaissance” (Wolcott, 1999, p.210). In the context of Covid-19 the practical implementation of this may be accurately described as semi-structured interviews using telephone and online tools: this term conveys the method but not however so much about the methodology or approach to the field. In other words, a semi-structured interview method could fit with a number of epistemological positions: participant observation more clearly makes the link to the overall methodology and an approach to understanding the social life and cultures of the street environment. This draws on Wolcott’s description that, “...much stands to be gained for any researcher who poses long enough to have a look around, with the intention of putting an enquiry into some broader perspective.” (1999, p.207)

Whilst acknowledging this is more reflective of the spirit of participant observation rather than a fuller application of the method the term is used in this thesis to convey the underlying methodology and how I approached the fieldsite as a researcher. This also links to research ethics as something that was addressed throughout the research including in the field and not just at a point in time. For example this involved the continual consideration of issues highlighted by Fetterman (1998) including permission, trust, and reciprocity which are important within participant observation. It is a practical term as well as it was a constant prompt in the field for me as researcher to remind me of the methodological aim of the interviews. It is important also to highlight the very unusual circumstance of the Covid-19 pandemic and that arguably what this thesis presents is one form of participant observation during a global pandemic.

In practical terms, observations with participants comprised semi-structured interviews lasting about an hour, these were conducted remotely by computer or telephone. Observations moved from open toward more structured forms of questioning informed by the idea that the, "…most effective strategy is, paradoxically, no strategy. Being natural is much more convincing than any performance." (Fetterman, 1998, p.46).

To minimise the chance of exclusion of potential participants a range of options including Skype, Zoom, WhatsApp video, and telephone voice call were offered. For ethics, a particular technical move that supported this within the existing ethical approval was to that all recordings of

observations were on a stand-alone handheld device, the same as was originally approved. Fieldnotes were also kept (Fetterman, 1998) following a template that was developed. Considering the means of communication, most people would have access to these, but not everyone. In 2020 3% of households in Wales did not have any mobile phone and 2% of individuals in Wales did not personally use a mobile phone. Groups with lower levels of access to a mobile phone who this may have disproportionately affected include those aged over 55 and in households in the lowest income group (Ofcom, 2020).

A detailed interview protocol was developed and adjusted throughout fieldwork with a clear version history (see Appendix 6). Key questions that formed the bulk of the interview were:

- "Please can you imagine you are showing me around your street and tell me about the day-to-day things you do there?"
- "Perhaps start with day-to-day activities as they are now during the lockdown and then we can talk about what might have changed."

These were supported by a series of optional questions to extend or delve deeper into particular aspects. More structured questions included:

- Identity and demographic data collection.
- My Street definition: Where do you feel that your "street" extends to; in other words, what do you see as your territory or home patch? (developed from Appleyard, 1972; Barton, Grant, Guise, 2010);
- Current health status: using Office for National Statistics (ONS) wellbeing survey questions (Tinkler and Hicks, 2011).
- The 'what have I obviously missed' question: "Are there any other aspects of your identity or life that you feel might be important to consider in relation to the street, your activities there, and how they relate to health? Have I missed something glaringly obvious?"
- Validity questions (pilot stage): relatability of the topic.

The protocol included particular consideration of participant health and wellbeing and a wellbeing 'check in' was developed to be included at the end of the observation. This was supported by protocols in case, for example, a participant experienced stress or upset during the

interview including the Samaritans method of Having a Difficult Conversation approach (Samaritans, n.d.).

Observations were conducted in English as this is the only language I am fluent in. There was no legal obligation to provide the option of Welsh, however the role of languages for people including Welsh was actively considered during data collection and analysis. The questions were also made available in advance on request, for example for a participant with English as a second language.

Street observation

Street observation methods aimed to achieve an "intensive immersion" (McLean, *et al*, 2020, p95) in the street environment and methods were used together to embellish (Mason, 2018) this from different perspectives, these comprised:

- Fieldwork observation including fieldnotes (Fetterman, 1998) based on a template.
- Survey tool: Microscale Audit of Pedestrian Streetscapes (MAPS) (Millstein *et al.*, 2013; Sallis, 2010), modified.
- Photography with specific objectives.
- Hand drawn sketches of the streetscapes in open air settings (Chilvers, 1996).

The MAPS tool was used in line with the published manual (Cain *et al.*, 2012) with modifications. The aim was not to collect data for the purpose of quantifying health scores for streets but rather to provide a structured method for observations. This also supported thinking about the different ways that built environment researchers think about the street environment compared to participants. The MAPS-Mini tool (Sallis *et al.*, 2015) was also used in the pilot street observations but not continued beyond this.

Street photography was taken on a dedicated device (Honor 10 Lite, focal length 26mm with location data stamping disabled). Photos for context were taken at eye height of the researcher (165cm above ground). The aim of these photographs is not to represent the 'reality' of the street, rather photographs were taken with particular objectives:

- Surrounding area and views towards the street for subsequent reference and analysis;

- General views along and across the street; for subsequent reference and analysis;
- Photos related to MAPS survey for subsequent methodological reflection;
- Close up photos of materials, objects, surface colours, stickers, and notices for analysis of street materiality by photomontage;
- Photo of hand drawn sketch view; for sharing with participants.

Hand drawn sketches of the streetscape *en plein air* (in open air) were made. The aims of this method were: to provide a contrasting way of looking at the street. The drawing method was in line with impressionistic thinking (not style) and one approach to capturing an "…objective recording of contemporary life, trying to capture an 'impression' of what the eye sees at one particular moment… [a] desire to look at the world with a new freshness and immediacy… trying to capture the effects of light on varied surfaces, particularly in open-air settings…" (Chilvers, 1996, pp.255–256). Sketches were also used as reciprocation with participants who were sent a copy electronically.

Factors that could influence street observations included the time of day, weather, day of week, school term status, and Covid-19 lockdown status. These data were recorded in the fieldnotes.

Pilot

A pilot stage was undertaken to validate and refine the methods. The pilot included four interviews, including two participants per street and this provided validation of how different people interpret and construct their knowledge of the street.

The pilot highlighted the challenges of recruitment with people being under significant time pressure due to Covid-19 and lockdowns. Some potential additional methods for participants to complete on their own (street photographs, street map drawing) were omitted at this stage as it proved difficult for participants to take time to do these. Use of the MAPS-Mini tool was discontinued in favour of the more detailed MAPS tool. The pilot was otherwise successful with no major changes to the methods subsequently used and the data collected from the pilot was incorporated into the main fieldwork data.

Data collection protocols

A series of protocols were developed within the boundaries of the ethical approval, these were:

- Participant Information: Consent Email
- Recording Newly Consented Participant Data
- Participant Observation Exercise 1: Photos (discontinued after pilot)
- Observation Exercise 2: Draw a Map (discontinued after pilot)
- Advertising: Online Posting (discontinued after testing in one location)
- Participant Thanks: Post Interview
- Fieldwork Kit List
- Street Pseudonymisation
- CAD Drawings of Street
- Printing for Participants
- Historic Map Download

What is notable is that something like printing participant information sheets would hardly be considered as requiring a protocol before Covid-19 but was now a specific, risk assessed process.

3.2.4 Ethical considerations

Research ethics addressed both: institutional compliance, regulation, and risk management; and a formative research values perspective, with ethics being an important and reflexive process at each stage.

Institutional ethics approval was obtained on 30/01/2020 following revisions in line with previous committee observations. The impact of Covid-19 on the ethics approval was addressed closely with the supervisory team and it was determined that adjustments to protocols could be satisfactorily addressed within the scope of the ethics approval. Ethics approval incorporated preparation of: Data Management Plan; Data Protection Impact Assessment Screening; Data Protection Impact Assessment; and fieldwork health and safety risk assessment. At the outset it was recognised that it was essential within the limits of legal orders by the courts that

confidentiality between researcher and participant be maintained (Fetterman, 1998), the only exception to this being in the case of a vital interest disclosure “to protect someone’s life” (Information Commissioner’s Office (UK), 2019).

Compliance with Covid-19 restrictions required significant effort to understand and interpret regulations. The Health Protection (Coronavirus Restrictions) (Wales) Regulations 2020 (Senedd Cymru, 2020) had been introduced in Wales and were subject to multiple revisions over time. It was initially stated that “During the emergency period, no person may leave the place where they are living without reasonable excuse.” (Senedd Cymru, 2020, sec.8) The research was assessed as within the definition of reasonable excuses however there was significant uncertainty around the interpretation of new regulations combined with examples of enforcement agencies exceeding their legal powers (Dodd and O’Carroll, 2020).

Significant efforts were made to make the research as accessible and approachable to participants as possible. Participant information was prepared in a booklet style (Appendix 7) incorporating all required information in a graphically clear and attractive format. A video (*Healthy Street Life Research*., 2020) – viewable at: https://www.youtube.com/watch?v=1m-AdQYM008 – was also made to introduce the researcher especially as this could not be done face-to-face. The brochure and video were intentional steps in recognition of my positionality as the researcher, for example as a white man, seeking to minimise potential difficulties in recruitment by showing potential participants my face and that I was approachable.

Figure 21: Screenshot of recruitment video

Research values were addressed at each stage of the research including through ethics and addressed: permission and informed consent; honesty and no concealment of researcher role; building trust with participants; use of pseudonyms for participants and streets; and reciprocity with participants (Fetterman, 1998). Pseudonyms and reciprocity are two examples of how this was done.

To anonymise streets a pseudonym was selected. Historic gender-biased street naming conventions are identified (Forrest, 2018): in this research all streets are named after women, mostly famous Welsh women, using a protocol (Appendix 1, page 5). All participants were anonymised by use of a pseudonym and individual participants were offered the opportunity to select their own pseudonym. When selected by the researcher a protocol was followed that aimed to identify names that were relevant to the participant's gender, age, and were culturally appropriate.

A practical reflection on the redaction of data through various means (use of pseudonyms, not including street names in photos, etc.) is that this was not as clear cut as a protocol might imply and required to be considered by the researcher throughout the research. Such consideration needed to address legal, institutional, and broader ethical requirements and concerns. Whilst

the risk of identification may be most apparent with visual data such as photos of streets it also needed to be considered in relation to transcripts and audio data, for example where participants gave detailed descriptions of a routes they walk from home. The distinction between what is and what is not personal data within the law informed the consideration given as well as the practical ethical aim of ensuring so far as practical that participants were not identified in, or identifiable from, the research. An implication of this for example is that the reason street names were changed was as a measure to protect participant personal data – not to protect the street per se. It was for example necessary to increase the level of redaction during transcription where neighbouring streets, the area or ward name, or adjacent area or ward names were said. Photographs of streets were redacted to remove street names and it was recognised that there is latent potential for these streets to be recognised by people who know them well or through future technological developments that may allow location searches using an image. Reporting of other data was also minimised, for example the interview protocol only asked for participant's age and year of birth not their date of birth as this was not needed. This age data was then further redacted by placing participants into age bands and only these were reported as this was what was necessary for the research. Overall the research took a systematic and conservative approach to redaction and protection of participants' personal data.

Reciprocity is an important tool for gaining access and also valuing the contribution of participants. Covid-19 restricted what could be offered, for all participants a donation of £10 to their nominated local charity or group – often the gatekeeper organisations – was made. A total of £220 was donated in reciprocation. The researcher also supported gatekeeper organisations through delivering spring bulb planting kits to people who had signed up to an in-person workshop that had to be cancelled and after lockdown restrictions eased completing one morning's volunteering at a street community garden. One participant with an interest in racial justice and environment was given a collection of writing (Johnson,A.E. and Wilkinson,K.K., eds., 2020). Two participants were sent copies of historic mapping of their street.

3.2.5 Methods of analysis

Within an overarching framework of facet methodology an integrated system of analysis was developed (see Figure 22) linked to the research questions. The main analysis method used

was a modified reflexive thematic analysis of participant interviews. The links between the research questions, the data types collected, and methods of analysis are tabulated at Appendix 4, Table 28.

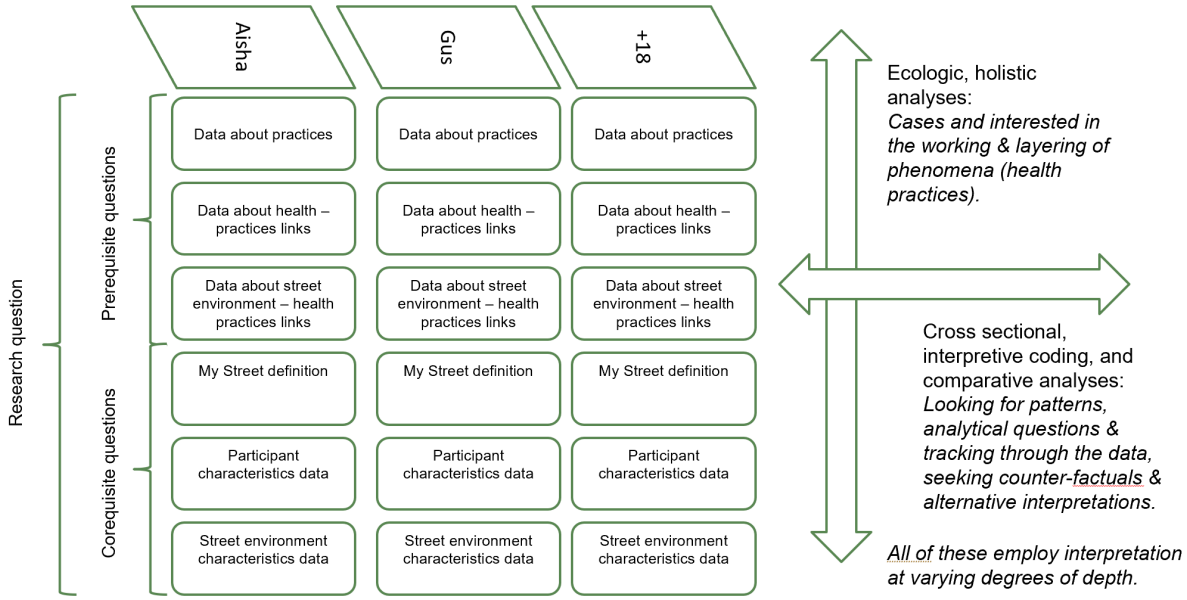


Figure 22: Integrated system of data and analysis methods

An impact of Covid-19 was that data collection and analysis were more sequential than overlapping. It was therefore only at the start of analysis that the data collected were able to be understood and considered as a whole including in relation to the system of analysis. A refinement in response to the data at this stage was to define individual facets around the research questions:

- Health practices (analysis by: thematic analysis of interview data)
- Street environment characteristics (analysis by: thematic analysis of interview data; street visual data; street environment characteristics)
- Health topics and domains (analysis by: thematic analysis of interview data)
- Ecologic pathways to health impact (analysis by: synthesis of preceding facets; ecologic analysis of individual cases)

A practical implication was that the thematic analysis effectively became three analyses as themes were developed from each facet.

Thematic analysis

Following consideration of a range of analytical methods (tabulated at Appendix 08) a modified reflexive thematic analysis (Braun and Clarke, 2022) was selected. Thematic analysis used here means modified reflexive thematic analysis. Reasons for this selection were:

- The sample size is relatively big, making methods requiring a finer level of language analysis impractical, such as interpretative phenomenological analysis (IPA).
- The research question did not require a fine language analysis (IPA) or discourse analysis (DA).
- Analysis was being undertaken sequentially following field data collection, excluding theory driven sampling such as Grounded Theory (GT).
- The requirement to integrate other data sources such as street observations, which thematic analysis can accommodate.
- Thematic analysis offers a practical and clear set of approaches.
- The acceptability of thematic analysis across a range of disciplines.

The thematic analysis followed a six phase approach (Braun and Clarke, 2022, pp.35–36):

1. “Familiarising yourself with the dataset…
2. Coding…
3. Generating initial themes…
4. Developing and reviewing themes…
5. Refining, defining and naming themes…
6. Writing up…”

Braun and Clarke (2019) deprecate the use of unacknowledged modifications, the modifications in this research were:

- The thematic analysis was not the only analysis method used and was integrated within facet methodology overall;
- Each facet to which thematic analysis was applied (i.e., street physical environment and street social environment) generated its own set of themes;

- For the health-related outcomes facet code-level findings were evaluated using two existing frameworks (Institute for Health Metrics and Evaluation (IHME), 2021; World Health Organization, 1946) and reported under synthesised domains from these. A granular evaluation was also undertaken against a globally used framework for health classification (World Health Organization, 2022a).
- The analysis applied a moderate level of interpretation as this was found sufficient to address the research question, the level of interpretation varied per facet;
- Code labels would normally be a means to theme development whereas they were found to contain useful findings to be reported;
- The presentation of the final thematic analysis report is adjusted to practically allow space for all facets to be reported;
- Counts and proportion of participants identifying code labels and themes were made and this was done reflexively and focused on identifying patterns and meaning whilst mindful of limitations described further below.

On this final item, counts of code labels and themes were undertaken. As Maxwell argues, "there are legitimate and valuable uses of numbers even in purely qualitative research." The positive reasons for this quantitizing of data was done "to facilitate pattern recognition or otherwise to extract meaning from qualitative data, account for all data, document analytic moves, and verify interpretations…" (Sandelowski *et al.*, 2009, p. 3) and as Maxwell argues such quantitized data can help, "to identify patterns that are not apparent simply from the unquantitized qualitative data…" (2010, p. 479). The presentation of numbers rather than terms such as 'most' or 'few' adds greater precision to the reporting and it also supported addressing the quality criteria that data had not been cherry-picked, this was particularly important to do given the practical need to condense longer data extracts in the findings (Maxwell, 2010). This stage of analysis, which was one part of the analysis, was undertaken mindful of the risks and limitations of such an approach, such as identified by Maxwell (2010) including: the risk of greater generalisation of findings than is justified; the risk of the researcher slipping out of the research epistemology and from what Maxwell terms "process theory" into "variance theory" and a "logic of inference" (2010, p. 477); that in counting the evidence should not be reduced to the amount rather than the meaning of the evidence; and finally simply the rhetorical strength of

numbers and the risk of misrepresenting the actual basis and validity for findings through apparent precision. These risks and limitations were carefully considered during the analysis and are highlighted in the findings including that both textual and numerical presentations of data in this thesis are both forms of presentation of qualitative data that has been constructed through an interpretive process.

Thematic analysis mainly used data from participant interviews. Fieldnotes and street observations embellished the analysis. Interview data were manually transcribed by the researcher as part of the familiarisation phase using a protocol. Transcribed data were coded in qualitative data analysis (QDA) software, NVIvo version 1.6.1. Due to practical constraints and the relatively large size of the sample coding was undertaken once in the order 1-20. To validate the coding the final list of code labels generated were reviewed across the whole dataset both manually and using built-in search tools in the QDA software.

The coding process was considered for its sufficiency. New codes continued to be identified throughout the coding phase. At the point of having coded 60% (n=12) of data items 94% (n=48) of finally included code labels had been identified. In other words, only three code labels were created in the remaining (n=8) coding of participant observations (data items). The sampling strategy is argued to support sufficiency in the data to investigate the research question. This is not to claim saturation suggesting a completeness of understanding, including at a population level. Additional participants representing additional population groups could have identified different practices. What is important is the “theoretical sufficiency” and “sampling adequacy”, and that the quality of the data, “their richness, depth, diversity and complexity” matter as much as quantity of data (Braun and Clarke, 2021b, p.202) and this is argued to have been justifiably achieved.

Categorical data about participant characteristics (see Table 5: Gender, sex, age (decade), ethnic identity (self-described), years living on street) were extracted to a spreadsheet file, then imported as case classifications to the QDA software. Categorical data about street characteristics (see Table 11: era, housing type, deprivation decile, and normal / major sampling category) were similarly extracted and imported to QDA software with streets being linked to participant cases.

Sampling criteria for participants included age, ethnic identity, and gender. In addition to reasons stated previously related to sampling, these data were collected as they link closely to the research values including addressing health inequalities. This includes addressing differential health impacts between population groups: gender, ethnic identity, and age-based inequalities are important ones to address. Categorical data for all three was primarily used as part of ecologic interpretations within analysis. Cross-sectional analysis of data was planned and the QDA software supported this method. Cross-sectional analysis by gender was possible and undertaken as part of the analysis, initially seeking cross-sectional patterns in the data between genders. These interpretations were then synthesised with the ecologic analysis. The selection of self-described categories for ethnic identity (chosen for valid ethical reasons related to self-description) and categorising age by decade meant there were many categories with often only one participant in them which frustrated cross-sectional pattern finding. This methodological challenge and considerations for future are discussed further in Chapter 4.8.

My Street analysis method

My Street descriptions were extracted from interview transcripts and transcribed using CAD onto an architectural street plan. This is an example of how even quite a technical process was an interpretive one requiring the original interpretation of the question by participants overlaid with my interpretation as researcher in transcribing this textual description into a geospatial description on plan. The plan area in metres square of My Space was also measured. My Space areas were graphically presented alongside each other for comparison.

Street physical environment visual data

For each street, data were prepared and collated into a booklet of visual materials across all streets: plan; section; My Street representation; materiality photomontage; and hand drawn sketch.

The use of street physical environment visual data in this thesis is to illustrate the context and inform an ecologic understanding of the street environment within which health practices are set.

Synthesis of combined facets

The third phase of analysis was a synthesis of the previous phases of analysis to address the overall research question. This synthesis was a reflexive, recursive, and interpretative process focussed on building the arguments presented in the findings using a range of methods As described by Mason as part of facet methodology (2018).

Practically what this stage involved was a reflexive synthesis of prerequisite and corequisite research questions and bringing these together in response to the central research question. This included synthesis of the outputs from the prerequisite questions as well as developing separate arguments to address any socio-ecologic pathways to health impact identified and the potential for the street as a health setting.

This analysis was ecological and aimed to support interpretations "…that involve explaining phenomena in contexts, or as narratives, or cases, or layerings…" and specifically considering complexity and ecologic pathways to health impact addressing "…a search both for the *particular and the processual in context*…" (Mason, 2018, p.206, emphasis in original)

What this practically involved was going beyond what QDA software can readily support and involved hard copy markups, diagramming approaches, 'soft' complex system mapping (Stansfield *et al.*, 2021; Cavill *et al.*, 2020) modified to be undertaken by the researcher working alone, and writing as part of methods. This synthesis was not linear but a recursive process involving moving back and forth across and between the data and the outputs from earlier stages of analysis.

Central to this stage was building arguments recognising that the expression of these and how they are constituted is fundamental within this qualitative research. As the arguments were developed and written this informed the structure and presentation of findings. A practical issue to address here within the word limit was how to present a robust reflexive analysis that did justice to participants' words whilst at the same time allowing space for other conceptual arguments to be developed. Arguments can be developed in many different ways, in this research the approaches used from Mason's longer list (2018) were: developmental arguments, about how social processes have come to be and presenting the issues with multi-layered

interpretations; constitutional arguments, focused on the mechanical and processual aspects of how social phenomena and processes are found to be working; ecologic arguments, about how phenomena are connected and complex; arguments based on reporting, through presentation of the relevant findings from previous stages of analysis; and finally development of arguments as a way to engage with theory, based on sound theoretical principles.

Reflexivity was integral to this synthesis of the facets. This involved demonstrating a rigorous process that addressed issues including whether my interpretations were the most appropriate considering a range of other possible explanations, testing assumptions, demonstrating rigor in the process, showing how conclusions were reached and what checks were made in doing so. All of this recognised that the analysis and arguments were built on top of the overall research design, ontology, and epistemology.

This phase of analysis in contrast to previous phases had a focus on bringing together all the facets previously analysed with a focus on the overall research question.

Data analysis protocols:

A series of protocols were developed in support of analysis within the boundaries of the ethical approval, these were:

- Transcription
- Case Classification
- Materiality Photomontage

3.2.7 Conclusion

This chapter section has linked the research questions to the methods used in data collection and analysis. Before reporting the findings in Chapter 4.0, the last section of this chapter describes the sample of participants and streets.

3.3 Sample description

3.3.1 Participants description

Potential participants (n=30) were identified and some consented to participate (n=22). Two participants withdrew (n=2) prior to observations being undertaken. Reasons for withdrawal were not wishing to be interviewed other than face-to-face (n=1) and due to participant availability (n=1). Participant observations with included participants (n=20) were conducted from May 2020 to February 2021 and the timing of observations is mapped against Covid-19 restrictions in Appendix 09 which affected not just people staying at home but also wider factors like whether schools, businesses, and leisure facilities were open. Recruitment was by direct approach by the researcher (n=5); through gatekeeper organisations (n=13); and by snowballing from participants or potential participants (n=2). Gatekeepers and participants recruited via them were:

- A local environmental volunteer project with a focus on street greening (n=6)
- A community hub and social enterprise (n=4)
- A church leader (n=2)
- A community food pantry (n=1)
- A Known Local Resident (n=1)

The average time from first contact to participant observation was 14 days with a maximum of 52 days. This reflects the need to be flexible to participant availability during the pandemic. Table 5 is a descriptive summary of participants.

Table 5: Participant Descriptive Summary

Participant Pseudonym	Street Pseudonym	Gender	Sex	Age (Decade)	Ethnic identity	Years on Street
Katrin	Philippa Street	woman	female	40-49	White European	9
Robyn	Simpson Street	Woman	female	30-39	White British	7
Paul	Philippa Street	man	male	50-59	White European	9
Luke	Simpson Street	man	male	30-39	Mixed White and Asian	4
Rania	Nia Street	woman	female	50-59	Mixed heritage British Iraqi, and culturally British, ethnically Arab, Armenian, American.	23
Anthony	Beddoe Street	man	male	30-39	White British	8
Gus	Kinsey Street	man	male	30-39	White English	13
Julia	Hester Street	woman	female	50-59	Welsh	6
Ann	Cadwaladr Street	woman	female	50-59	White European	4
Luanne	Steer Street	Woman	female	50-59	Mixed African and Irish	2
Aisha	Holman Street	woman[1]	female	30-39	Somali Welsh	Whole life
Beth	Dillwyn Street	woman	female	40-49	White British	20
Abdi	Arfon Street	man	male	18-29	Somali	18
	Campbell Street					
Mabon	Chamberlain Street	man	male	70-79	Welsh	5
Shiva	Legall Street	woman	female	50-59	British	1
Ima	Tomos Street	woman	female	30-39	Arab African	5
Jessica	Hoggan Street	woman	female	30-39	Mixed, Jamaican and English	13
Rebecca	Holford Street	woman	female	40-49	White Welsh	18
Samantha	Hoggan Street	woman	female	30-39	Mixed, British and Caribbean	4.5
Scott	Ashley Street	man	male	40-49	White Welsh	9

Note 1: not collected during observation, subsequently confirmed with participant.

Figures are tabulated for participant sex (Table 6); gender (Table 7); age (Table 8); and ethnic identity (Table 9). Participants were adults in the age brackets covering 18-79 years old. Sex and gender are both important determinants of health and are reported in this thesis in line with recommended reporting for health studies (Gogovor *et al.*, 2021; Adisso *et al.*, 2020). In the rest of this thesis gender terms are used whilst noting that all males in the sample identify as men and all females as women. The range of time participants had lived in their street was from one year to the whole of their life.

Table 6: Participant sex

Male	Female	Intersex
7 (35%)	13	0

Table 7: Participant gender

Man	Woman	Gender-diverse
7 (35%)	13	0

The sampling criteria of ≥30% for men and women was met.

Table 8: Participant age (decade)

18-29	30-39	40-49	50-59	60-69	70-79	80+
1	8	4	6	0	1	0

Table 9: Participant ethnic identity self-described

White British	3
White European	3
White English	1
Welsh	2

White Welsh	2
Mixed white and Asian	1
Mixed African and Irish	1
Mixed Jamaican and English	1
Mixed British and Caribbean	1
Mixed heritage British Iraqi. Culturally British, ethnically Arab, Armenian, American.	1
Somali Welsh	1
Somali	1
British	1
African Arab	1

Strengths of the sample are: sex and gender balance; heterogenous years on street; heterogenous ethnic identities. Age was not a sampling criterion except to aim for a spread of ages, participants are mostly in the age bracket 30-59. Experiences of people aged 18-29 and over 60 are less represented which is a limitation of the sample.

A further potential limitation of the sample is that recruitment via gatekeeper organisations for 13 participants might suggest these people are more inclined to join volunteer groups and with an interest in the group's specific focus. This is argued to be partly moderated due to the individual participants' varied levels of engagement and views, for example, Beth noted, "I do feel like, "I should be coming back and doing something" but I just know at the moment I can't…" and Scott who lives on arguably the street closest to healthy design principles said, "I'm one of these people that switches a gardening programme off, I just have no interest in it… we have our artificial lawn out the back and that's as much gardening as I ever do.".

Observations were undertaken by Skype for Business (n=2), Zoom (n=13), WhatsApp video call (n=2), and by mobile telephone voice call (n=2). Zoom, whilst initially new, through the pandemic became widely known and participants often requested this as a preference. WhatsApp video call was selected by two participants one being the oldest participant, Mabon,

and the other by Jessica. Telephone calls were used for Gus as it was easier for him to remember this and Samantha who was caring for her young children during the observation.

Pre-existing health status of participants was noted as a weakness of studies in this field in the systematic review and therefore in this research participant wellbeing was measured once on the date of the observation using the 'ONS four' wellbeing survey questions (Tinkler and Hicks, 2011). The numerical responses are detailed in Table 10. The table includes local authority averages for the preceding year (2019/20) and the year of the observations (2020/21). On average in the population of Cardiff all domains of wellbeing were lower in the year of the pandemic than the previous year. From a descriptive perspective, on average participants had better wellbeing measures across all four domains. Men in the sample had lower levels of anxiety than women, women on average had somewhat higher anxiety than the local authority average. The role of this data in this research was to inform ecologic understanding of the individual participants and provide a description of the sample.

Table 10: Participant wellbeing responses and comparison to local authority average (Office for National Statistics, 2022b) (shading denotes materially different to local authority average, green = better, orange = worse)

Participant Pseudonym	Satisfied	Worthwhile	Happy	Anxious
Katrin	7	7	10	1
Robyn	7	10	10	0
Paul	8-9	8-9	8	2-3
Luke	7	8	8	2
Rania	8	10	6	1
Anthony	8	10	7	1
Gus	8	8	7	3
Julia	9	10	10	0
Ann	9	10	9	5
Luanne	10	10	10	2
Aisha	7	10	7	10
Beth	5	7	6	4
Abdi	6	6.5	10	2
Mabon	6	6	8	1
Shiva	5	7	7	6
Ima	9	10	10	3
Jessica	6-7	6-7	5	9
Rebecca	7	8	7	4
Samantha	7-8	8	9	2
Scott	8	8	10	0
Local authority 2019/20	7.61	7.72	7.45	3.26
Local authority 2020/21	7.36	7.60	7.27	3.30
Males in sample	7.4	7.9	8.3	1.6
Females in sample	7.5	8.7	8.2	3.6

3.3.2 Streets description

Eighteen streets (n=18) are related to included participants. This is one street per participant except for Philippa Street where Katrin and Paul live in the same household; Hoggan Street where Jessica and Samantha live; Simpson Street where Robyn and Luke live; and Abdi who uniquely in the sample has two streets, Campbell Street at one side and Arfon Street at the other side of his house. In Abdi's case these two streets are considered separately except within area level deprivation analysis where they are assessed as one item. Table 11 describes the included streets further.

The predominant housing types are terraced houses (n=13); semi-detached houses (n=3); maisonette (n=1); and purpose-built apartments (n=1). All participants live in the same type of house as the predominant house type, except for Abdi, who lives in a terraced house whereas Arfon Street to one side of his house is predominantly purpose-built apartments. There are no detached houses in the sample. Half the streets have an era of construction of 1880-1918 (n=10); and then post World War I 1918-1945 (n=2); post World War II 1945-1960 (n=2); 1960-2000 (n=1); and 2000-2020 (n=2). All of the properties from 1880-1918 are terraced houses but this housing typology is not limited to this era with streets from 2000-2020 also being terraced houses.

All streets are within the Southern Arc except Beddoe Street and Legall Street, these met the WIMD 50% most deprived criteria and provided an example of semi-detached housing typology. As presented in Table 11, all streets are in the 50% most deprived overall areas except for Arfon / Campbell Streets which shows how, despite a policy focus on areas of greatest need the Southern Arc boundary includes examples of least deprived areas too.

Arfon / Campbell Streets are the only location in the 50% least deprived overall and the only location in the 50% least deprived for income, health, and housing domains. In contrast Arfon / Campbell are one of the few (n=2) streets in 10% most deprived for community safety. Half the streets (n=9) are in the 50% least deprived areas for access to services: like schools, GPs, and broadband. All streets are in the 50% most deprived areas for physical environment and most streets (n=16) are in the 10% most deprived in Wales for this domain which measures factors

like air quality, proximity to green space, and flood risk. The housing domain is equally low across the sample and the majority of streets (n=11) are in the 10% most deprived of this domain. Except for Arfon / Campbell (n=16) all streets are in the 10%, 10-20%, or 20-30% most deprived in the health domain which combines a range of health-related outcomes. In summary, the sample has a prevalence of streets that are categorised overall as deprived, have good access to services, but very poor physical environment, very poor housing, and poor health-related outcomes. The one street that is in the 50% least deprived by contrast is in an area where people have relatively good income, health, and housing for Wales.

Using the definitions previously given, half the streets were normal streets (n=10); those with major environmental characteristics included a railway behind (n=2); a river at one end (n=3); a river at one side (n=1); light industrial units (n=1); and a public park at the end or one side of the street (n=5). The presence of a river in most cases (Beddoe, Legall, and Tomos Streets) coincided with the presence of public parks and green space but not at Ashley Street where there is simply a retaining wall and pavement. The sampling criteria of a Home Zone or street closer to healthy design principles is met by Ashley Street which had been subject to contemporary regeneration of this post WWI street. No new development after 2016 was included, this seems most likely this is due to there being little of this in the areas sampled.

Most participants have space between their front door and the public highway: a shared front garden / yard (n=2); a balcony (n=1); and a private front garden or yard (n=16); some have no space (n=2). Carriageway widths (kerb to kerb) range from barely as wide as a car (2.61m) to as wide as a bus is long (12.41m). Public street widths (including pavements and any verges or grass) range from 4.59m to 59.61m. House to house widths range from 15.12m to 30.61m where there are houses both sides, or up to 63.25m where there is a railway, river, or other feature on one side. These physical features are related to overall street characteristics yet are also specific to the participant. For example, Simpson Street has a range of situations with doors directly onto streets, front gardens on one side, and front gardens on both sides of the street. For Robyn and Luke who live on different parts of Simpson Street these characteristics are particular to them. Therefore, in analysis street characteristics are particular to the participant case and not the street case.

Table 11: Street names, era, housing type, deprivation decile, and normal / major category

Street Pseudonym	Street Era	Street Predominant House Type	WIMD Overall (Welsh Government, 2019)	Sampling of environmental characteristic
Philippa Street	1880-1918	Terraced House	10% Most	Normal street
Simpson Street	1880-1918	Terraced House	10-20% Most	Major: railway line behind
Nia Street	1880-1918	Terraced House	10% Most	Major: railway line behind Major: part light industrial
Beddoe Street	1945-1960	Semi-Detached	10-20% Most	Major: river at end
Kinsey Street	1880-1918	Terraced House	10% Most	Major: park at end
Hester Street	1880-1918	Terraced House	20-30% Most	Normal street
Cadwaladr Street	1880-1918	Terraced House	20-30% Most	Normal street
Steer Street	1880-1918	Terraced House	10% Most	Normal street
Holman Street	1970s	Maisonette	10% Most	Major: play park and adjacent park
Dillwyn Street	1880-1918	Terraced House	20-30% Most	Normal street
Arfon Street	2000-2010	Purpose Built Apartments	50% Least	Normal street
Campbell Street	2000-2010	Terraced House	50% Least	Normal street
Chamberlain Street	1880-1918 (participant) 1930-1950 (other part)	Terraced House	10-20% Most	Normal street
Legall Street	1945-1960	Semi-Detached	10-20% Most	Major: river at end
Tomos Street	1880-1918	Terraced House	10-20% Most	Major: river on one side
Hoggan Street	2000-2010	Terraced House	10% Most	Normal street
Holford Street	1918-1945	Semi-Detached	10% Most	Normal street
Ashley Street	1918-1945	Terraced House	10-20% Most	Major: river at end Major: regeneration close to healthy design principles

Strengths of the street sample include heterogenous predominant housing types; heterogenous era of construction; and a mix of both normal streets and streets with major environmental characteristics. Limitations of the sample are the lack of certain housing types including detached houses and participants living in purpose-built apartments. There is no Welsh Housing Survey as for England which means there is a lack of data about the Welsh housing sector (National Residential Landlords Association, 2021) however plausibly detached houses may be more likely to be found in areas in areas of lower deprivation. Residents of apartments may be more difficult to contact and there may be differences in age profile by housing type and tenure which may have affected recruitment such there being fewer participants in the 18-29 age group. It was also found in sampling that the predominant house type appears related to the era of construction. The era of construction may therefore be as relevant as the housing type.

3.3.3 Conclusion

The research design was prepared using methods to address different facets of the main research question. These included addressing the sampling of both participants and streets. Data collection in the sample comprised: desktop data; participant observations; and street observations. The methods were refined in response to the Covid-19 pandemic. Ethics were addressed both for institutional compliance and as formative research values.

Analysis followed data collection sequentially due to the impact of Covid-19. The research facets were refined as: health practices; street environment characteristics; health and wellbeing-related outcomes; and ecologic pathways to health impact. Analysis of facets used: thematic analysis; and a new method for My Street analysis. Street environment visual data were also prepared and are presented to illustrate the findings. The overall synthesis addressed the research question and is reflexive and interpretive.

3.3.4 Chapter Conclusion

This chapter has described how the research was conceptualised, designed, and implemented at both the level of overall methodology and methods subsequently used. This included refinements in response to the Covid-19 pandemic. The participant and street sample has also

been described. Chapter 4.0 Findings and Discussion will now presents the outputs from the data collection and analysis and contributes to addressing the requirement for the “..creation and interpretation of new knowledge..” (UWE Bristol, 2023).

Chapter 4.0 Findings and Discussion

The findings are presented in as follows.

Chapter 4.1 is different to the remainder of the findings as it presents the visual outputs related to street physical environments, mainly in a separate booklet. This booklet of visual material at Appendix 1 is part of the examined materials and within the word counts. This illustrates for the reader the different streets in the sample and informs the ecologic understanding of the street settings.

The central findings related to the street environment, illustrated in Figure 23 below, are presented in two written parts. Part I includes the disaggregated findings of a reflexive thematic analysis of participant observations (4.2-4.4). Part II presents the integrated findings related to ecological pathways to health impact in the street (4.5), the street as a health setting (4.6), and the street as a "transdisciplinary knowledge domain" (Lawrence and Gatzweiler, 2017, p.595) (4.7).

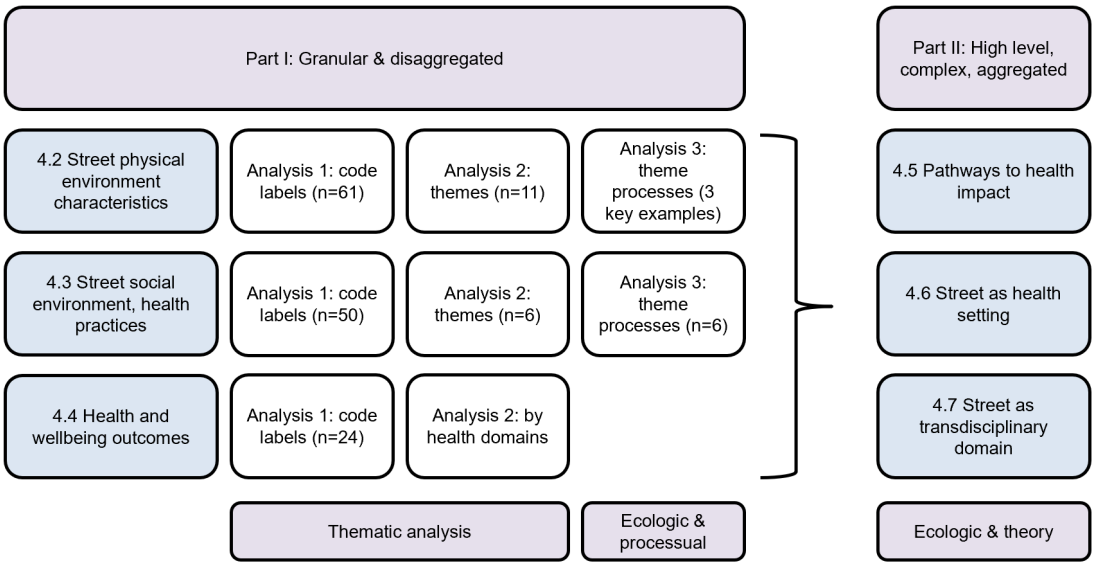


Figure 23: Chapter sections for main findings

The final chapter section, methodological findings and discussion (4.8) concludes the chapter.

Findings and Discussion Part 1

4.1 Street physical environment visual analysis (separate document)

Please refer to the separate visual analysis artefact at Appendix 1.

4.2 Street Physical Environment

4.2.1 Introduction

This section relates to the street physical environment characteristics that, through analysis of participant observations, are found to support, inhibit, or otherwise influence health and health-related practices.

At their simplest these findings provide an extended set of street environment characteristics to be considered when addressing health in the street setting, including by street design practitioners and residents. They extend existing understanding of what physical characteristics matter for health at the street scale and not just those normally thought of as design-related. The analysis intentionally works methodically through a series of disaggregated findings. It is considered important to present these granular findings as they have implications for research and practice. Taken together they can be viewed simply as an extended understanding of the street environment and a contribution to new knowledge based on residents' knowledge and experience. They demonstrate the complex, ecologic, processual links along a pathway to health impact in the street.

The reader is reminded that in the research design and scope, characteristics are all at the residential street scale where participants live. They include the visible and physical environment plus aspects such as acoustics, temperature, wind, and nature. Environmental characteristics generated beyond the street (e.g., neighbourhood level air quality) are excluded except where it is modified or manifest at the street scale (e.g. creating noticeable dirt on windows). Descriptions, code labels, and themes aim to reflect participants' own words. Characteristics can be historic, present today, or future desired ones.

Findings for street environment characteristics are presented at three levels of analysis:

- Analysis 1 – thematic coding
- Analysis 2 – seeking patterns
- Analysis 3 – detailing processes within selected themes

Figure 24 summarises the themes for street physical environment characteristics. Analysis 3 will present the three themes indicated as being identified by over half of participants.

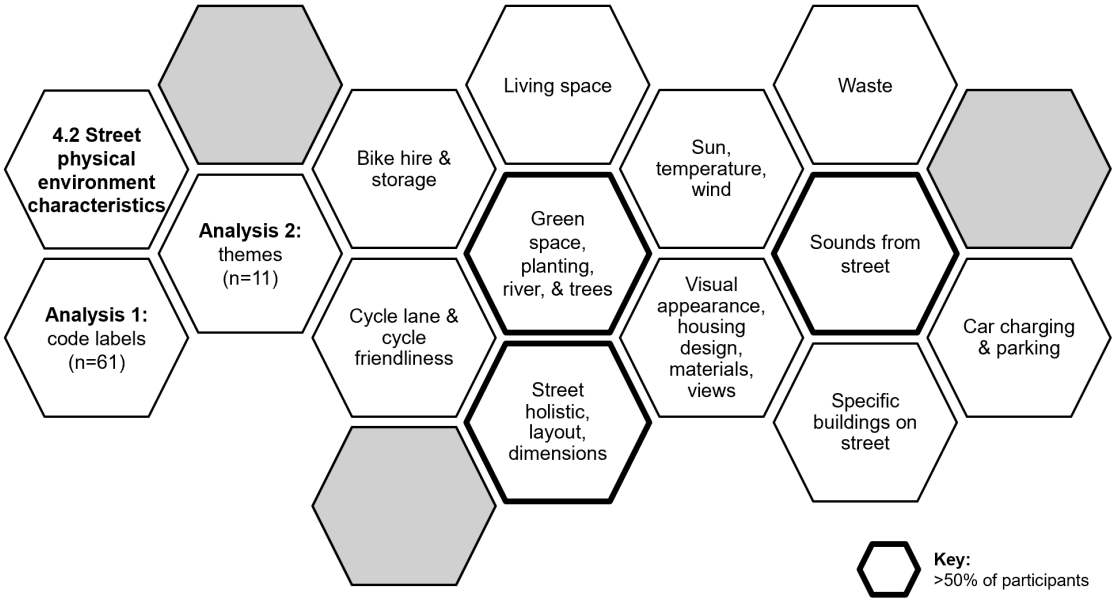


Figure 24: Overview of themes, street physical environment characteristics

4.2.2 Findings and discussion

Analysis 1 – thematic coding

Through structured and rigorous application of coding, street physical environment characteristics are identified with code labels (n=61). All code labels are presented in Table 12. Appendix 10 provides illustrative photographs from street observations of these code labels.

This list responds in part to the research question:

> Do street environment characteristics impact on health practices and if so, which ones and how?

Some codes have potential for more latent interpretation, such as the *concrete jungle*, but all also all have semantic meaning. The impact of these codes on health vary and include both positive and negative impacts.

Table 12: Street design characteristics grouped

U_STREET CHARACTERISTICS (U_ prefix denotes street physical environment codes)	Women (n=13)	Men (n=7)	Total (n=20)	Women % ≥50% highlighted	Men % ≥50% highlighted	Total % ≥50% highlighted	Women- Men % Difference +/-≥25% highlighted
U1_Bike hire and storage	2	0	2	15%	0%	10%	15%
U_Bike hire station	1	0	1	8%	0%	5%	8%
U_Bike storage, parking	1	0	1	8%	0%	5%	8%
U1_Car charging and parking	5	4	9	38%	57%	45%	-19%
U_Cars, electric charging	1	0	1	8%	0%	5%	8%
U_Parking, parked cars as a feature or issue in the street, residents parking, knock on effects	5	4	9	38%	57%	45%	-19%
U1_Cycle lane and cycle friendliness	2	1	3	15%	14%	15%	1%
U_Changes in street for cycle friendliness	1	0	1	8%	0%	5%	8%
U_Cycle lane	1	1	2	8%	14%	10%	-7%
U1_Green space, planting, river, and trees	11	6	17	85%	86%	85%	-1%

U_Greenery, green spaces, planters, plant pots, a river on street, sustainable drainage	10	5	15	77%	71%	75%	5%
U_Street Tree	3	3	6	23%	43%	30%	-20%
U1_Living space	3	0	3	23%	0%	15%	23%
U_Crowded, can't move freely, insufficient space, cramped living space impact	2	0	2	15%	0%	10%	15%
U_Houses, types, big, small	1	0	1	8%	0%	5%	8%
U1_Street holistic, layout, dimensions	8	7	15	62%	100%	75%	-38%
U_Cul-de-sac, dead end	3	1	4	23%	14%	20%	9%
U_Lanes, visibility, alleys, gated alleys, passageways, cut throughs	3	1	4	23%	14%	20%	9%
U_Length of street, notable or relevant	2	2	4	15%	29%	20%	-13%
U_Pavements, good size, narrow	2	0	2	15%	0%	10%	15%
U_Street environment and holistic wider arrangement, specific mention	1	0	1	8%	0%	5%	8%
U_Street layout, terraced street, house sizes, historic field patterns	5	2	7	38%	29%	35%	10%
U_Width of street	2	4	6	15%	57%	30%	-42%

U1_Sun, temperature, wind	1	2	3	8%	29%	15%	-21%
U_Orientation to north, sun angle	1	2	3	8%	29%	15%	-21%
U_Temperature of street or garden due to sun	1	1	2	8%	14%	10%	-7%
U_Wind direction, sea air	0	1	1	0%	14%	5%	-14%
U1_Visual appearance, housing design, materials, views	7	2	9	54%	29%	45%	25%
U_Changes in street for cosmetic reasons, or with cosmetic effect	1	1	2	8%	14%	10%	-7%
U_Concrete jungle	1	1	2	8%	14%	10%	-7%
U_Decorative features, Victorian tiles, original features, facades look good	4	0	4	31%	0%	20%	31%
U_Houses look the same	1	0	1	8%	0%	5%	8%
U_View, long distance across city	1	0	1	8%	0%	5%	8%
U1_Waste	6	3	9	46%	43%	45%	3%
U_Bins, household waste, being an obstacle, commercial bins, litter bins	2	1	3	15%	14%	15%	1%
U_Rubbish, being everywhere, glass, dog shit, plastic pollution, cigarette butts	5	2	7	38%	29%	35%	10%

U2_Sounds from street, pleasant or noise, incl. speed bumps, quiet	6	6	12	46%	86%	60%	-40%
U2_Specific buildings on street, wet house, block of flats, care home, businesses, shops, chip shop	4	3	7	31%	43%	35%	-12%

Individual codes not developed into themes (individually identified within ≤4 / 20% of participant observations)	12	5	17	92%	72%	85%	n/a
U_Air pollution, fumes, filth in air	2	0	2	15%	0%	10%	15%
U_Barriers, metal street ones, bollards	0	1	1	0%	14%	5%	-14%
U_Benches, as sitting places	2	1	3	15%	14%	15%	1%
U_Building works	1	0	1	8%	0%	5%	8%
U_Bus stop, being a timed stop, bus route	2	0	2	15%	0%	10%	15%

U_CCTV	1	2	3	8%	29%	15%	-21%
U_Community space, having communal space	1	0	1	8%	0%	5%	8%
U_Condition, of places to walk	1	0	1	8%	0%	5%	8%
U_Disused space, waste land	1	0	1	8%	0%	5%	8%
U_Flooding, risk, river, water level, ground water, drainage	1	2	3	8%	29%	15%	-21%
U_Front garden, having or not	2	1	3	15%	14%	15%	1%
U_Level crossing, dropped kerb, pram access	0	1	1	0%	14%	5%	-14%
U_lighting, street lighting	2	0	2	15%	0%	10%	15%
U_Location in wider city, as an important factor	2	1	3	15%	14%	15%	1%
U_Nature, wildlife, presence of	0	1	1	0%	14%	5%	-14%
U_Neighbourhood watch scheme	0	1	1	0%	14%	5%	-14%
U_Notable people on street	2	1	3	15%	14%	15%	1%

U_Phone boxes, dilapidated	2	0	2	15%	0%	10%	15%
U_play areas, sports facilities, astroturf	1	0	1	8%	0%	5%	8%
U_Public-private side of house with two streets	0	1	1	0%	14%	5%	-14%
U_Railway line	0	1	1	0%	14%	5%	-14%
U_Safety of junction, street turning	0	1	1	0%	14%	5%	-14%
U_Satellite dishes, aerials, restrictions on placement	0	1	1	0%	14%	5%	-14%
U_Satnav routes, directing large vehicles, being on a thoroughfare, a major cut through, busy road	2	2	4	15%	29%	20%	-13%
U_Signage, street signs, stickers, warnings, poles, house numbers, Welsh signs	1	2	3	8%	29%	15%	-21%
U_Smells	2	1	3	15%	14%	15%	1%
U_Speed bumps, traffic calming	2	2	4	15%	29%	20%	-13%

U_Street clutter, poles and things	1	0	1	8%	0%	5%	8%
U_Tarmac and paving, impervious to water	0	2	2	0%	29%	10%	-29%
U_Topography, being flat, being hilly	1	2	3	8%	29%	15%	-21%
U_Vibration, whole house shakes	0	1	1	0%	14%	5%	-14%
U_Ward boundary	0	1	1	0%	14%	5%	-14%
Total (unique)	13	7	20	100%	100%	100%	0%

Note to table: presentation of numbers – this table should be read in conjunction with the methodological considerations stated at 3.2.5. This is a numerical presentation of qualitative data. They are not generalisable beyond the sample in this research and are themselves the output of an interpretive process.

Analysis 2 – seeking patterns

Themes were developed from the list of codes in order to identify patterns in the data, as detailed in Table 12. Unlike themes in health practices (Section 4.3) themes for street physical environment characteristics were more semantic and did not result in deep interpretative themes. Individual items, such as related to sounds, could have latent meaning for participants but overall the themes are more semantic. This is a finding in its own right: themes related to the street physical environment were described in semantic terms by participants.

Street physical environment characteristic codes (n=29) were integrated into themes (n=11). This included codes (n=27) grouped together into themes (n=9) as well as codes (n=2) which became themes (n=2) in their own right. In this analysis and with the level of interpretation applied most codes (n=34) were not therefore allocated within themes: they were heterogenous concepts. The resulting list of themes of street environment characteristics identified through participant observation is:

- Bike hire and storage;
- Car charging and parking;
- Cycle lane and cycle friendliness;
- Green space, planting, river, and trees;
- Living space;
- Street holistic, layout, dimensions;
- Sun, temperature, wind;
- Visual appearance, housing design, materials, views;
- Waste;
- Sounds from street, pleasant or noise, incl. speed bumps, quiet;
- Specific buildings on street, wet house, block of flats, care home, businesses, shops, chip shop.

Table 13 presents analysis to identify patterning in the data. Themes identified within more than half of participant observations are:

- green space, planting, river, and trees;
- street holistic, layout, dimensions; and
- sounds from street, pleasant or noise, incl. speed bumps, quiet.

Differences appear when considering relative proportions by men and women. Themes identified within more than half of women's observations are:

- green space, planting, river, and trees;
- street holistic, layout, dimensions; and
- visual appearance, housing design, materials, views.

Themes identified within more than half of men's observations are:

- car charging and parking;
- green space, planting, river, and trees;
- street holistic, layout, dimensions; and
- sounds from street, pleasant or noise, incl. speed bumps, quiet.

Comparing proportions between men and women it can be said that noticeable differences are identified within this sample. The methodological aims stated at 3.2.5 should be noted including as one part of the overall analysis "to identify patterns that are not apparent simply from the unquantitized qualitative data…" (Maxwell, 2010, p. 479).

- Themes proportionately more for men than women are:
    - Street holistic, layout, dimensions (noted by all men and a smaller majority of women); and
    - Sounds from street, pleasant or noise, incl. speed bumps, quiet.
- Themes proportionately more for women than men:
    - Visual appearance, housing design, materials, views.

Table 13 Street Characteristics Grouped Summary

U_STREET CHARACTERISTICS	Women, count, (n=13)	Men, count, (n=7)	Total, count, (n=20)	Women % ≥50% highlighted	Men % ≥50% highlighted	Total % ≥50% highlighted	Women-Men % Difference +/-≥25% highlighted
U1_Bike hire and storage	2	0	2	15%	0%	10%	15%
U1_Car charging and parking	5	4	9	38%	57%	45%	-19%
U1_Cycle Lane and cycle friendliness	2	1	3	15%	14%	15%	1%
U1_Green space, planting, river, and trees	11	6	17	85%	86%	85%	-1%
U1_Living space	3	0	3	23%	0%	15%	23%
U1_Street holistic, layout, dimensions	8	7	15	62%	100%	75%	-38%
U1_Sun, temperature, wind	1	2	3	8%	29%	15%	-21%
U1_Visual appearance, housing design, materials, views	7	2	9	54%	29%	45%	25%
U1_Waste	6	3	9	46%	43%	45%	3%
U2_Sounds from street, pleasant or noise, incl. speed bumps, quiet	6	6	12	46%	86%	60%	-40%
U2_Specific buildings on street, wet house, block of flats, care home, businesses, shops, chip shop	4	3	7	31%	43%	35%	-12%

Note to table: presentation of numbers – this table should be read in conjunction with the methodological considerations stated at 3.2.5. This is a numerical presentation of qualitative data. They are not generalisable beyond the sample in this research and are themselves the output of an interpretive process. It is not a statistical analysis, rather one analysis of patterns in the qualitative data from the perspective of what most participants identified overall and by gender. Shading indicates noticeable difference (+/-≥25%), it does not indicate or imply good / bad or more / less important.

Analysis 3 – detailing processes within selected themes

The third level of analysis of this dataset addressed the processual understanding of pathways to health impact. As the research is focused on population level health impact, and within the resources available for analysis this section is focused on those three themes identified in the majority of the sample:

- green space, planting, river, and trees;
- street holistic, layout, dimensions;
- sounds from street, pleasant or noise, incl. speed bumps, quiet;

This method of analysis also demonstrates how other themes could be analysed in future. Figures 25-27 below summarise the *processual components* identified within each theme which are then detailed and evidenced in the rest of this section.

These processual components represent the very granular scale of what is happening for participants at the street scale in relation to each theme. They are the processes or mechanisms that act on, or along, pathways to health impact. Patterns are identified in cross-sectional analysis across cases and ecologic differences are also identified that have the potential to create distributed impacts in a population or across population groups. Many of the processual components reported include both direct and obvious mechanisms as well as complex and indirect mechanisms.

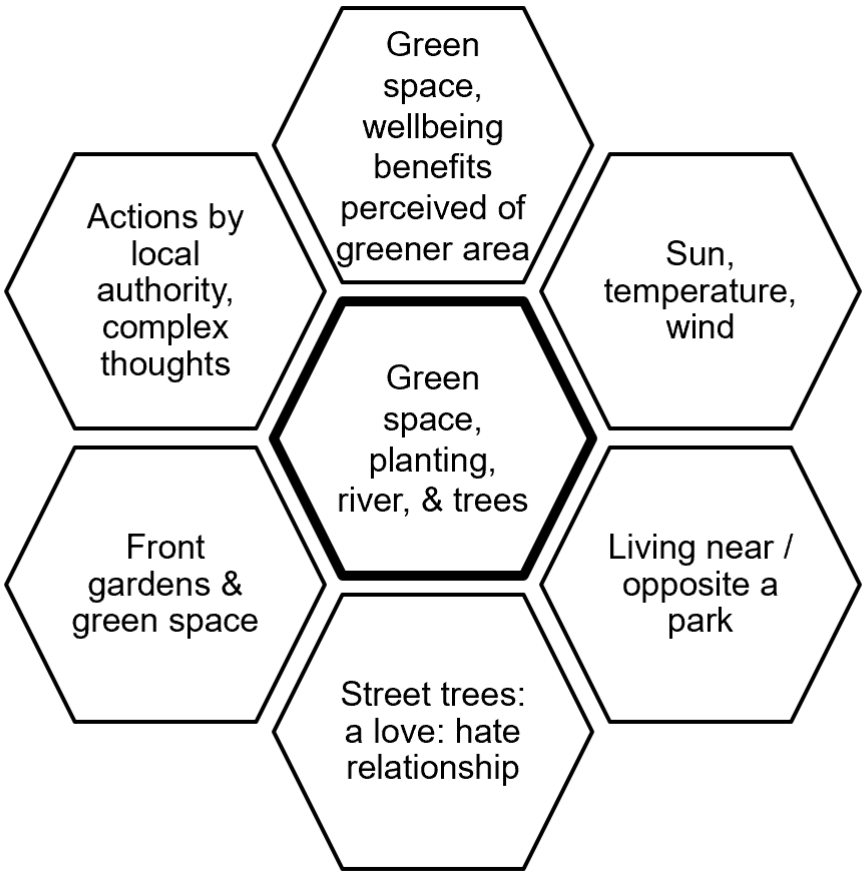


Figure 25: Processual components, theme green space, planting, river, and trees

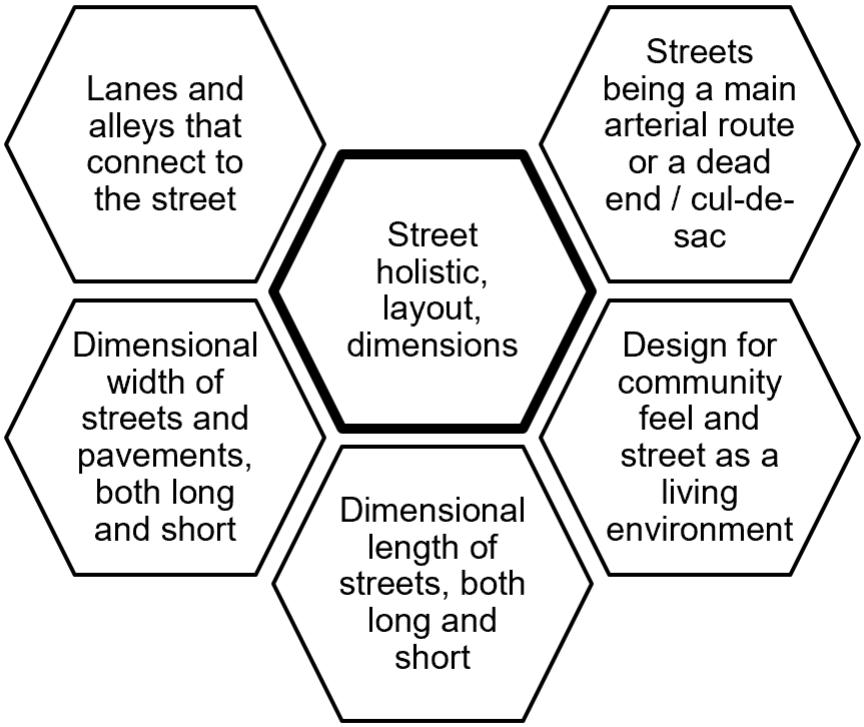


Figure 26: Processual components, theme street holistic, layout, dimensions

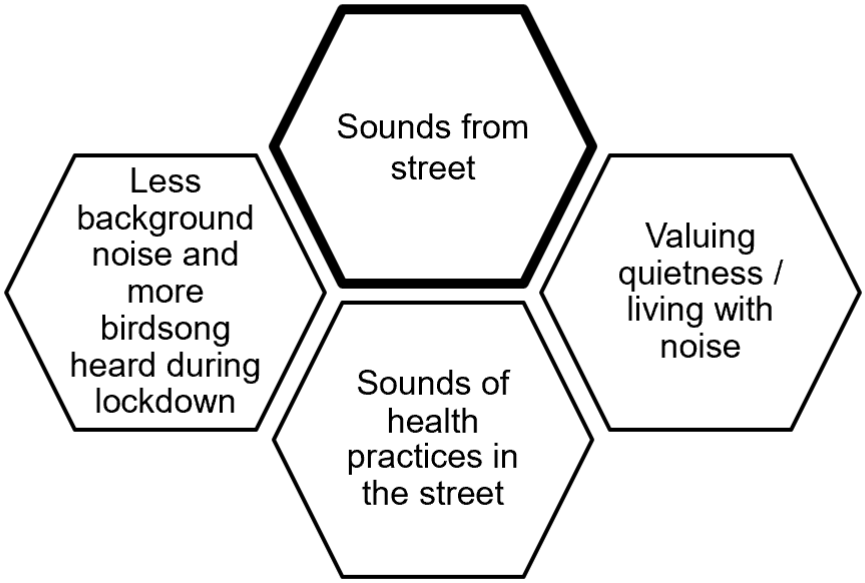


Figure 27: Processual components, theme sounds from the street

Theme A: green space, planting, river, and trees

Analysis of coded data extracts under the theme – green space, planting, river, and trees – resulted in processual components (n=5), as illustrated in Figure 25 above:

- Green space, wellbeing benefits perceived of being in a greener area;
- Actions by local authority, cosmetic changes that reduce green space. Complex thoughts of participants in relation to improvements like street planters;
- Front gardens and green space: an opportunity (for some) for agency in the street;
- Street trees: a love: hate relationship and varied impact on health practices; and,
- Living near / opposite a park.

Theme A green space; processual component: green space, wellbeing benefits perceived of being in a greener area

Participants link green space to wellbeing, in one case even describing this like a dose-response relationship. The absence of greenery is noticed by participants and it seems there is always space for more greenery on the street. A number of participants are making positive changes in their street yet their ability to have agency in the street is limited.

Participants make a clear connection between green space and wellbeing. To avoid repetition, some data extracts linked to this component are reflected in subsequent components. Paul makes a direct connection and also observes benefits for other people:

> …the greenness of the outside of both our front and back garden, but the front in particular which acts as this green buffer to the street outside and, it's not just the birds there you see cats wandering through and so on. I'm conscious that that adds to my sense of wellbeing without a shadow of a doubt. And I'm conscious that it does add to the wellbeing of others, people who pass… say, "oh, I love your garden, you always keep your garden nice and tidy and so on". (Paul)

For Robyn and Luke the relative lack of greenery has a negative effect:

> So, it wasn't until we had been here a little while, that we looked round and went, "ahh, [.] there's no trees, there's no green … (Robyn)

Robyn's part of Simpson Street has no front gardens, Luke lives at the other end where there are small front gardens:

> we have limited facilities and green, and usable green spaces (Luke)

> I would be happier if I lived somewhere cleaner, I guarantee you it, guarantee you it. And somewhere with more of a natural bent as it were, more green space, more of a natural environment… (Luke)

Figure 28: Simpson Street South, no front gardens

Figure 29: Simpson Street North, example with small front garden / yard

At Kinsey Street with no front gardens Gus links health and greenery like a dose-response relationship especially for mental health.

> …if there's more trees and more greenery I think you would feel a lot healthier… I think you'd feel you're in a healthier environment and I think that'd help you mentally. (Gus)

The links can be more complex too, Aisha's Street is interpreted through her experiences as a Somali Welsh woman, as a practicing Muslim, and wearing traditional Islamic dress. Aisha sees a clear link between the street physical environment and everyday practices. She contrasts her maisonette at Holman Street with living in a rural National Park setting, also linking this to the social environment:

> …if I lived in Brecon Beacons or somewhere with greenery then I think my lifestyle would be totally different. I'd be more inclined to maybe exercise more, go for regular walks, help with my mental health and wellbeing… (Aisha)

Gus is actively trying to make more greenery on the street and since the Covid-19 pandemic has retrained as a carpenter. He makes planted window boxes and now there are planters down Kinsey Street that he has made whilst also managing childcare during the pandemic.

Figure 30: Kinsey Street, no front gardens, window boxes

Luanne is satisfied with her street but there is always room for more greenery and she has very practical ideas and knowledge about how this could be achieved.

> Do you know what would be nice would be a bit more street greenery. …you've got boxes, troughs on the pavement where they've got plants in. It would be nice to have some-thing like that dotted along the pavements, of course giving space for people to walk on. We're very lucky we have good sized pavements… (Luanne)

Gus is prepared to actively contribute through skills and other resources to improving the street environment but reflects that even for simple things like whether the local authority will permit a plant pot outside his front door that, "you hit a brick wall" (Gus). He laughs in a way that suggests he is resigned to this and wishes the local authority had "…more of a 'can we do it' attitude rather trying to look of ways of not doing things."

Participants link green space to wellbeing. The absence of greenery is noticed by participants and it seems there is always space for more greenery on the street. Gus and others are making positive changes in their street yet their ability to have agency in the street is limited. This links to the next processual component of actions by the local authority.

Theme A green space; processual component: actions by local authority (specific to green space theme), cosmetic changes that reduce green space. Complex thoughts in relation to improvements.

The role and impact of the local authority in the street is wide-ranging. Local authority policies and approaches change over time yet changes in the street can outlast these. Some past approaches that removed greenery from the street are still there years later. Participants respond in complex ways to street interventions by the local authority and understanding why something has been done can influences peoples' response to them.

Katrin notes historic local authority actions that reduced green space:

> The Council, before we moved here, in the early 2000s, did cosmetic changes to these streets where they all gave exactly the same fencing around the front garden, they gave certain cladding to the houses so they all look the same. And I think they took away a lot of green in the process of doing so, and it ended up that all the front gardens looked the same and none of them are used as gardens… And it was sold as improving the environment that you live in, I'm not sure to what extent it did… because it took all the green away. (Katrin)

Figure 31: Philippa Street, evidence of previous regeneration intervention to standardise garden walls and railings

A contemporary regeneration project at Ashley Street is the closest in this research to representing an intervention that reflects current healthy design guidance, Scott's response is complex and he also thinks there are surface water problems resulting from the changes:

> …on the one side the street looks phenomenally better than it did… five, six years ago before it was there… I know it's an award-winning scheme, and I'm not sure it was as collegiate and driven by the community… as everybody says it was really. (Scott)

Street planters are one way that the local authority has provided for residents to participate in street improvements. Julia is an elected councillor and resident at Hester Street and can see both perspectives. She notes the positive but also the potential for neglect after a neighbour was keen to have one but then moved away. For Luke, planters at Simpson Street are a symbol of the positive efforts of residents but sometimes these are vandalised. The negative impact of this seems more intense than the positive impact:

> Well, I don't know if there's anything intrinsic to this environment which is beneficial to anyone's mental health. I mean, [partner] has done her best I mean there's the planters that she put at the north end of Simpson Street on [main road] Road. On some fencing there. But they got trashed and [.] that was just depressing. To be honest there's really very little around here that I would say, the things that make me happy, or the things that give me hope are the efforts made by the conscious residents of [ward]. (Luke)

Figure 32: Simpson Street North, planter with writing

The use of different knowledges by participants and researcher in interpreting the street are notable here. At Ashley Street the contemporary interventions to me as the researcher including as a professional architect have a clear range of observed functions such as for surface water collection and as biodiverse planted areas. Scott's interpretation draws on his experience and knowledge including as a resident of the street. What I interpret as clear and understandable: Scott interprets as confused and a problem. In contrast, as the researcher I had no knowledge of the historic removal of greenery at Phillipa Street which was *only* understood when integrated

with Katrin's knowledge, providing context for why Katrin's front garden stands out as very green within the street.

The local authority has a particular role in relation to greenery in the street. Interventions that are undertaken for positive reasons are not always seen as such by residents and communication of the purpose of interventions seems important to addressing this. Changes at the street scale are often longer lasting than local authority policies and certainly the election cycle. These findings inform recommendations for policymakers at Chapter 5.6.

Theme A green space; processual component: front gardens and green space

Front gardens are linked to greenery in the street. This process can be deeply ecologic. The absence of a space between the front door and street can have a negative impact and this impact varies by population group.

Benefits for Mabon of his front garden include the sense of achievement at removing the previous thick concrete, the enjoyment people passing take, and benefits for nature:

> …what we tried to do with the garden in the front is to have everything as far as possible bee friendly and with a good scent… coming in the front door the scent of this today was – *ah* – magic, just really cheers you up [small laugh] you know, it's lovely. (Mabon)

> The benefits go further for Mabon, providing opportunities to include plants that were cuttings from his dad's plants. Mabon's dad was a professional gardener and these plants are a daily reminder of him.

Paul notes the health benefits of the front garden for himself and people passing (see data extract at first component above). Paul's activity to create green space in his front garden also has the potential to mitigate historic actions by the local authority at Phillipa Street (as identified previously). Paul's garden stands out in the street as being a green one and is so different that it would "…often be commented upon by people who in the main don't have front gardens…" (Paul)

The presence or absence of a front”gard’n or space matters for Gus and even a small space can help:

> …all our houses are all straight onto the street, which is a bit frustrating really… you’d love to have something out the front, cause it even makes a huge difference having a little small front garden to be able to put a few pots or a bit of greenery I think it makes a massive difference… (Gus)

Figure 33: Kinsey Street, absence of front yards or gardens, window planters provide some greenery

The role of the front garden is ecologic, Ann is a survivor of domestic violence and when moving to her current house a front garden was a “must have”. It is a space through which she can have a sense of her own safe patch:

> You’ve got your own little bit of territory, that’s outdoors, that people have to come into your territory to even approach your front door. Yeah. That makes an *awful lot of difference*. Psychologically and health-wise. (Ann)

Figure 34: Cadwaladr Street, example of front gardens and street trees

The process related to green space and front gardens does not affect everyone equally and this is not just due to a binary of having a space or not. Gus has no front garden but has made efforts with window boxes to bring greenery to the whole street. Mabon identifies tenants in private rented accommodation who cannot garden without their rent being increased by their landlord. Ima lives in such a rented property, a house in multiple occupation, and the front yard area is used for storing refuse. Ima does not interpret this as her space but the landlord's and it has a negative impact on her health.

Front gardens are linked to a mechanism of creating greenery in the street. It is an ecologic process that can result in positive or negative impacts and these arguably can unequally vary across population groups.

Theme A green space; processual component: street trees: a love: hate relationship and varied impact on health practices

Where identified in the observations, street trees are greatly valued by residents. They can create problems too, both positive and negative aspects are identified. Several residents have a love: hate relationship with street trees.

For Ann, having street trees means Cadwaladr Street (see Figure 34 above) is a “slight cut above the rest with our little front garden areas and our trees”. There is a negative consequence of the trees for pavements however which possibly compounds Ann’s “hate” of walking and she notes the impact on other groups too:

> Well, it’s lovely living on a tree lined street, it’s beautiful, but the pavements are rubbish if you haven’t got very good balance. You know where the roots have pushed the asphalt up. So, you’re watching the old people and you can see them getting a bit wary, cause it’s like oh you’ve got a bit of a little slope to go up and down. But I wouldn’t wanna live without the trees, but I’m much safer on the road than I am on the pavement, balance-wise. (Ann)

Beth values a tree that marks the end of Dillwyn Street at a bus stop although this tree drops fruit that makes a mess. This combined with the general condition of that space makes her think of how it could be improved:

> …we’ve got a lovely tree at the bottom, it makes a hell of a mess with… they look like black cherries and they’re horrible. But it’s a lovely tree, you know is a tree and it’s great. I love trees and I wish we had just a bit more of nature in what is, it’s obviously very urban isn’t it but I think … there’s definitely potential cause we’ve got a dead end… it could be quite a pleasant place just at the end of a street… (Beth)

Beth links this in a way that reflects the need for a holistic street design, linking together the cul-de-sac layout, greenery, street tree, mess and maintenance, waste, bus stop, parking, and rubbish.

Figure 35: Dillwyn Street, street tree

Anthony has a love: hate relationship with one particular tree at Beddoe Street which is the widest street in the study with large mature trees. Anthony's aim in gardening is to create neatness, including his lawn, and the tree has a role to play in this.

> …there's a massive tree outside the house. I'm not sure what type of tree it is, but it does drop all its leaves on my lawn in the winter and destroys my lawn so [small laugh] I don't like it [small laugh]. ...it's a nice feature to have a tree don't get me wrong but the effect on my lawn is not good [small laugh]. … I'm quite happy to have the tree, but it just annoys me in the winter when the leaves come down so. But then it's my challenge then in the spring to get my lawn looking nice again, I quite like a challenge. (Anthony)

Figure 36: Beddoe Street has large street trees, pavements are wide with trees in them although people park cars on these pavements

Street trees are valued by residents but they can create challenges too. Some residents who identify street trees have a love: hate relationship with them.

Theme A green space; processual component: living near / opposite a park

Parks are found to play an important role in the street. In this research this means parks that are directly part of the street or form one side or end of the street, not nearby neighbourhood parks. Removal of park space can have a long-term negative impact. The benefits of parks in streets are noted for different population groups.

Six streets have parks on them or at one end of them such that they are an extension of the street environment. These are summarised in Table 14.

Table 14: Streets with a park

Street	Type of green space	River present	Relationship to street
Beddoe Street	Green space / river path.	River present	Part adjacent, one end.
Kinsey Street	Playing fields / open space.	No river	Part adjacent, one end.
Holman Street	Children's play park. Playing fields.	No river	Wholly within. Part adjacent, one end.
Legall Street	Green space / river path.	River present	Part adjacent, one end.
Tomos Street	One side of the road is a park adjacent river.	River present	Wholly within.
Hoggan Street	Community garden.	No river	Wholly within.

Holman Street and Simpson Street both have community gardens on them, these were not publicly accessible during fieldwork and therefore not assessed as being part of the street. In the literature parks are frequently considered a neighbourhood scale feature (for example, Saelens *et al.*, 2003) and yet it was found that some smaller parks were contained wholly within one street, in other cases only a small portion of the park was within the street.

Figure 37: Hoggan Street, community garden publicly accessible

Having a publicly accessible green space on the street is positive for several participants. Shiva moved to Cardiff from a large city in South Asia and the park contrasts positively with this, is “very important” and a “unique” feature.

Ima’s home faces a park across the road which is next to a river. It was one of the reasons she and her family chose to live on Tomos Street. The front garden at her house in multiple occupation is not an accessible green space (refer front garden component) so the park provides some accessible outdoor green space within the street.

Figure 38: Tomos Street, park forming one side of the street (river behind)

Having lived in different homes around Holman Street her whole life, Aisha remembers a second playground that was removed with a negative impact particularly for social and mental health.

> …the park I used to play in is now a car park. …I was just so shocked when we saw that and we were like, "that's our whole childhood, now it's cars there". [small laugh] I feel like I related more to cars than I can to a slide. [small laugh] …putting a car park there not realising that it was a social space for people, for my elderly neighbour, who is Yemeni, and all these other people, …and now there's cars there.
>
> [later]
>
> It's shocking, I've only started getting over that now. The conversations we were having when that was put in, we were actually quite traumatised about reliving our childhood and that was just taken away. (Aisha)

Aisha also notes the sports pitches adjacent to Holman Street as somewhere that public Eid prayers have previously been said though not during Covid-19. Sports equipment has been removed due to vandalism which has impacted negatively on healthy activities for boys who played there.

Figure 39: Holman Street, children's playground, note Covid-19 signage

Figure 40: Holman Street, former park and seating area now replaced with parking

At Holford Street Rebecca experienced the closure of a public park due to misuse by gangs. Even herself having been violently assaulted by adolescents in her street Rebecca still sees the positive potential of the park:

> I don't think they'll ever open it back up… Which is a shame really, because you've got generations of children missing out on there, that little bit of green space right on their doorstep. It is quite sad. (Rebecca)

Parks play a role in the street setting. Their removal to address short term problems can have a long-term negative impact. Parks affect population groups differently including: older adults, children, and people of different faiths. Parks are mainly thought of as a neighbourhood resource in academic literature, here they are found to also be a street scale health resource.

Summarising all the processual components under the theme – green space, planting, river, and trees, these have been described to include:

- Green space, and health benefits perceived of being in a greener area;
- Actions by the local authority, including changes that reduced green space. Complex thoughts of participants in relation to improvements like street planters;
- Front gardens and semi-private green space: an opportunity for agency in the street;
- Street trees: a love: hate relationship and varied impact on health practices; and,
- Living near / opposite a park in the street.

Theme B: street holistic design, layout, and dimensions

The processual components in this theme relate to aspects of the street such as dimensions and layout. These are quite detailed observations that a professional designer might make so it is notable that residents, who do not necessarily have formal education in this, highlight many of these features. In doing so they have a particular perspective and do not use technical terminology or taxonomy, nevertheless this knowledge is equally insightful and detailed. The analysis identified key components being:

- Dimensional width of streets and pavements, both wide and narrow;
- Dimensional length of streets, both long and short;
- Design for community feel and street as a living environment;
- Lanes and alleys that connect to the street;
- Streets being a main arterial route or a dead end / cul-de-sac.

Theme B street design; processual component: street width

Street width is important and matters for aspects such as sunlight and a sense of openness or enclosure. Street width seems simple yet can be complex, affected by factors like street clutter. It is a characteristic that residents perceive, and this perception does not always match the observable characteristics of the street. Width is a key practical constraint in making changes in the street. This mechanism can lead to differential impacts on different population groups.

Street width is noted by several participants and Gus identifies the benefits of a wider street in Kinsey Street:

> …it's a wider street so you get more sunlight in. …some of the other streets, especially you know towards town they get very narrow. (Gus)

Kinsey Street has the *narrowest* house-to-house width (15.12m) in the sample but Gus' perception is not related to the width of every street in the sample but rather his experience of Kinsey Street and relative to nearby streets. It is a complex perception relating to: the width of the street, the buildings that limit sunlight, and orientation towards North and therefore the path of the sun.

Street width, as previously identified, is the characteristic of Steer Street that Luanne observes as creating opportunities for installing planters. Luanne also has an interest in the history of her area and demonstrates knowledge of house types and street layouts including width.

Beth is particularly interested in the problems created by street clutter that she has heard about and thinks should be addressed, creating beneficial impact especially for parents and caregivers and people of limited mobility (see also Figure 41):

> …On our street, the roads aren't that wide, …there's quite a lot of, I think anyway, far too much street clutter with signs, poles and things, lampposts obviously, …I wish they could look to combine, have fewer posts and things in the way cause some people who have buggies or need less clutter to help them around.... (Beth)

Figure 41: Chamberlain Street, illustrative example of ‘street clutter’ including utilities and bollard that restrict the effective clear width of the pavement

For Mabon the width of Chamberlain Street is part of a cluster of street environment characteristics that create positive benefits:

> …I think the geography is good cause it’s quite wide and you’ve got front gardens, and you’ve got the speed bumps, and you’ve got the kind of factors that make it a nice place to live, I think that does make it a bit special to be honest with you. (Mabon)

For the first time visitor to Holford Street the narrowness of the public street width is striking, being 4.6m (carriageway and pavement width). All other streets in the sample are at least 9.0m wide. For Rebecca however it is the condition of the pavements not their width that means she does not use them.

Figure 42: Holford Street, narrow public street space

From observations and desktop data the public street width of Arfon Street is 59.6m although much of this is not accessible due to the planting. Abdi feels positive benefits of having this sense of openness:

> …I enjoy living here as well and I like going on walks and stuff cause there's a lot of open space at the front of the street, gives you that small refreshment rather than being in a compressed, confined street, so that, so there is the joys of that as well and just going for long walks like that. (Abdi)

Figure 43: Arfon Street, a wide street but planting renders this space mostly inaccessible, Abdi values the open aspect of the street

Abdi's perception is complex as he does not consider the whole width of the street as his street territory or part of his My Street definition. On this main thoroughfare in the city, a cycle lane and wide public footway are spaces where Abdi "wouldn't class that as the street". Arfon Street is not unique in the sample for being a main street but it is the only one designed more like a highway than a street.

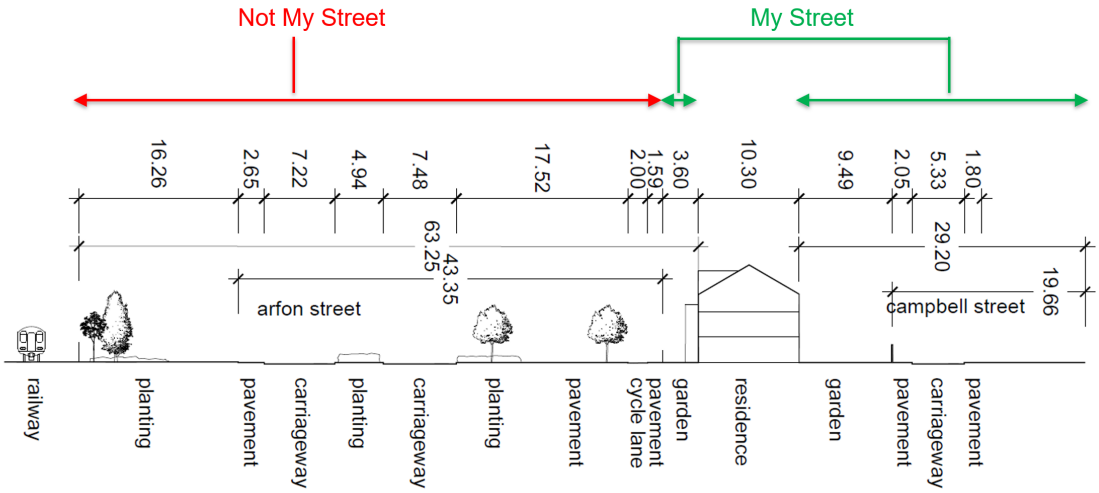


Figure 44: Arfon and Campbell Streets, street section, the vast majority of Arfon Street does not feel like Abdi's street as a resident: it's for other people

Figure 45: Arfon Street, photo showing cycle lane and pavement, only the narrow pavement furthest away feels to Abdi like it is part of My Street

Anthony hasn't thought a lot about his street before the research observation yet the first feature

Anthony notes is the street width. His description is an example of a participant not having the

terminology or taxonomy to describe the street environment: thus the researcher's role needed to balance not leading participants whilst aiming to going beyond basic descriptions.

Street width can be a complex concept. It is important and matters to residents who perceive it. Width is an important constraint in making changes in the street. The processual component of width can lead to differential impacts on different population groups.

Theme B street design; processual component: street length

Street length is an important characteristic for some participants and one that they can perceive. People on the same street can have divergent perceptions of street length. Along the length of a street there can be physical changes but also social and economic ones are observed too. Some of this is integrated historically in the original development of streets, for example, with houses increasing in size along their length and people in higher income roles like managers living in larger houses. Space along the length of the street is valued and this may have been especially so during Covid-19 for exercise and social distancing. The health impact of this processual component is like others in being indirectly along a pathway to health impact rather than directly on health.

Simpson Street is a very long street, "a record-breaking street length", notes Robyn. Luke and Robyn's My Street definitions do not intersect. These two people living on the same named street have separate definitions of My Street – effectively they live on different streets. Luke highlights the differences between the two ends of the street with the North end where he lives being, "horrible but tolerable" compared to the South end as, "minging and I wouldn't live down there". "Down" is where Robyn lives and she experiences these negative aspects too but of course has to live with them.

As well as the openness of Arfon Street's width, Abdi also values its length. The main thoroughfare pathways that are beyond his definition of My Street are nevertheless valued for going on longer walks. He also values the space for passing people without worry which may be an increased concern during Covid-19 due to social distancing practices.

Ashley Street is the shortest in the research such that Scott knows without thinking about it that there are twelve houses. This relates to Scott's view that this is the friendliest street he has ever

lived on with a high sense of neighbourliness. Scott's impression of My Street covers the frontage of the all the houses in the street. The length of street is also something that Scott is aware of relative to other streets nearby and Scott feels "possessive of" his street: notably different for example from how Luke feels about the southern part of Simpson Street.

Julia's perception of the street demonstrates a similarly complex and multi-faceted understanding of the street length. This includes not only the size of houses along the street but also the political opinions of residents which is something Julia is aware of through being an elected councillor.

> …it's a long street and …the houses start off quite small and they get progressively bigger. So the houses at the top of the street, I know this from door knocking [small laugh] as a councillor so I get to talk to lots of my neighbours, probably more than most people. …Just talking to people. So that would be UKIP voters lived and they're quite hostile to politics. (Julia)

Street length is an important characteristic for some participants and similarly complex to width. A long street can be positive such as for Abdi and this is interpreted in terms of comfort (rather than safety for him) and also an increased need for social distancing during Covid-19. Equally a short street for Scott plays a role in relation to the social wellbeing of the street. Long streets mean people along them may have different perceptions of them to the extent that they feel they live on different streets. Even where people's My Street spatially overlaps they can have heterogenous perceptions of their street. These perceptions can include social changes along the length of a street as well as physical differences. Health impacts are indirect and along a pathway.

Theme B street design; processual component: design for community feel and street as a living environment

The idea of the street environment being important as a holistic entity is obvious to professional designers. Observations evidence, somewhat unexpectedly, that this matters for some participants too. Their knowledge illuminates processual links to social environment and heath.

Samantha and Katrin both offer perspectives of the street environment as a whole supporting “community feel” and making the street “part of the living environment”. Of Hoggan Street, Samantha, in some detail, says:

> …the way in which it’s laid out it’s brilliant, there’s room for other things for example they’re building a park and they’re renovating the… community building as well... You know the fact that they’ve mixed all different houses together and properties so it’s not massive blocks of flats, it’s the small flats look like a home so they blend into the design so there’s not, “oh there’s flats”... I think this design works so well and looks so lovely and can cater to a number of different types of people, like different age and background. And it helps then to interact with others, so if you’ve got say a block of five of those flats together you know where there’s like five ground floor, and there’s five above and they’re all terraced, and then you have houses next to those with a bit of a space and then opposite as well. You mix … people together and if they want to interact to each other… which helps with that community aspect. …the design is well thought out and planned out in regards to what properties they would put where and to keep that community feel… (Samantha)

Figure 46: Hoggan Street, for Samantha this has sense of community feel which she values, related to both housing mix and building aesthetics

Samantha integrates numerous street environment characteristics: layout; not building on all available space; community facilities; housing types; mixing of different house types; visual integration housing types; and being visually appealing. Crucially it is the integration of these that matters. Jessica also links housing types at Hoggan Street to a mix of people living there. The specification of house types is a purposeful design decision and an example of how closely street physical and street social environment are linked. Samantha demonstrates detailed knowledge about street physical environment characteristics; how they interact; and the processual linkages between physical and the social environments.

Katrin's perception of Phillipa Street links holistic street environment to health:

> …in relation to health and wellbeing, it would be really good to think of something else with regards to parking situation …nobody here has very big front gardens or drives so to do something there where you can allow people to have electric cars, electric charge points on the street, something like that.

> Something that doesn't annoy the car drivers to the extent where they park in the non-parking spots because they are pissed off that they can't find anywhere else. But where the car gets a little bit more incorporated into the landscape…, I'm not sure to what extent you would be successful trying to get rid of it but trying to shift the ways in which the car relates to the street in other ways. …there must some creative solution about that, where you maybe can turn parts of the street into proper playing fields. You know if the kid, if the boy sees it as a football field why not paint a football field on the street, that would add to my wellbeing. And the football field painted on the street might be more useful than double yellow lines for cars not to park there because they can see that… it's also there for other use. So those little bit more creative thinking about how to make the street part of the living environment rather than just a thoroughfare. (Katrin)

Katrin's analysis addresses existing challenges and opportunities whilst balancing what might be practical. Consistent with Samantha, whilst individual street physical environment characteristics are described, it is the bringing together of these to make the street "part of the living environment" that is important.

Further evidence of such understanding includes Luanne at Steer Street who notes house types, the presence of lanes behind streets, and the impact of this on overall layout. At Dillwyn Street, Beth can relate the street physical environment today to the original development patterns a century before, and at Philippa Street, Paul assesses the street as like others in the area, being terraced, demonstrating his knowledge about street layouts and what makes the street similar or different to others.

Holistic street environment is not just a concern for professional designers, residents identify this as important for health too. Whilst using different terminology, Katrin and Samantha demonstrate knowledge and understanding of the issues that is equally detailed and integrated as that of a professional designer. Observations with residents inform an increased understanding of the links to social environment and heath through creating a "community feel" and making the street "part of the living environment".

Theme B street design; processual component: Lanes / gated lanes / recesses in streets / overgrown hedges

Alleys are a street physical environment characteristic on most streets in the research. They can provide or restrict access, affect visibility impacting on anxiety, and contribute to or detract from quality of place as well as health risks from fly-tipping.

Alleys include: alleys, alleyways, gully-ways, accesses, and lanes both with and without gates to restrict access. Street alleys are present in varying forms across streets of different eras. Rebecca remembers at her mum's house, "the coal man would deliver to the back" indicating both a spatial and socio-spatial hierarchy. Table 15 summarises alleys by street.

Table 15: Alley status by participant and street

Alley (within 400m of participant home)	**Street**	**Street Era**
No	Simpson Street – Robyn	1880-1918
No	Simpson Street – Luke	1880-1918
No	Nia Street	1880-1918
No	Campbell Street	2000-2010
No, behind*	Hester Street	1880-1918
No, behind*	Cadwaladr Street	1880-1918
No, behind*	Steer Street	1880-1918
Yes, gated (open on visit)	Tomos Street	1880-1918
Yes, a pedestrian square	Holman Street	1970s
Yes, between large apartment blocks	Arfon Street	2000-2010
Yes, gated	Philippa Street	1880-1918
Yes, gated	Philippa Street	1880-1918
Yes, alleys gated; workshop access ungated	Dillwyn Street	1880-1918
Yes, gated	Ashley Street	1918-1945
Yes, gated (open on visit)	Kinsey Street	1880-1918
Yes, gated (some open on visit)	Chamberlain Street	1880-1918 (participant part) 1930-1950 (other part)
Yes, path closed	Legall Street	1945-1960
Yes, path closed	Hoggan Street	2000-2010
Yes, path closed	Holford Street	1918-1945
Yes, path closed	Hoggan Street	2000-2010
Yes, path closed	Beddoe Street	1945-1960

* No, behind: meaning there is an alley present but it is parallel to street and does not intersect with the street at any point within 400m of the participant's home. Usually this is because the alley intersects with a street running perpendicular to the participant's street.

Figure 47: Ashley Street, example of gated alley with signage noting legal restrictions on public use of space

Figure 48: Beddoe Street, example of closed path

Samantha reflects on the memory of when the alley at Hoggan Street was open and the impact closure has for school children and their parents:

> …years ago there actually was an access through the bottom of our [street] like a little gully-way in which you could access the road behind us and it was great for the people who's got children in the same school as my children… now it's just the one way into the [street] and one way out unfortunately. (Samantha)

> I think it would be brilliant if they made a pedestrian path … for pedestrians and for our schools… it would be… beneficial. …it's an ongoing issue for access for people that don't drive. (Samantha)

It is notable that this issue at this location is not identified on statutory active travel maps produced by the local authority for residents to comment: Samantha's knowledge is not represented within such plans.

Beth also identifies alleys as a street environment characteristic, she proposes how they could be improved based on other examples, and highlights negative impacts related to waste and fly tipping. Dilwyn Street's alley gates are recessed from the pavement and for Beth this has a negative effect on her mental health:

> …the lanes are set back a little bit, they are gated but sometimes the gates are open and even if they're not there's a recess really so you can't see and people do linger there. …they definitely drug deal, they just go down the lane and they're quite blatant about it…
>
> …the neighbour's house who lives just before the lane, the front garden's massively overgrown and there's a big tree, that blocks your view… it frightened me once cause you're walking down and it was dark and somebody just emerged from the darkness.
>
> …I am though quite jumpy… I think I've just become more nervous generally. …I think I've got underlying anxiety sometimes which is not all [small laugh] their fault I think it's just me if you know what I mean. (Beth)

Figure 49: Dillwyn Street, gated alley with recessed gates where Beth identifies drug dealing happens

Figure 50: Kinsey Street, some gated alleys were not closed during observations

Beth acknowledges other influences on her anxiety including accompanying her elderly mother and social media. She also blames herself for this, “I think it’s just me”, not others such as the local authority; people dealing drugs; or her neighbour. Elsewhere Beth describes modifying her health practices in the street due to anxiety and alleys are one part of the street environment that impact this. Self-blame regret (Kraines, Krug and Wells, 2017) is linked in literature to health outcomes including mental health ones, also being modified by the Covid-19 pandemic (Belen, 2021). Part of this processual component, which would warrant more research, is the chain of existing anxiety being influenced by street physical environment characteristics such as alleys which then causes people to modify their health practices with potential for negative health impact such as less walking. The actions of other actors including the local authority should also be assessed for their health impacts. Self-blame regret is also manifest later for participants seeking to overcome physical health challenges in mobility (see also Chapter 4.3, Getting from A to B in the street).

Alleys are a street environment characteristic on most streets in the research. They can provide or restrict access, affect visibility, and contribute to or detract from quality of place. One participant expressed self-blame related to anxiety which may be an important mechanism to investigate further in future.

Theme B street design; processual component: arterial road / cul-de-sac

This processual component relates to the state of a street being either on an arterial road, or a cul-de-sac or dead end. These may be viewed as states where traffic and people passing through is either blocked, or in contrast a key function of the street. Both were found to have implications for the street culture and norms for strangers, including a researcher, to be there or not.

Cul-de-sacs include streets such as Philippa Street with a filter meaning traffic cannot pass but pedestrians and cycles can. Katrin reflects on street activities noting that street play has diminished over time partly due to Covid-19 and partly due to a cohort of children on the street growing older.

> So for [daughter] she would play with the neighbours, with some kids from higher up the street, they would play on the street, they would play in the front garden, in our front garden, in their front garden, on the pavements. [Daughter] learned how to cycle on that street so we, cause it's a dead end there is no through traffic so it's relatively easy to make sure you are safe enough to do things on the actual street rather than the pavement. …the street is quite a communal space.... But that I think is mainly due to being a dead end, and the kids very much used that for play. (Katrin)

Luke notes that due to location of Simpson Street within the city and the layout of the road network it would be a busy shortcut if there was no filter. He notes the positive aspects of reduced traffic but also negative aspects of fly tipping at the filter, this is something in common with Philippa Street.

Figure 51: Simpson Street North, example of closed road to much busier road beyond, street tree with planter, and identified location of fly tipping by Luke

Figure 52: Philippa Street, dead end with recent new modal filter for walking and cycling, new bench, identified as location of fly tipping

Holford Street is a cul-de-sac and Rebecca knows many of her neighbours well. She knows who they are and what their jobs are including a care worker, a taxi driver, and a florist. As a cul-de-sac it is quite busy. It also has a "mirror image" street opposite yet Rebecca has virtually no connection at all with that half of the street, so much so that one occasion fifteen years previously is memorable:

> The other side I'd feel like an imposter. I think I've only ever been down there once actually and that was when I had a birthday card delivered to my house that I couldn't understand and it wasn't for me at all. But there was money inside there. …I can remember writing to the Echo [newspaper] because they sent another Christmas card then with more money in it… and they put a post back in the Echo, saying "oh thank you so much, go and buy yourself some chocolates for being so honest." [laughing]

From street observations the sense of being an imposter in the street is something that was identified in field notes, particularly at Holford Street and Hoggan Street. This contrasts with streets on a busy route. Steer Street is "impersonal" for Luanne and this busy traffic impacts on health practices:

> … it can seem a bit impersonal, relatively speaking of course… some roads I walk past and there'd be groups out in the street exercising [laughs]. That was something we never had in Steer because that road is a major cut through for traffic… (Luanne)

Figure 53: Steer Street, amount of traffic changes Luanne's perception of street

For Abdi the busy street is a notable feature of Arfon Street which has two lanes of traffic in each direction but this contrasts with Campbell Street to the rear of his house which is a cul-de-sac.

> …the uniqueness of our street would be that, that balance of the main road… and then it being then like smaller into a smaller street, prior to this conversation I wouldn't have thought of it like that but yeah it is two different sides of the street... (Abdi)

This processual component relates to arterial roads and cul-de-sacs. These physical environment characteristics were found to have implications for the street culture and norms and to impact on health practices in the street.

In summary, the theme of street holistic design, layout, and dimensions was found to combine processual components of:

- Dimensional width of streets and pavements, both wide and narrow;
- Dimensional length of streets, both long and short;
- Design for community feel and street as a living environment;
- Lanes and alleys that connect to the street;
- Streets being a main arterial route or a dead end / cul-de-sac.

Theme C: sounds from street, pleasant or noise, incl. speed bumps, quiet

This theme relates to one particular human sense, that of hearing, and includes sounds or noises that can be positive or negative. This theme was one of three identified by the majority of participants however proportionately more men than women in the sample related to this theme. The analysis identified key processual components being:

- Less background noise and more birdsong heard during lockdown;
- Sounds of health practices in the street;
- Valuing quietness / living with noise.

Theme C sounds; processual component: less background noise and more birdsong heard during lockdown

This component was strongly influenced by the context of Covid-19 lockdowns, a resultant reduction of background noise, and participants hearing more birdsong. Birdsong seems a particularly potent connection for some people. Sound provides an example of how the threshold between house and street can be blurred.

Birdsong was highlighted as important by several participants in the context of observations during Covid-19 lockdowns. Paul and Luke's observations were during the last week of the first national (Wales) lockdown where it was a legal requirement for participants to stay in their homes except for exercise once per day; only essential shops were open; it was school termtime and children were learning from home: Paul, Luke, and Gus have their children living at home.

> …the whole thing in lockdown at the moment is about the increased – whether it's increased or not or whether we're more aware of it – the

> background noise is diminished, so we hear a lot of birds' song, we see a lot of birds. (Paul)

> …at the moment the street is pretty quiet really both – cars are non-existent, as in moving cars; there's one or two people wandering back and fore… but really two or three times a day now I just wander out by the gate, perhaps open the gate, step onto the pavement, have a look up and down the street. Yeah, it's all very sort of tranquil [laughing] although saying that if there's an odd shout out on the street, which obviously is so quiet at the moment beyond the bird sing, any slight noise you can… hear... (Paul)

These are aspects that Paul relates quite directly to his health. The sounds of birds in the street are something Luke listens to but does so from the bay window in his front room inside his house: the acoustic environment of the street extends into and overlaps with his home.

> The birds hey, that's something I like to do, have the windows open in the evening and listen to the bird song. Because over lockdown now, and do you know what it's bloody less now cause everyone's out in their cars again, but for a little bit, a little window there was a lot of bird song in the street. Just listening to that was really enjoyable and very meaningful to me. (Luke)

> In my lounge, I can have my windows open here in, the bay windows in the lounge. And I can hear it obviously through there. (Luke)

> The presence of birdsong in the street is not unique to Covid-19 lockdowns however and Gus identifies how contributing to a voluntary street greening project in his area has increased birdsong over several years which has positive health impact for him.

> …it's not like I've been counting birds or anything but I think the song choruses in the morning have definitely been louder the last two years…

> And the sound is lovely, when hearing all the birds it's really nice in the morning. (Gus)

The processual component identified here relates to a reduction in background noise from traffic during Covid-19 lockdowns and a consequent increase in ability to hear sounds, specifically bird song. Sound provides an example of how the threshold between house and street can be blurred.

Theme C sounds; processual components: sounds of health practices in the street

This processual component focuses on sounds from health practices in the street. It relates to the health practices of others and therefore to the social environment. Impacts from this can be positive or negative. Sound is a clear example of how health practices modify the street environment – they can make sound. Sound is identified as a characteristic that blurs boundaries including to the larger scales of neighbourhood and city.

Other people's health practices form an important part of Katrin's street physical environment, the sonic environment. When Katrin hears those sounds it changes her own health practices and they are an example of what can be described as a liminal sonic boundary between home and street.

> It's always really busy on a Friday because there is a mosque round the corner so it gets very busy and you can hear the prayers and all the kids, …they actually do this on a daily basis, …there's an after school mosque club / school for children, so they all go there, so at six o clock when they come back out the street is really busy for about twenty minutes because they all come from mosque, they're all excited, they want to run up, they want to jump up and down, there's a lot of energy going so once a day apart from weekends, Monday to Friday, the street turns into a real bustling, child running and screaming and laughing place which is nice.
>
> …when I hear the kids come back it's the end of my working day.
>
> …that is actually better than a clock sometimes… when we first moved here [my daughter] had to go to bed a whole lot earlier, …it was quite difficult to

> convince [my daughter] that it was really bedtime when she could hear quite a few kids having a great time out there playing. (Katrin)

Sound can be associated with negative health practices (the reader is reminded that health practices include ones that may have positive or negative health impacts). Sound sometimes alerts people to potential danger. Robyn notes an incident with "aggressive sounding men", Rania notes how "…there'll be anything from raised voices, and shouting, to people being abusive, to outright violence…" These sounds are generated directly from violence or disorder but sound can also be indirect, Julia notes the sound of the police helicopter in response to violence.

> Last week the police helicopter was here, and the armed response were here because there was an incident two doors down where there're flats. That was eleven o' clock at night, nobody was going to sleep with the helicopter buzzing overhead and armed police outside. (Julia)

Noise generating events and activities that happen elsewhere in the city such as large concerts appear to be beyond the street environment and part of that larger environmental scale. For Abdi however these larger events come right through his street in the form of a half-marathon that has an impact on Abdi:

> …there's Cardiff half-marathons and a lot of on Sundays at least three, four times a year it is closed off for half-marathons, 10k runs and stuff like that.
>
> …It wakes me up on a Sunday morning [small laugh] so it's a good alarm. I can hear a lot of footsteps and people running and then people cheering them on. (Abdi)

This component is about sounds from health practices in the street. It relates closely to the social environment. Sound provides an example of how health practices modify the street environment and sound is identified again as blurring the boundaries between different scales of home, street, and city. It is plausible that other street physical environment characteristics operate similarly but were not observed such as smell and air which can physically cross the boundary of scale. It is not just 'intangible' characteristics however that impact across scales, a

lack of bike storage in the street for Ima has a consequential impact on cramped storage in the communal stairwell. The findings related to sounds emphasise that the street scale is not a hard boundary but rather permeable and linked to other scales.

Theme C sounds; processual component: valuing quietness / living with noise

This final component is different in that it highlights the importance placed on sound and it being at the right level. This varies depending on individual perception or attitude and such differences have the potential to create individual stress and conflict. Beyond individual variation negative noise on the street can also have a significant negative impact on the health of many people on the street. It is hard to get away from noise in the street because it often comes into the home. Sounds link closely to certain health practices and are modified by the street environment. Sound can also have latent meanings. Sound impacts across the lifecourse: both in seasonal temporal changes and through memory across life stages.

For Anthony quietness is a positive aspect which is understood in relation to his broader outlook when asked about street parties or events:

> "…one of the corners for VE day they had flags, bunting up, nothing really on our street. Which kind of suits me. Because I like to know the neighbours and have a little chat and friendly but I'm not the sort of person who would be in my neighbours' house all the time and I like that balance of friendliness but you live your own life as well." (Anthony)

Figure 54: Beddoe Street, bunting from a street party at street corner

So the quietness and calmness in Beddoe Street are characteristics that Anthony values and relates to the pleasantness of the street for him. When Mabon was choosing a street to live in having moved five years ago noise at night was a consideration:

> One of the things we were worried about, were there gonna be all night parties on a Friday and Saturday night and I think we've only had two since we've been here and... people tell me I was young once, I don't really remember it, but I must have done the same thing myself. [laughing] So we can live with that no problem at all. (Mabon)

Ann goes out of her way to keep good relations with and between neighbours – intervening in disagreements over waste bins for example. She views a certain level and type of noise as part of everyday streetlife.

> …if you're going to live in a residential street where there are families, teenagers will play music, that's my attitude. (Ann)

In contrast at Simpson Street noise exceeds many people's limit, impacting at a street population level. Noise has negative health impacts linked to health practices by others that impact on the street physical environment. Robyn has experienced violence in the street and for her "noise on our street, and loud things is a whole massive conversation" with neighbours. She notes the "k-chink" of people driving vehicles fast over speed bumps which Robyn identifies as the "normal noise" outside – and notably not the adjacent mainline trainline. This is in contrast to speed bumps which Mabon previously highlights as positive aspect of Chamberlain Street (previous theme). Robyn notes the particular layout of the speed bumps which causes noise and this emphasises the need for careful design of such interventions and to minimise negative impacts. Robyn also notes practices around rubbish bins and how this has changed during the pandemic.

> …used to be we'd regularly get woken up on bin day because the seagulls regularly early in the morning as soon as, you'd be like, "oh it's bin day tomorrow, oh get ready to be woken up at the crack of dawn", because seagulls are pulling people's bins apart… that doesn't seem to have happened so much during lockdown… (Robyn)

Figure 55: Kinsey Street, speed bump with markings where vehicles have hit / scraped the ground generating noise

The intensity of negative health impact from sound seems greater than other pathways. This may be due to sound transcending the boundary between street and home: the ability for Robyn to avoid or mitigate exposure to these sounds is restricted.

Awareness of noise and limiting it is something Samantha is conscious of. She regularly provides activities at her house for children from her street. Sound from these activities is something she actively considers to not create noise for others, specifically she notes as other people might respond differently to the same noise. She views this as reflecting something more latent about her own character:

> …so it's sometimes just giving other people a break and being more aware of your neighbours, even if they aren't the same to you as such, I just feel as long as you carry that respect and those values yourself then that [speaks for] you as a person. (Samantha)

Rebecca notes another latent interpretation in the temporal seasonality of the sound of the ice cream van and also how sound links to the memory of her son's childhood.

> …we've got an insane ice cream van man that comes round all the time and plays Popeye the Sailor Man and does my head in! He's always around.
>
> …when my son was little, he'd be like, "mum please get me an ice cream!". Now I'm lucky if he comes out of his bedroom [small laugh]. (Rebecca)

Figure 56: Philippa Street, ice cream vans will typically play loud tunes based on nursery rhymes to attract customers

This final component highlights the importance placed on sound and it being at the right level but also how this varies depending on individual perception or attitude. Beyond a certain level noise can impact negatively at a street population level. Many sounds link to health practices that then modify the street physical environment. Sound can also have latent meaning and impact across time too.

4.2.3 Conclusion

Findings for street physical environment characteristics in this chapter section have been presented at three levels of analysis:

- Analysis 1 – thematic coding
- Analysis 2 – seeking patterns
- Analysis 3 – detailing processes within selected themes

Whilst the findings have necessarily been presented at a granular and disaggregated level, at their simplest they are an extended set of street physical environment characteristics to be considered when addressing health in the street setting. They address the research question:

- Which characteristics of the residential street built and natural environment support, inhibit, or otherwise influence these health-related practices?

A list of code labels has been presented (n=61) containing street physical environment characteristics that matter for health at the street scale. Many of these are heterogenous and stand alone. Others are grouped through second level analysis into themes (n=11) that represent a thematic understanding of what matters for participants and for health.

Three of these themes, identified by the majority of participants in the sample were analysed for their processual components, a micro-scale of causal linkages and pathways. These findings demonstrate a complex, ecologic web connecting street physical environment characteristics, health practices, and health and wellbeing. The level of complexity is manifest: something as seemingly simple as street width has been demonstrated to be a compound and complex component.

These findings address population health to the extent possible within the methodology. This is mainly through identifying patterns in the data as well as processual components that are justifiably plausible within a wider population. Population health is also addressed through the identification of definable population groups within the findings who may experience unequal health impacts. These include: gender differences; people without front gardens or private

outdoor space; private rented tenants; older adults; children; people of different faiths; people with limited mobility and balance when walking; and survivors of domestic violence.

These findings centre residents' experiences and knowledge. This knowledge about the street environment is a relatively untapped resource of community-based, street-based knowledge. The findings show that, for example, if street physical environment interventions do not engage with residents then they might be less well understood and accepted. It also shows how the potential for citizen-led change in the street environment is sometimes impeded through simply a lack of express permission to make changes that could consequently have a positive health impact. Finally, resident's perception affects their definition of their street territory – My Street – this differs from the definition of the street on a map or by the street name. My Street space is important to consider as the focal point for health practices.

This chapter section has presented findings related to the street physical environment. The next chapter section addresses the street social practices through the lens of health practices. Together, these two parts in this research – physical and social – make up the street environment.

4.3 Street social environment – health practices

4.3.1 Introduction

This chapter section presents residents' health practices in the residential street, the main phenomenon of interest in this research. This is a composite definition comprising three strands: everyday practices, health practices, and urban practices and linked to broader literature on practice theory (see Chapter 3.1).

Health practices in this research are those everyday practices that have an impact on health. Health (see Chapter 1.0) is defined broadly and holistically. The impacts can be positive or negative and it is not presumed that participants do the practice primarily for reasons of health.

Following the same format as the previous chapter section, findings for health practices are presented at three levels of analysis:

- Analysis 1 – thematic coding
- Analysis 2 – seeking patterns
- Analysis 3 – detailing processes within themes

Figure 57 summarises the findings at each stage and the six themes identified. Four themes are identified as 'big latent themes' and two themes as 'semantic causes and consequences'. Theme 4, the streetlives of children, parents, and adults, is important but as no children were included in the sample it can only be a partial understanding, for this reason and practical space limitations it is presented in shortened format. The other five themes are detailed in full at the three levels of analysis.

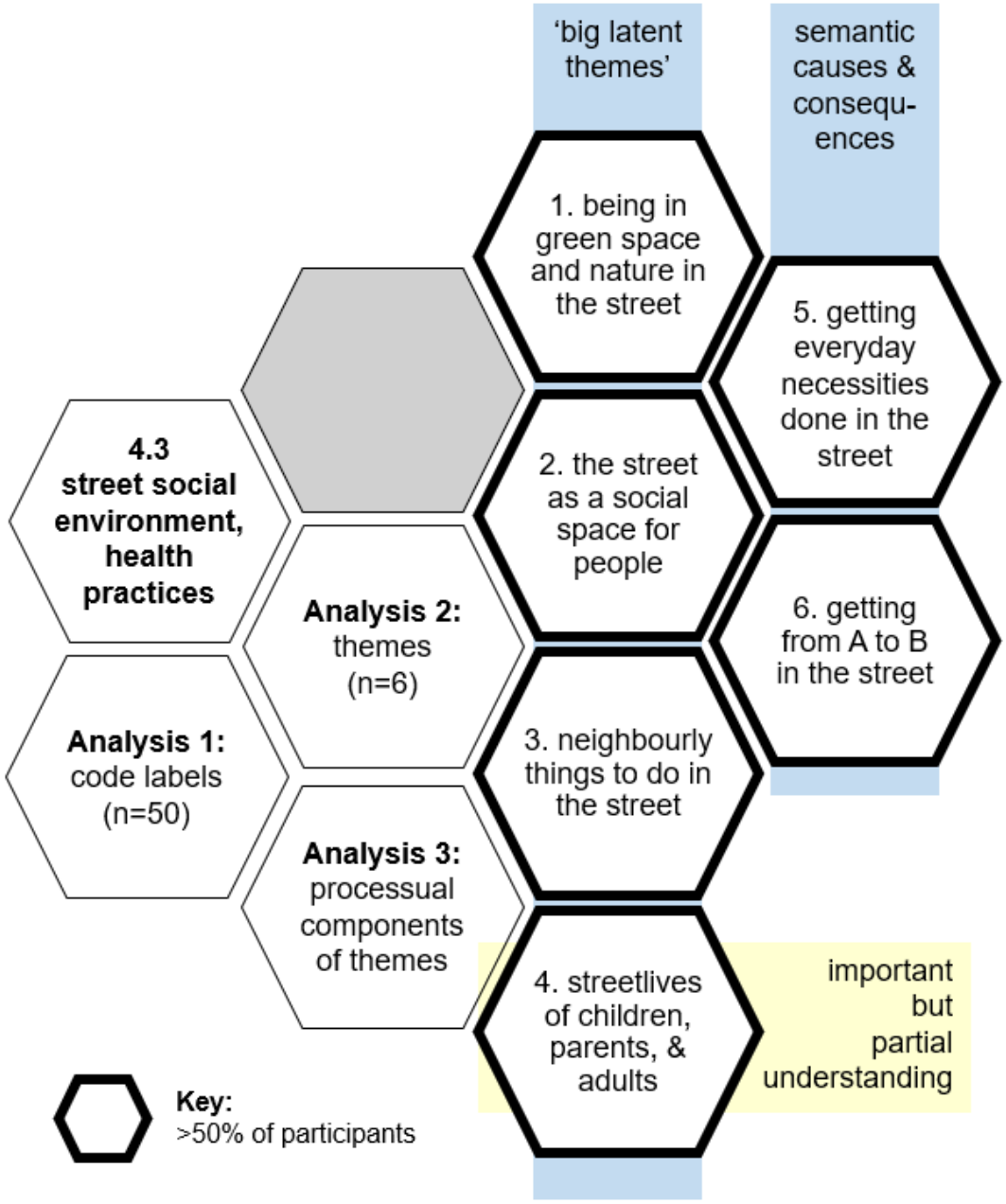


Figure 57: Overview of analysis stages and themes, street social environment, health practices

4.3.2 Findings and discussion

Analysis 1 – thematic coding

Following a structured and rigorous method code labels related to health practices were identified. Table 16 presents code labels (n=50) identified at this Analysis 1 level grouped by

themes (n=6) that were identified at Analysis 2. Code labels are developed from participant language and descriptions.

This list responds to the research questions:

- What are residents' everyday practices in the residential street environment?
- Do these practices relate to residents' health and if so, how?

Table 16 includes counts and proportions of participants identifying codes and themes, this is presented overall and by gender. The counting of data does not imply a "logic of inference" (Maxwell, 2010, p. 477) but is rather one form of pattern identification. What makes a health practice important in this research is not just the proportion of participants identifying it but also factors like the intensity of impact, for example experiences of violence in the street are few (n=6) but intensely felt by participants.

An important conceptual finding to report at the outset is that it is not just participant health practices that are important for health but those of other people too. The health practices done by one person or group become part of the street social environment for other people including those who are not doing the practice but are experiencing the impact of them. Health practices therefore are found to be important both directly to people doing them and separately as part of the street social environment.

Population groups considered in Analysis 1 and 2 are whole population (the whole sample), women, and men. The heterogenous ethnic identities of participants limits cross-sectional pattern finding within Analysis 1 and 2. Ethnic identity is presented as an ecologic dimension within Analysis 3.

Table 16: Health practice codes, ordered by number of participants stating this practice

Health Practice (grouped by themes) (S_ prefix denotes health practice codes) SP: Practice by Participants only SO: Practice by Others only SX: Practice by Participants and Others	By whom	Main direction of Health Impact	Women, count, n=13	Men, count, n=7	Total, count, n=20	Women %, ≥50% highlighted	Men %, ≥50% highlighted	Total %, ≥50% highlighted	% Difference women-men, +/- ≥25% highlighted
Theme 1 Being in green space and nature in the street			13	7	20	100%	100%	100%	0%
SP_Going to park or green space, or river, allotment, Cardiff Bay, doing outdoorsy things	Participant only	Positive	8	4	12	62%	57%	60%	4%
SP_Looking at or appreciating nice front gardens or window cills	Participant only	Positive	4	0	4	31%	0%	20%	31%

SX_Dog walking (1,2)	Both participants + others	Negative	3	0	3	23%	0%	15%	23%
SX_Growing, plants, in own front garden, maintaining, or other people doing, Growing Street Talk	Both participants + others	Varies	9	5	14	69%	71%	70%	-2%
SX_Nature, birds, watching, feeding; negative impact on, look at moon, appreciate the environment, seagulls	Both participants + others	Varies	2	5	7	15%	71%	35%	-56%
Theme 2 The street as a social space for people			13	7	20	100%	100%	100%	0%
SP_Going to community centre, community allotment, theatre, festival, volunteer teaching, volunteer food kitchen, library	Participant only	Positive	8	1	9	62%	14%	45%	47%
SP_Travelling further afield, beyond city, gateway to Wales	Participant only	Positive	4	2	6	31%	29%	30%	2%
SP_Visiting friends, family, grandchild	Participant only	Positive	6	3	9	46%	43%	45%	3%
SO_Social glue, certain people, women	Others only	Positive	0	1	1	0%	14%	5%	-14%
SO_Youth, teenager activities, play, playing music	Others only	Negative	7	1	8	54%	14%	40%	40%

SP_Observing, people watching, an awareness of what's going on, awareness of other people passing through, watching boats on river	Participant only	Positive	6	1	7	46%	14%	35%	32%
SP_Social or leisure, going out for, food, meet friends, or on own, cultural stuff, leisure walk, choir, watch rugby	Participant only	Positive	7	3	10	54%	43%	50%	11%
SX_Chat to people, including a socially distanced hello, greeting people, hiya byt, civility in street	Both participants + others	Positive	12	5	17	92%	71%	85%	21%
SX_Hanging out in street, front gardens, with or without other people, drinking tea, socialising, going into neighbours' houses, have a fire, street bingo, read book	Both participants + others	Positive	9	4	13	69%	57%	65%	12%
SP_Birth of a child, practices associated, introducing, care, family, midwife visit home	Participant only	Positive	0	1	1	0%	14%	5%	-14%
SX_Celebrations, birthday, wedding, festivals, VE day, street party, Halloween	Both participants + others	Positive	7	5	12	54%	71%	60%	-18%

SX_Faith and religion related, Muslim, Christian, incl. Islamic school, going to church, Diwali	Both participants + others	Positive	7	2	9	54%	29%	45%	25%
SX_Litter picking, organised, or by self, sweeping, cleaning, weeding (1)	Both participants + others	Positive	6	3	9	46%	43%	45%	3%
SX_Violence, incl. threatened, experienced or seen, verbal abuse, domestic argument, intervening in a situation, drunkenness (1)	Both participants + others	Negative	4	2	6	31%	29%	30%	2%
Theme 3 Neighbourly things to do in the street			12	7	19	92%	100%	95%	-8%
SP_Political canvassing, registering voters	Participant only	Positive	1	0	1	8%	0%	5%	8%
SP_Posters, signs, political messages, putting up in windows, cycling related, supporting NHS	Participant only	Positive	2	0	2	15%	0%	10%	15%
SO_Drug dealing and use and factory and litter and alcohol	Others only	Negative	9	5	14	69%	71%	70%	-2%
SO_Fly tipping, by others, burning rubbish, arson, littering, dog waste	Others only	Negative	4	3	7	31%	43%	35%	-12%

SP_Deliveries, receiving, taking for a neighbour, chatting to the postman, food delivery	Participant only	Positive	3	4	7	23%	57%	35%	-34%
SP_Making a community space or activity, hub, garden, choir, using disused space	Participant only	Positive	7	0	7	54%	0%	35%	54%
SP_Neighbours, knowing well – getting on with, relationship with, close by and specific rather than people generally	Participant only	Positive	12	5	17	92%	71%	85%	21%
SP_Planters, gardening, and street planters, as a communal activity	Participant only	Positive	5	4	9	38%	57%	45%	-19%
SP_Work to maintain, repair, keep in good order front of house visible from street	Participant only	Varies	1	1	2	8%	14%	10%	-7%
SP_Work, employment, specifically related to or happening in the street, councillor, running a business with visitors from home	Participant only	Positive	3	1	4	23%	14%	20%	9%

SX_Bins and Recycling, generally, charity bag, people doing them wrong, interactions with bin men, waste piled in front gardens	Both participants + others	Varies	7	7	14	54%	100%	70%	-46%
SX_Helping neighbours, fix electrics, fix things, find dog, reverse car out of drive, pump up car tyres, first aid, shelter in house; receiving help from others	Both participants + others	Positive	5	2	7	38%	29%	35%	10%
SX_Litter picking, organised, or by self, sweeping, cleaning, weeding (1)	Both participants + others	Positive	6	3	9	46%	43%	45%	3%
SX_Mutual aid, during Covid, receiving and giving support, street WhatsApp or chat	Both participants + others	Positive	4	2	6	31%	29%	30%	2%
SX_Petition, or getting people to sign up or campaign, create Neighbourhood Watch	Both participants + others	Positive	1	1	2	8%	14%	10%	-7%
SX_Sharing and swapping things with neighbours, leaving things out to give away, electricity money	Both participants + others	Positive	4	0	4	31%	0%	20%	31%

SX_Violence, incl. threatened, experienced or seen, verbal abuse, domestic argument, intervening in a situation, drunkenness (1)	Both participants + others	Negative	4	2	6	31%	29%	30%	2%
Theme 4 The streetlives of children, parents, and adults			11	5	16	85%	71%	80%	13%
SX_Children playing, children's activities, adults playing with children, childcare	Both participants + others	Positive	11	4	15	85%	57%	75%	27%
SX_School, doing the school run, own or other children, nursery	Both participants + others	Varies	5	4	9	38%	57%	45%	-19%
Theme 5 Getting everyday necessities done in the street			12	7	19	92%	100%	95%	-8%
SP_Food, sharing – receiving, communal activity, growing, chickens, street food bank	Participant only	Positive	6	0	6	46%	0%	30%	46%
SP_Supermarket, going to, avoiding	Participant only	Varies	10	5	15	77%	71%	75%	5%
SP_Local Shops, going to, interactions with local businesses, getting take away food, zero waste food	Participant only	Positive	10	6	16	77%	86%	80%	-9%

pickup, haircut, GP, pharmacy, cash machine, halal shopping, ice cream van, chip shop									
SP_Shopping, non-food outside local area, city centre, other city	Participant only	Positive	2	1	3	15%	14%	15%	1%
SP_Blocking out the street, music, tunnel vision, walking fast, desensitising self from street	Participant only	Positive	0	1	1	0%	14%	5%	-14%
SX_Don't do much, don't do anything in street, as initial thought, or anytime in discussion, reflections on how much is done in street	Both participants + others	0	5	4	9	38%	57%	45%	-19%
SX_Work, going to, incl. working from home, being made redundant, going to training course, student studies, travel for work	Both participants + others	Varies	10	5	15	77%	71%	75%	5%
SP_Exercise, going out for, doing exercise, running club	Participant only	Positive	2	3	5	15%	43%	25%	-27%
SX_Dog walking (1,2)	Both participants + others	Positive	3	0	3	23%	0%	15%	23%

Theme 6 Getting from A to B in the street			13	7	20	100%	100%	100%	0%
SO_Other vehicles, horse and cart, e-scooter, off road motorbikes, scooties	Others only	Varies	2	0	2	15%	0%	10%	15%
SX_Dog walking (1,2)	Both participants + others	Negative	3	0	3	23%	0%	15%	23%
SZ_Bus, catching, travelling by	Both participants + others	Positive	8	1	9	62%	14%	45%	47%
SZ_Cycling, for any reason, cycling related, learning to ride, bike storage, bike hire	Both participants + others	Varies	11	5	16	85%	71%	80%	13%
SZ_Driving, any reason	Both participants + others	Varies	11	6	17	85%	86%	85%	-1%
SZ_Parking, accessing a parked car, things in the car, washing car, loaning parking space, helping others with car	Both participants + others	Positive	12	6	18	92%	86%	90%	7%
SZ_Walking, scooting, baby in pram, for any purpose, in the street	Both participants + others	Positive	12	7	19	92%	100%	95%	-8%

Note to table: presentation of numbers – this table should be read in conjunction with the methodological considerations stated at 3.2.5. This is a numerical presentation of qualitative data. They are not generalisable beyond the sample in this research and are themselves the output of an interpretive process.

(1) code repeats under several themes

(2) dog walking: direction of impact is different by theme. It is treated as ‘varies’ when summarised for Analysis 1.

Differences by gender

In Analysis 1, at the level of code labels, differences by gender are reported. For health practices identified by most participants across the whole sample, more women identified: children and childcare health practices; and more men identified: bins and waste related health practices.

Most women and noticeably more (≥25% difference) compared to men identified health practice codes of: bus travel; making a community space or activity; going to community and volunteering activities; youth and teenager activities; and faith and religion related. A minority of women but still noticeably more than men identified: appreciating nice front gardens; food related; sharing and swapping with neighbours; and people watching and an awareness of what's going on.

Most men and noticeably more compared to women identified health practices around: nature and environment related; and deliveries. A minority of men but still noticeably more compared to women identified: physical exercise health practices.

The corollary of these findings is of importance: what men or women do not do in the street and the reasons why. For example, few participants overall identify physical activity in the street but within this, men do physical activity in the street more than women. There may also be methodological reasons as to why a health practice is present or absent in the data. The presence or absence of a health practice in these qualitative data can be due to a number of reasons. Yes, it may be due to these being true reflections of participants' experience either way however it equally could be that for example during interviews the particular health practice, "…(a) did not come up; (b) was not seen by the analyst; (c) was forgotten as a factor by the participant; (d) was thought by the participant to be so understood as to not require bringing it up; (e) was a factor, but the participant did not want to bring "it" up; (f) was not brought up because the conversation veered away from "it"…" (Sandelowski, Volis and Knafl, 2009, p. 8). This did not however frustrate the aim of identifying patterns in the data which was to aid construction of meaning making through the overall analysis. The difference highlighted within this stage of analysis underlines the importance of the subsequent analysis undertaken to understand the processual mechanisms which is what Analysis 3 partly addresses.

Who is doing the health practice and direction of impact

Participants describe both their own health practices and the health practices of others. This raises some important considerations for quality and interpretation. Participants do not incriminate themselves and mostly relate negative health practices as being done by other people not them. Table 17 summarises who is doing the health practice as well as the predominant direction of health impact as interpreted by the researcher.

Table 17: Health practices summarised by who is doing them and positive / negative health impact

Predominant direction of health impact	More positive	More negative	Varies	Total
Who does the health practice?				
Others Only	1	3	1	5
Participant Only	20	0	2	22
Participants and Others	13	1	9	23
Total health practices	34	4	12	50
% health practices	64%	12%	24%	

Examples of positive, negative, and variable health impacts resulting from health practices are:

- More positive: looking nice front gardens or window cills;
- More negative: violence; and,
- Varies: cycling children to school.

Health practices were mostly positive (n=34) not negative (n=4). More negative health practices were mainly described as being done by others (n=3): drug dealing, fly tipping, youth activities. Participants are found to focus on positive health practices more than negative ones, plausible factors related to this that I was attentive to during analysis include:

- Sampling strategy and recruitment;

- Data collection: interview protocol; power dynamic between participant and researcher;
- Participants not self-incriminating themselves;
- Participants framing of negative actions as reasonable or justified.

These potential limitations are recognised although it is also noted that in each case methods were designed to respond to these as far as practically feasible.

In Analysis 1 at the level of code labels health practices are reported (n=50). Differences by gender are identified. The findings inform a conceptual development that health practices of participants are important for health and separately contribute to the street social environment.

Analysis 2 – seeking patterns, themes, what's important to groups of people

Analysis 2 reports code labels (n=50) integrated into themes (n=6). This is the output of a modified reflexive analysis. It was not an analytical aim or requirement, but all code labels are in fact integrated into themes, which is notably different to street physical environment. It is also found that themes for street social environment and health practices are deeper and with more latent interpretations than those for street physical environment themes. Patterns are identified at a high level within these themes and reported under population groups of whole population (whole sample), women, and men.

Table 18 lists themes and shows that nearly all participants can be related to every theme. It can be stated that themes include health practices that are important across the whole sample. At this level of analysis no noticeable difference by gender is reported.

Table 18: Health Practice Themes with count and percentage of participants identifying within each

Health Practice (grouped by themes)	Women, count, n=13	Men, count, n=7	Total, count, n=20	Women %, ≥50% highlighted	Men %, ≥50% highlighted	Total %, ≥50% highlighted	% Difference women-men, +/- ≥25% highlighted
Theme 1 Being in green space and nature in the street	13	7	20	100%	100%	100%	0%
Theme 2 The street as a social space for people	13	7	20	100%	100%	100%	0%
Theme 3 Neighbourly things to do in the street	12	7	19	92%	100%	95%	-8%
Theme 4 Getting everyday necessities done in the street	12	7	19	92%	100%	95%	-8%
Theme 5 Getting from A to B in the street	13	7	20	100%	100%	100%	0%
Theme 6 The streetlives of children, parents, and adults	11	5	16	85%	71%	80%	13%

Note to table: presentation of numbers – this table should be read in conjunction with the methodological considerations stated at 3.2.5. This is a numerical presentation of qualitative data. They are not generalisable beyond the sample in this research and are themselves the output of an interpretive process.

These findings present six themes comprising an umbrella of complex health practice themes that are important at a whole population (whole sample) level.

Analysis 3 – detailing processes

This third level of analysis reports processual understanding of pathways to health impact for each theme. The grouping of themes into 'big latent themes' and 'semantic causes and consequences' (see Figure 57) results from synthesis at this level of fine grain analysis. As noted previously, the theme, streetlives of children, parents, and adults, is presented in summary only and identified as an area for future research.

Each section that follows starts with a theme definition and figure to illustrate the processual components. Each section reports:

- processual components;
- processual component latent meanings;
- other processual aspects;
- theme health impacts;
- theme ecologic and population group aspects;
- theme Covid-19 impacts; and
- theme street physical environment characteristic links.

This format is repeated for each of the six themes.

Similar to Chapter 4.2 these processual components represent the very granular scale of what is happening for participants at the street scale in relation to each theme. They are the processes or mechanisms that act on or along pathways to health impact. Patterns are identified in cross-sectional analysis across cases and ecologic differences are also identified that have the potential to create distributed impacts in a population or across population groups. Many of the processual components reported include both direct and obvious mechanisms as well as complex and indirect mechanisms.

Theme 1: being in green space and nature in the street

Theme definition

This theme is about health practices that are very closely tied to green space and / or separately to nature. It is different to other themes because green space and / or nature is the driving component. Participants' motivations inform the health practices but how those motivations are interpreted vary ecologically. The components for this theme are shown in Figure 58 below.

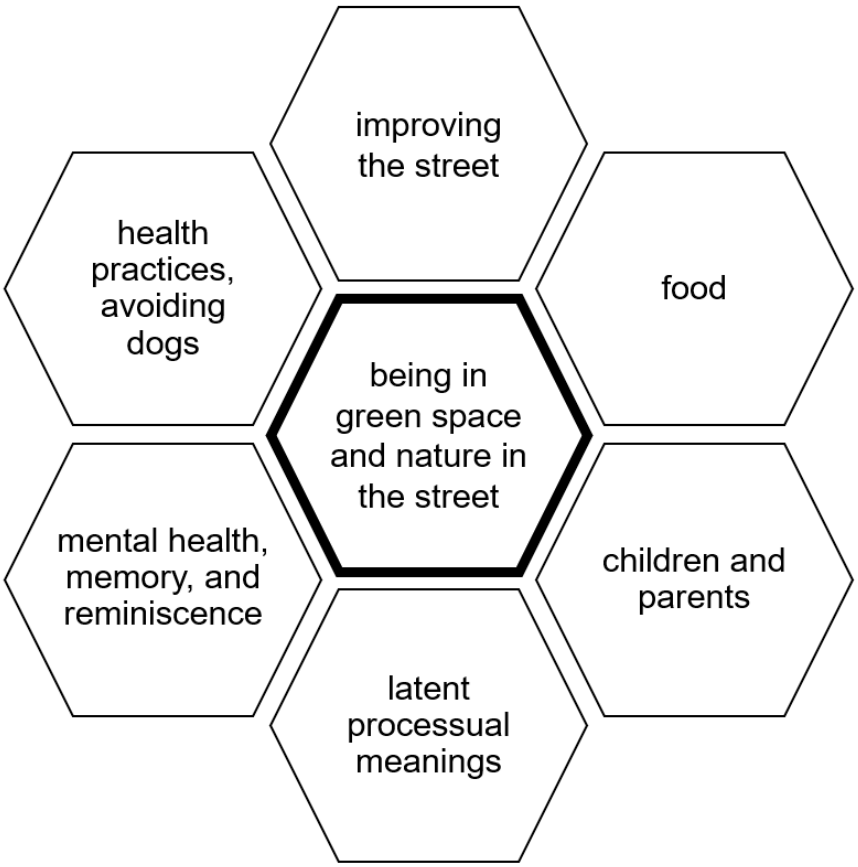


Figure 58: Processual components, theme being in green space and nature in the street

Theme 1 green space and nature; processual component: health practices, improving the street

Motivations for improving the street vary, a sense of fulfilment and positive health impact can result but equally if these efforts are frustrated this can create a sense of failure to keep up with the norms on the street and negative health impact.

Improving the street environment including by making it greener are motivations that several people express for their health practices (Mabon, Gus, Jessica).

> Make it looking nicer but also increase the amount of wildlife down here, help the environment, that's why I did mine. And then obviously it's a business opportunity for me now as well …it's really good for me, cause it's something I feel very passionately about - improving the built environment where we live, making places greener, but also being able to maybe get work on the back of that as well. (Gus)

> …by the container, I made it cause it was a bit concrete... we made a salad table, a salad corner, we had cabbages, green beans, we've got a herb garden which is still going now. (Jessica)

For some participants maintaining tidiness is an important motivation: for Julia partly because she runs her business from home where clients come to see her and for Anthony because he likes having a challenge and values neatness which he applies to his lawn and his car equally. This is important because what participants value varies. For some, greening is about plants and natural elements, for others neatness is what they value. Julia is a keen gardener so had very specific planting ideas about how her front garden should look when she started creating it.

> …the sort of person I am. I like to have things looking decent, and [if] it's not it would annoy me. …I'm that sort of person that likes things ordered and tidy… (Julia)

Beth believes that keeping the front of her house well-presented and making improvements to it is important. This is part of the culture of Dillwyn Street however Beth perceives she has not

done as well as she would have hoped to. Her lack of progress on increasing greenery in her front garden adds to Beth's anxiety.

> …it's to my shame that I haven't developed it at all really… my plan was to get, […] the whole house but definitely the front. But because I've been made redundant, I'm just a bit anxious about spending, so things are on hold… (Beth)

By contrast Julia has improved her garden and is part of an emerging culture of making nice front gardens on Hester Street:

> I think there's a sense of keeping up with the Jones' do you know, …do you know what I mean, "oh they've got a tidy front garden". And there's that sense of wanting to fit in. Yeah. I think that's what happens a little bit, if somebody's already got something nice then other people want to join in with that.

There are positive health impacts from making an improvement to the street and helping to increase greenery in the street. Equally for those like Beth who can't keep up with the Jones there are negative impacts on anxiety. Motivations for street improvements vary such as for promoting nature or for neatness, these are important differences in motivation for health practices.

Theme 1 green space and nature; processual component: health practices, food

This component relates specifically to growing food and how this links to the theme of green space and nature in the street. For several participants this is something they do to help others. For Ann, "a big part of being healthy isn't it to have access to affordable, healthy food." She grows food mainly at a community garden but also grows tomatoes and strawberries in her front garden.

Jessica grows plants in her front garden for food for Hoggan Street's own food bank, started and run by mums on the street. This links strongly to activities with children on the street because the food bank, run from a shipping container, also organises children's activities. In mixing the

two activities, children from the street water the plants in her front garden with reused plastic bottles on the fence. As identified in theme getting everyday necessities done in the street however the street is often limited for growing a material quantity of food.

Growing food is the aim within this processual component that results in participants health practices in the street and contribute to the wider theme.

Theme 1 green space and nature; processual component: health practices, children and parents

This component highlights the importance of outdoor green space for parents of young children without outdoor space at home. It links to the theme of streetlives of children, parents, and adults but is linked most directly to this theme of being in green space and nature in the street.

As a mum of young children green space is also integral to Ima's health practices around being in green space for childcare, family time, and meeting neighbours. One side of Tomos Street is a park of open space with trees and a river on the other side.

> We do have a lovely sight in front of our house, a river and a big grass yard that people walk their dogs in, and you can have a walk or do some training. The kids also play there, football or cricket, or cycling around the area. (Ima)

Ima's definition of My Space is defined by the space she is happy for her children to play in. Ima's living conditions are cramped and create negative health impacts. Other participants link being with children in the street but do not relate this to green space. This may be because outdoor space is really important for Ima being the only participant living in a house in multiple occupation with no outdoor space at home.

Theme 1 green space and nature; processual component: health practices, mental health, memory, and reminiscence

Green space and nature connect people with memories and reminiscence. The health practice of being in green space can be used to help with loneliness and separation from friends and relatives either in space or time including those who have deceased.

Jessica remembers how her mother would always encourage her to get outdoors and be in nature for mental health benefits. When in green space Jessica is reminded of her mother who has since died.

> I was […] always out when my mum was around […], rock paddling, rock finding, every..., she was so outdoorsy… and I think that's when I noticed my mental health go dipping, I took things for advantage because everything that she did, […] it was probably cause she knew that it made the difference like getting me out, making me walk outdoors, keeping the kids active […]. And, like wow, mum, you weren't just my mum you were like my best friend, you knew everything, you knew what to do. (Jessica)

Shiva emigrated to Wales from South Asia, she moved with her husband, they do not have children and she jokes that they garden instead to keep themselves busy. Shiva is lonely as she misses her family and she has several health practices related to this including joining the river path at the end of Legall Street and walking or cycling there. She does this when her husband is working late running a small business for which he uses their car.

> …when I came here I couldn't speak English so I hadn't any contact. But the area especially all [park name] was very good help for me, I went over there walking, riding the bicycle and because I was very alone, so it was a great help […] It's very, very related to the health because when for example sometimes when I am very stressful or I miss my home, my family I go for walking to [name] park, it's very close just two minutes. It's helpful for me and I can see very beautiful green area, it's very nice, I can see there some animals over there some birds definitely is a good health. Mentally and physically… (Shiva)

This loneliness is reflected directly in Shiva's response to the ONS wellbeing questions (Tinkler and Hicks, 2011) both in terms of life satisfaction and hedonic emotions:

> [ONS Satisfied: 5] …with my personal life I can say eight but because of Coronavirus it's a long time I couldn't see my family and I can't have contact

> with friends, so I think I'm not very satisfied... overall, I can say five because there's two parts and average is five.
>
> [ONS Anxious: 6] …maybe six because I had lots of things in my job and I must do them and hadn't time, other hand, I was very worried about my family and my parents in my country so this day I can say six. (Shiva)

The ONS survey captures numeric scores and this is an example of how the methods in this research are able to investigate a different aspect, the processual mechanisms.

More than any other theme green space is tied to participants' reminiscence, like a palimpsest the meaning of the green space of the street is overwritten with participants' memories. Mabon is continuing as an amateur gardener his family tradition of professional gardening. In tandem with this Mabon recalls memories of his father and his peaceful death. One of his father's plants in his front garden provides a daily reminder of that connection.

> …there's a fuchsia that my father had […] so this is the cutting of a cutting of a cutting of his fuchsia and that's always travelled round with me. […] It is a constant reminder of my father really, he was a professional gardener as his father was before him and his father before him, goes back a hundred years or more. […] I wish I'd had more of his plants […] But I did manage to get this fuchsia so that is Dad basically that fuchsia. (Mabon)

The health practice of being in green space can be used to help with loneliness and separation from friends and relatives either in space or time including those who have deceased. The stimulus for this reminiscence health practice varies but the common thread is that green space provides a link to bring back memories.

Theme 1 green space and nature; processual component: health practices, avoiding dogs

Ima is afraid of and allergic to dogs so has a health practice to avoid them. Fear of dogs affects Ann's health practices too. This is quite a semantic impact: a fear of dogs affects participants use of green space in the street.

Plausibly there are positive health impacts for people who own dogs and links to their use of green space. This was not identified in the data and participants were not systematically surveyed for dog ownership.

This is an example of a key finding about health practices, for participants they are their own health practices. The health practices of others however become part of the street environment for others including participants. Therefore, health practices are found to be, and evidenced throughout this chapter section, as a key component of the street social environment.

Theme 1 green space and nature; processual component, latent meanings

A range of more latent meanings are reported within this analysis and across other processual components. In the processual component, improving the street, there are latent meanings for Beth who feels she can't keep up with the Joines and the negative impact this has on her anxiety. Mental health, memory, and reminiscence is a particularly latent processual component as identified for Jessica through memories of her mother, for Shiva missing family, and for Mabon's fuchsia providing a memory of his father.

It is notable within this first theme - green space and nature – that certain meanings were so profoundly latent that they were developed into distinct components. This may reflect that green space and nature have particularly deep connection for participants and potential for such deep and latent interpretations to be developed.

Theme 1 green space and nature; other processual aspects

Two other yet important aspects of how green space and nature operate which affects health practices are seasonality and time. As for subsequent themes, these processual aspects are special to this theme: here because the theme involves greenery this theme is affected by processes related to plants. Seasonality reflects how plants and nature change and vary. There is both a linear time aspect to this and a cyclical repeating aspect. Changes can impact health practices through the year and those impacts can also happen every year. Anthony reflects on how his health practices change through the year and his love: hate relationship with the street tree outside his house. It is an annual impact as the tree drops its leaves on his lawn every year.

> …trimming the lawn, keeping the shrubs decent, sweeping the driveway […] it's obviously mainly something I would do more in the spring and summer, into the early autumn. And then the winter, there's a massive tree outside the house. […] it does drop all its leaves on my lawn in the winter and destroys my lawn so [small laugh] I don't like it [small laugh]. […] I'm quite happy to have the tree, but it just annoys me in the winter when the leaves come down so. But then it's my *challenge* then in the spring to get my lawn looking nice again, I quite like a challenge.

Plants grow over time and this can have various impacts on health practices. It causes Mabon, who has several serious health problems, to reflect on how long he will live. This impacts his decisions around selecting new plants so that he can enjoy them sooner.

> …to be serious, it is a thing that worries me a bit, because the timescale of the garden and things is quite a long time, and with what's happening I don't know how long I've got. So that is a worry. I must admit. […] will I still be here? These things go through your mind. (Mabon)

Health practices in this theme can range in scale and effort from very small to quite large undertakings that even go beyond someone's lifespan such as for Mabon. This analysis has not used a personal projects method (Little, 1983) to analyse practices, this is identified as a potential tool for future analysis. It appears this could be readily applied for further analysis of health practices.

Theme 1 green space and nature; theme health impacts

Health links identified are varied, quite conceptual, and semantically don't sound very 'clinical' and that is true even for Anthony who as a medical doctor knows certain health terminology. Nevertheless, they are how participants describe the links and that is what is important here. For example:

- The idea of a rich garden habitat for insects:

> …it's not even really how they look, it's more [.] I suppose just the idea of it really." (Luke)

- It's beautiful:

> And lately, particularly Covid, I've been using the end of the street which is where you get onto the [river name] the [river] trail. And it's a beautiful walk both ways actually. (Anthony)

- A sense of calmness: clear mind, look at birds, have a little think:

> …definitely, that would be part of my wellbeing […] either walk round to Tesco or a little walk along the [river name] trail, not for long, not for far, clear my mind and just look at the birds and the sky and the sunset and just enjoy the fresh air, have a little think. (Anthony, a medical doctor)

- Lifting the spirits, magic, and joy:

> Ah, it's good it does lift the spirits […] I think there's more magic and more joy in just one little teeny plant that has the guts to stick itself above the soil and face the weather and everything than there is in all the […] technology of going to the moon and everything else [small laugh]. (Mabon)

- Being helpful, very beautiful, and very nice (Shiva)

The clearest link is to mental health but given the framing of health in this research these are interpreted as having impact across all dimensions: physical, social, and mental.

Theme 1 green space and nature; theme ecologic and population group aspects

Several processual chains of health practices were identified related to green space and nature. What is meant by chain is a series of individual health practices linked together sequentially, for example:

- Making planters at Simpson Street led to conversations with children for Robyn;

> Those planters have led to loads of street interactions prior to lockdown with some of the young families that live on the street… (Robyn)

- Planting pots in the front garden led to meeting neighbours and making connections for Luanne. This led to going for a long city ramble with a neighbour who had not done such a long walk before;

> I can honestly say, having the plants growing with the street, using it as a medium to meet my neighbours. […] one of my neighbours that I met through the community allotment likes walking but she hasn't walked in the kind of walking I do. So I took her on one of my walks and she really enjoyed that but she found [it] really tough. […] it was good that we met through being out on the street you know chatting and connecting. (Luanne)

- Creating neatness in his garden and shine on his car linked to chatting with neighbours for Anthony;
- Planting her front garden enables Ann to then offer strawberries to passing children whose parents she knows; and,
- Making the street greener linked to Gus making window boxes for his own house which in turn led to him earning income from making window boxes for other people on the street and as part of his new business.

In each of these cases the initial green space and nature health practice was instrumental to the subsequent chain of health practices.

Theme 1 green space and nature; theme Covid-19 impacts

Two impacts of Covid-19 are identified. First, there being less background environmental noise, such as from traffic, and as a result of this more ability to listen to birdsong.

> …going out into the front garden, we're close up to the birds. …I find that quite a calming experience in itself and that places great emphasis on the benefits, if there are benefits, of this lockdown. (Paul, during week 10 of 10 of the first stay at home lockdown in Wales).

Second, how small aspects of day-to-day health practices were impacted, such as being in the front garden or on a path. Paul for example became very aware of avoiding people and social distancing.

> …obviously during lockdown I was very wary about people passing and if I could see somebody, a number of metres away sort of coming closer I then would step into the garden keeping the distance, saying 'hello' or whatever as they passed. But beforehand I wouldn't think twice of going out onto the pavement… (Paul)

Theme 1 green space and nature; theme street physical environment characteristic links

Front gardens are an important link to this theme, both the presence and absence of them. Front gardens where present provide an opportunity for increasing greenery in a space that people who are property owners have more control over.

As identified in Chapter 4.2 there are disincentives for people living in rented properties to maintain a front garden. For Ima she has no access to external green space at the front of her property and this area has a negative impact on her as it is used for communal refuse.

> Once I tried to plant in it, but it got destroyed, I couldn’t keep it like green or any kind of good looking. And also if the landlord got some stuff, need to throw away, he just put them there… (Ima)

The absence of a front garden does not completely prevent street greening health practices as Gus and Robyn demonstrate. They use window boxes, which is interpreted as an example of health practices in line with de Certeau’s conception (1984) that people shape their everyday practices based on the environment they find themselves in. Where back gardens are present as well as front gardens then this changes how people use the front gardens. Back gardens are excluded from the definition of the street in this research and yet they can have an effect on health practices within the street.

Theme 2: the street as a social space for people

Theme definition

This theme contains health practices that are about connection to other people. Many of these health practices to do with social connection arise through a processual link from other health practices including within other themes. The components for this theme are shown in Figure 59 below.

Figure 59: Processual components, theme the street as a social space for people

Theme 2 street as social space; processual component: health practices, chatting and stuff

At its most sematic level this finding is about how having “chat and stuff” (Aisha) are important health practices in the street. That stuff comprises health practices like greeting people or having a cup of tea in the street. What unifies these practices is that they are about sociability and connection to other people. To that extent even just being in the street can be considered a social act and a health practice, creating the potential for these social interactions.

A number of participants identify the importance of greeting and acknowledging people (Paul, Katrin, Gus, Ann).

> …kids do sort of bounce around the street quite a bit, older people go for their daily walks with their masks on and their little sticks. That's quite nice, stop and have a chat, sort of thing. It's a nice, I feel safe in the street, I think we all do. (Ann)

> …I think that sense of having people around to speak to, even if it's just on nodding terms. (Julia)

Things that inhibit chatting and stuff can have negative impacts on health practices such as the removal of a park by the local authority:

> …putting a car park there not realising that it was a social space for people, for my elderly neighbour, who is Yemeni, and all these other people, sitting there in the evenings and chat and stuff like that, and now there's cars there. (Aisha)

By contrast Robyn notes a small intervention can support social interactions, “…that sparked a lot more interactions and meeting people and neighbours… even just that *one* planter being installed on the street.”

Chatting needn’t be short in time and can be combined with the health practice of drinking tea (Ima, Katrin).

> With the neighbours, yes. They've got kids in the same age as mine, and we do have some cup of tea or just chat... (Ima)

Just being in the street is a health practice for Rania:

> I don't know if it's a doing, a verb-al thing, but one is engaging in what goes on just because if you're moving around… there'll be lot of like greetings happen on the street. …those people that you recognise but don't necessarily know. (Rania)

Covid-19 did not just impact existing health practices under this theme, it created new ones too. It introduced the new health practice of the socially distanced chat (Robyn, Luke, Gus).

> …we will walk up [friend's] end of the street so that we could socially distanced say hello to her and the family, because obviously we're really close, we love her kids… so not seeing them is difficult. (Robyn)

> …because of the Coronavirus when I came back from my job I could see more people in the street because they didn't allow go inside with each other. So, they was in the street and had a chat and see each other… (Shiva)

In many streets it was part of the culture of the street to come out and clap for carers (Manthorpe *et al.*, 2022; Saner, 2020) (Jessica, Rebecca, Aisha, Julia) and this became an opportunity for social connection when people were subject to various degrees of lockdowns. On Hester Street for Julia it became a weekly lifeline. This potential for social connection was created whether or not people actually clapped for carers, there were opportunities for chat created anyway. For example, Aisha did not clap for carers but explained to her neighbours how she wanted carers to be paid more. In Hoggan Street Covid-19 drove new health practices of street bingo and people gathering round fires in front gardens.

For both Paul and Luanne chatting and stuff represents a planned, intentional set of health practices. Objects in the street or front garden can act as prompts for ready talking points and for some participants this itself is an important part of chatting and stuff.

> …one of the lovely things about… Steer Street is that people will randomly stop and talk to you [small laugh] for absolutely no reason. So it's a space that I do come out onto and I stand by my gate and just wait sometimes for people to pass. And many will stop and chat… (Luanne)

Chatting and stuff has latent meanings for some participants such as Mabon.

> I value civility a lot… up in the valleys if you walk past somebody in the street they will always say hello, or good morning, or bore da, or shwmae byt, shwmae byt is a common one. And coming down to Cardiff it's not so common, but it's still a fair bit in Chamberlain Street...

Something as apparently small as chatting and stuff is nevertheless important. For Jessica it is a purposeful practice. She reflects on this in the context of at least ten recent suicides she is aware of in her community during the Covid-19 pandemic.

> …if I see someone struggling… I will make time for them. Even if I've gotta go in a rush or I've got to myself, I think five minutes can make that difference and potentially save someone's life... (Samantha)

How this specific point about suicide is interpreted for health impact including limitations on this is discussed later in this section.

This component relates to the very simple and everyday social interactions in the street and how the importance of these for health belies their seeming simplicity. They can in fact be complex and intricately planned health practices.

Theme 2 street as social space; processual component: health practices, celebrations and life events

The street is an important setting for health practices related to social events such as celebrations, cultural, and religious events. Covid-19 meant that a number of these health practices moved into the street whilst it restricted others. Celebrations and events may be religious such as Eid prayers and Christmas; life events such as introducing a new-born baby to

neighbours, or parts of a marriage ceremony; cultural events such as the celebration of Victory in Europe (VE) Day, or Halloween.

> …on Christmas day …at midday we all came out, we all had a glass of champagne and greeted each other and went back and carry on cooking the turkey, it's that kind of street basically. (Scott)

> …during lockdown I'd bring a deckchair out and I'd sit out in the front bit here. …I've got like a baritone ukelele… and I took the ukelele. …And a couple from a few doors down came out and they brought out a banjalele which is like a… ukelele mated with a banjo and… we just sang some songs and stuff like that together… it was really nice. …I've seen them loads… but now I know their names, and we sang together, and it was really nice, really special thing to happen and I doubt it would've happened if not for this.

> …that… really, really made me happy. (Luke)

This is particularly ecologically important for Luke as he had low mental health recently. Luke, Aisha, Rebecca, and Samantha describe positive benefits of these health practices, but there can be negative impacts such as for Beth for whom Halloween health practices of others have a negative impact on her mental health.

Covid-19 had a particular impact on these health practices, restricting them and therefore reducing the health benefits from them, and also putting increased importance on those that were able to go ahead.

> …when it comes to religious celebrations we have Eid twice a year. …when it wasn't Covid, we did use to pray outside …on the field. …that was literally the highlight of our year… [with] Covid obviously we couldn't do that which was really sad but we still were able to celebrate at home. (Aisha)

In October 2020 after a month of local lockdowns and the start of the second national stay at home lockdown, Beth identifies how initial enthusiasm to do things as a street community reduced over time.

> …when we were doing the clap for carers we did say, "oh, when this is all over we'll have a street party: be lovely to get to know you all better"… It feels like the atmosphere's a bit different at the moment… I think we were all just hoping it would be a couple of weeks and now it just feels very different doesn't it [small laugh]. (Beth)

Some health practices that might in the past have happened indoors now took place in the street also. For example, babies were introduced to grandparents and neighbours in the street, something that both Luanne and Scott experienced.

> …we'd just hold the baby up and that was you know, "here meet your new neighbour"! …It's like the [neighbourhood] version of the Lion King! (Scott)

> …during lockdown the highlight of my daily walk was to stand [at the] window and wave to my grandson and have a you know little chat with them. …I think he used to see me… through the window. …But I remember the first time I walked into the house he screamed [laughs]. He was quite shocked! (Luanne)

The street as a social space for people includes celebrations and life events. The street environment and Covid-19 both impact on these health practices.

Theme 2 street as social space; processual component: health practices, litter picking

Litter picking has parts related to theme two, the street as a social space and theme three, neighbourly things to do in the street. For Julia the health practice itself is a social activity that allows connection with people. For Mabon and his wife who go litter picking together, this provides an opportunity for social connections in the street.

> …we meet so many nice people when we're out, because obviously the sods [who] do the littering they're not going talk to you… people come up to us, and a lot do, and say hello, thank you it's great, blah blah blah, and you start chatting, you learn about them …so yeah things like that are activities, they

> *are* activities no two ways about it and they're very good, very worthwhile, love it. (Mabon)

Like chatting in front gardens above, here the litter picking acts as a prompt to social interaction.

Theme 2 street as social space; processual component: health practices, moving practices

Health practices related to moving house into a street are important for making initial connections with new residents. People can be nervous about whether a new resident will be neighbourly, at the same time wanting to be good neighbours themselves. Immediate neighbours can have a very direct impact on each other's street social environment.

> …most of hours we are at work and we haven't any kids so we haven't really much contact with people but so far our neighbours we found them very kind and when we came here for the first week they came and said, "hello, how are you doing, need any help, if you need our help we are here." (Shiva)

A burglary during building works is negative for Scott but at the same time provides an opportunity to form new social relations.

> …when we bought the property there was a spate of burglaries… the police suggested that we set up a Neighbourhood Watch scheme cause there wasn't one on the street so… it was a way that we actually ended up meeting everybody in quick succession… I'm not saying that we were the catalyst for the kind of street that we've got right now but… you have to make an effort...
>
> …this is always the case when somebody you know moves out of a street and somebody moves into a street there's always that sense of nervousness… So for some people on the street it did take us a while to get to know them and …build up that sense of community and trust… (Scott)

The potential for concern or anxiety was observed during Samantha's observation, a new neighbour moved in a few days before and during the interview Samantha says, "…sorry my neighbour's [drumming?], weren't expecting that - oh dear that's the new neighbour"!

Moving house and getting new neighbours is a potential cause of anxiety for some people and participants demonstrated a range of health practices linked to making new social connections as positive as possible.

Theme 2 street as social space; processual component: health practices, violence and injury

The social interaction that happens between neighbours as a result of violence is the focus of this component (for violence itself see, Theme 3, Processual component: health practices, resisting violence and drugs). Violence has obvious negative health impacts yet also unexpected indirect impacts. Violence can bring neighbours into social engagement in the street, as Julia notes, "…crime brings us together as well" and Rania describes:

> We had a …stabbing not long ago on the street so and it was literally cordoned off for like a day and a half… those moments where everyone's coming out and everyone's having these… chats… So these strange, random chats that come out of some of the social problems that are experienced on that street. Which now that I'm talking about it, are significant [small laugh] from drugs, to domestic abuse, to kids not being in school, to you know, there's a bunch. (Rania)

Arfon Street does not have street parties, but the thing that brings everyone out of their houses are the road traffic collisions that happen on Arfon Street. It is a dual carriageway and the traffic lights often confuse drivers turning across the opposite lanes. For Abdi, "that's what gets everyone talking. …that's when the …the majority of people on the street are out."

Despite the negative impacts of violence it can also be a cause for people to come into the street and interact socially in ways that are positive.

Theme 2 street as social space; processual component, latent meanings

A sense of belonging is an important latent meaning within this theme. It is ecologic and found to overlap with ethnic identity, religious identity, being an immigrant, the culture of a street, and

how a street relates to its wider neighbourhood. Both Rania and Aisha identify the role of identity within a sense of belonging.

> …I don't have a traditional family, we're not from a Muslim background where there might be the mosque or there might be certain spaces where you reconnect with that identity and that language and my parents are not like that. …I haven't …necessarily connected to Iraqi communities here. I feel like… a kind of floating person sometimes and one aspect of that is it gives me great freedom, and another aspect of that is I never know quite where I fit in. (Rania)

Abdi's street is a short section of social housing within the much longer Arfon Street which is mostly not social housing. A sense of belonging for Abdi derives from the knowledge of where the people on his street, who all moved at the same time, used to live and therefore the culture of Abdi's street is in contrast to the rest of Arfon Street.

Feeling safe in the street is an important pre-condition of belonging and impacts health practices for both participants: positively for Ann, who feels safe in her street; but negatively for Aisha often feels unsafe in her street, especially at night, and particularly due to her wearing Islamic dress.

These latent interpretations nevertheless are clearly described: Mabon highlights the importance of vibrancy and a mix of ethnic groups; for Shiva the culture of the street is about it being "quiet, nice, clean, kind people"; and for Samantha she has a sense of belonging through a street culture of "homely, sense of pride, approachable people". These contribute to a sense of belonging which is positive for health.

Theme 2 street as social space; other processual aspects

The street as a social space has notable aspects related to how the process operates. These include how the social environment affects spatial perception, whether people engage with anyone or only people they know, and individual characteristics.

Social connection is unsurprisingly linked to people's definition of My Street boundary. Anthony knows his immediate neighbours best: for Gus it is more about who he knows on his street with his definition of My Street stretching to include the people he knows well.

Who people are making a social connection with varies and this seems to matter also. For Beth it doesn't matter so much who this is including strangers but Julia values being around "locals" more than socialising with "other people".

Lastly, social connection is affected by individual traits too. For example, Paul actively seeks opportunities for social interaction on the street whereas Scott and Anthony largely avoid this.

Theme 2 street as social space; theme health impacts

In this theme health impacts are quite semantic for participants. Mental health benefits are particularly identified.

Two specific health impacts in this theme relate to suicide, as reported, and autism (reported Chapter 4.4). These were not experiences directly of participants and this limits what can be interpreted about these. Also, factors affecting these are complex and do not necessarily act in the obvious direction, for example suicide rates in Western European countries (UK not included) broadly *increase* with levels of happiness and the factors affecting suicide and reported suicide rates are complex, including sex, age, "…access to means, religion and reliability of data…" (Bray and Gunnell, 2006, p.336). Findings related to autism and suicide in the street environment are identified as potential areas for future research.

Overall, this theme identifies the importance of small everyday health practices particularly for mental wellbeing.

Theme 2 street as social space; theme ecologic and population group aspects

In this theme several ecologic aspects are highlighted. Jessica identified the potentially important ecologic pathway of class-based differences noting front gardens being used as communal space in working-class streets compared to other streets. For Ann, as a survivor of domestic violence, her front garden is vital private space, a buffer to the public street.

The theme of the street as a social space contains various lifecourse aspects including:

- Impact of experiences over time, Rebecca noted that being violently assaulted in her street had an impact on her willingness to socialise or come out of her house for a long time (Rebecca);
- Intergenerational learning and togetherness (Paul);
- Childhood experiences that carry forward into adulthood (Abdi);
- Parental experiences of sociability and spending time with children as they get older (Rebecca); and
- The concept of what 'being an adult' means (Samantha) particularly for someone who has had traumatic life experiences.

Theme 2 street as social space; theme Covid-19 impacts

Covid-19 had significant impacts on health practices in the street related to this theme. These included certain health practices being brought into the street; certain health practices being restricted from the street and therefore a communal experience like Eid; health practices related to seeing friends and neighbours were reduced for some people (e.g. Ima); and creating new health practices like the socially distanced hello.

Changes such as to traffic and people walking in the street increased opportunities for social health practices to happen, a "slowdown of traffic, increase of foot fall actually, increase of people…" (Luanne) These impacts, as evidenced by Beth previously, varied over time and as restrictions changed over time.

Theme 2 street as social space; theme street physical environment characteristic links

Street environment characteristics particularly linked to this theme were:

- Front gardens, windows, and balconies;
- Street planters;
- Specific spaces – e.g., outdoor eating space at refugee centre; and
- Being a main road having both positive and negative impacts for health practices.

In several streets the housing type and street layout have an impact on sociability including blurring the boundary between the public street, semi-private areas particularly shared areas, and the private space of the home. These include: Holman Street, where Aisha lives in a maisonette and Tomos Street where Ima lives in a house in multiple occupation where the common stairs and front garden are not part of her home space.

The actions of actors in the street environment are important, Aisha provides two different examples with a negative long-term impact:

- Removal of park space; and
- Placement of solid panels on balconies which restrict social interaction.

Theme 3: neighbourly things to do in the street

Theme definition

This theme focuses on health practices that are about the concept of being a good (or bad) neighbour and doing things the right (or wrong) way. It includes health practices that have negative health impacts. These include experiences of violence and the impact of drug dealing. Some longer data extracts from participants are included here to centre participants own words about these traumatic experiences. A neighbour can be someone who lives on the same street but doing neighbourly things can also involve helping a stranger. The health practices of others become the street social environment for participants and visa versa and this is particularly clear with those creating negative impacts. The components for this theme are shown in Figure 60.

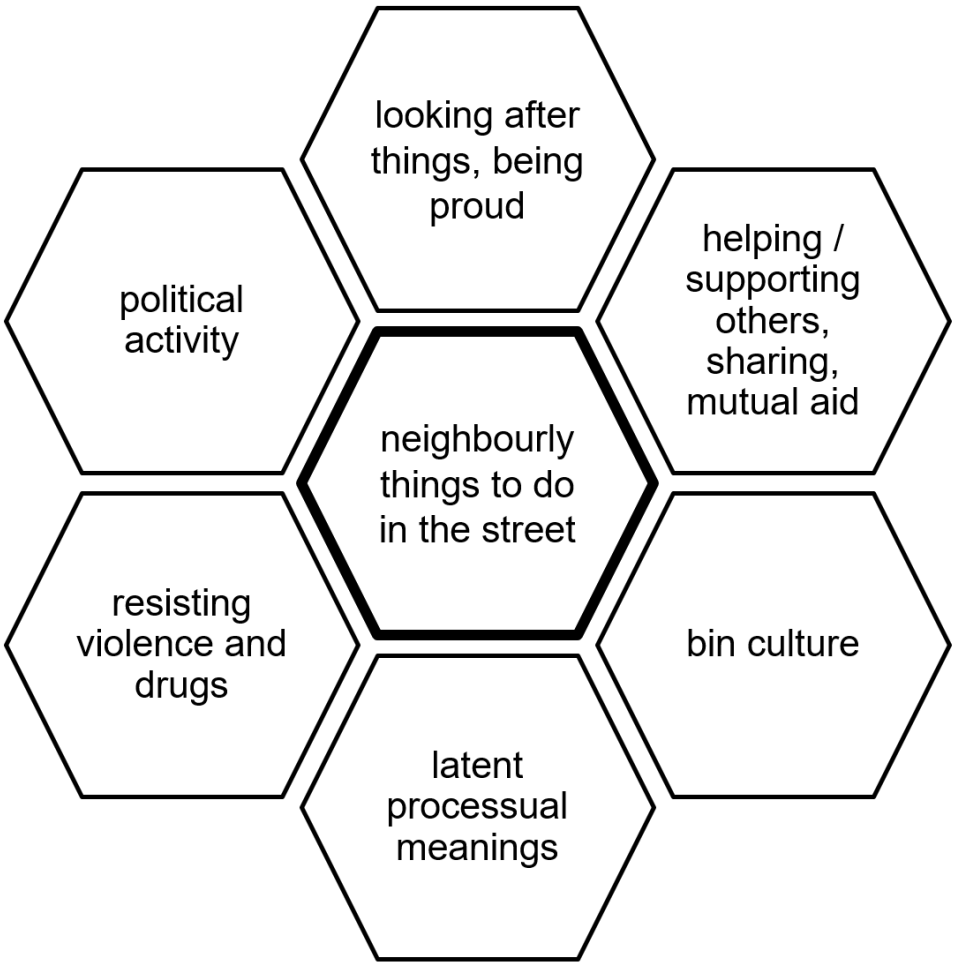


Figure 60: Processual components, theme neighbourly things to do in the street

Theme 3; neighbourly things; processual component: health practices, looking after things, being proud

This component relates to looking after the street environment and a sense of pride in it.

Planters in the street for growing are a health practice for a number of participants. For most of these it is about making an improvement in the street that they have willingly started. However Julia feels like she is having to do it after someone else requested the planter and then moved away. There are positive and negative health impacts: at Simpson Street, Luke and Robyn identify the damage caused by others to planters as a source of negative mental health impact, Robyn has love / hate feelings toward the planters. As a carpenter, Gus has started to make window boxes for his own house which led to being paid to do this for many other houses on the street.

Health practices can turn into much larger projects too. For Robyn, her work includes making a community garden and Rania describes a project through her “socially engaged participatory” arts practice to establish a street choir. For Robyn, Rania, and Gus, their health practices in the street have evolved into health practices of paid employment in the street.

At Hoggan Street, both Jessica and Samantha have been involved in starting a street-based community project with a food bank, growing, and children’s activities. Some mums participating in the group have experienced emotional and domestic violence and this ecologic understanding sets in context the positive health benefits of this practice for them. These impacts also benefit the whole street, and children who Jessica notes feel a sense of pride and will say, “my mum does this!” The latent meaning goes further however when interpreted through Jessica’s experience.

> I had my first child and then I had another one, and their dad left and I was left here with the three-year-old and new born, he left when he was about four, five months old. And I was just petrified, I just thought, "oh my God". I didn't know anyone here, …he knew everybody, and they were all a bit, you know, rough... And then… he left and I was still here. …I started… going to uni, …I thought there was no way of getting out of here. …I'm a single mum,

> two kids, I can't work… I was trying to make money and better myself to get out of here at the very beginning [laughs].
>
> So I started talking to all the girls then, the mums, and slowly by slowly most of them become single mums. And I just thought if I've got to stay here might as well try and make the best that I can at least. …I was lucky enough to be introduced to [community organisation], and it all just went from there… And we really enjoyed it, it was lovely, cause it was time for the mums as well even, it just felt productive, it felt nice, and you literally see the [kids], it just flew. I didn't expect it to take off and it's been running for about eleven years now. (Jessica)

This extract evidences the complexity of pathways to health impact for Jessica over her lifecourse. It reflects a norm for the girls, who became mums, who became single mums on Hoggan Street and how together they created new health practices in response.

The health practices of others including fly-tipping and littering has a negative health impact on participants (Katrin, Robyn, Beth, Luke). Dog mess is noted as having particularly negative mental health impacts (Luke). Litter picking is a health practice some participants do in response (Katrin, Robyn, Luke, Ann, Beth, Julia, Gus, Mabon) with positive health impacts through pathways of: satisfaction and pride; physical exercise; and social connections. Gus identifies the benefits for mental health of litter picking.

Litter picking has latent meanings too, Ann relates it to gentrification and creating a culture on a street. Julia is keen to be involved, as a politician it is an opportunity to meet lots of different people at once.

The final part of this processual component is being house proud. Health practices here with a positive health impact include (variously for Luke, Beth, Rania, Julia, Mabon, Rebecca) cleaning front windows of the house, sweeping the street, pulling weeds up in the street, keeping a tidy front garden. A negative health impact can arise where people are unable to take the actions they want to, including due to Covid-19 (Rebecca), redundancy, (Beth), and housing tenure / type (Ima).

Diverse health practices are involved in looking after the street environment and a sense of pride in it.

Theme 3; neighbourly things; processual component: health practices, helping / supporting others, sharing, mutual aid

This component includes health practices of providing help to neighbours. Who a neighbour is in this context is drawn broadly. Covid-19 impacted these health practices whilst creating new ones such as mutual aid groups.

Prior to Covid-19 such health practices included small ones like taking in deliveries for a neighbour (Rebecca) through to practices such as childcare for neighbours (Gus). For some participants an important part of street culture is knowing that they can ask for help. The specific task may vary like Shiva helping a neighbour find their dog, or due to people's religious health practices, for example Katrin's family receive many different curries from Muslim neighbours during Ramadan and they keep a chart of which is best!

A willingness to help is most important and it is noted when not given as Rebecca identifies. For Gus and Luke it's the norm and irrespective of the specific help it's the culture of the street that this reflects.

> It is a very friendly street, it's the most friendly place I've ever lived. Everyone really looks out for each other. (Gus)

> …there is something lovely about feeling quite well supported. You know the, little things… And obviously, in the wider sense… feeling part of something does help enormously I think. (Scott)

For Aisha the sense of a street culture of neighbourliness is so normal that it is a mental leap to think of it being any different.

> I've never thought of it as a street as a communal thing, I've just seen it as where I live, and the people I'm really comfortable with, and people that I'm close with, and I'll go and ask them if I need five pounds or whatever, my electric's gone off or something. (Aisha)

Street norms develop around health practices such as leaving out unwanted furniture and for Rania it is an important part of this to put out good quality items that people might want. Covid-19 impacted on various health practices in the street. For Robyn this involved an increase in sharing and swapping things with neighbours, giving away excess seedlings from a local nursery that would otherwise have gone to waste motivated by reducing waste as well as sharing.

Covid-19 also created new health practices like forming mutual aid groups to provide support to people who needed it (Ann, Mabon, Ima, Rania). Ann relates this to her attitude toward health and the role mutual aid can play.

> …maybe I'm a bit off your scale in terms of attitudes to people needing to take some responsibility for their health or the health of their street. But I think …mutual aid has shown us, if people come out there a little bit and start helping each other it snowballs. It's good. (Ann)

For Ima the overall impact of Covid-19 was a major reduction in contact with her neighbours and in response to this her health practices changed to include sharing home school ideas and staying in touch by WhatsApp.

> Health practices of providing help to neighbours are part of neighbourly things to do in the street. It is something taken for granted, notable when missing, but also varies depending on the culture of the street. Who a neighbour is in this context is broadly drawn and Covid-19 impacted these health practices.

Theme 3; neighbourly things; processual component: health practices, bin culture

There is a street culture of doing the bins right way and therefore also the wrong way. Ann describes Cadwaladr Street's bin culture:

> …it's a sort of street where people do put their bins out properly, I've lived in places where they don't... Not everybody does the recycling they should, but hey, you know. For months [during Covid-19] Cardiff were just taking it to the

> incinerator anyway… People put each other's bins in and out which is nice. …Seagulls are a problem: your bin's out too early, there's rubbish all over the street. …it's a pretty good service really.

At Dillwyn Street, Beth reflects on a health practice of competitively beating one neighbour to help another neighbour.

> … there's a chap two doors down and he's on his own and… has recently had a span in hospital… even before that we'll take it in turns to put the bins out… just as a neighbourly thing to do. So that's very mundane but important. …it is a small thing but it makes me feel really good… if I can get out before [neighbour] next door and do it [laughs]… she always seems to get there first! (Beth)

Getting the bins right is important to Robyn. When other people don't do this it causes her significant stress and negative health impact.

> …we are those people who get really annoyed when people do their rubbish wrong [laughing].
>
> I will try and talk to people directly about what's going on… I get different reactions, not usually great ones… sometimes I get to the stage where I feel like I'm gonna lose my temper and then I go back in my house and this is my love hate relationship with the street… I've had people slam the door in my face before. And I'll go to [partner], "we have to move, I've had enough, I've had enough… I don't like it.". (Robyn)

At Cadwaladr Street, Ann gives an example of a neighbourly health practice she does of intervening to smooth disagreements between neighbours over bins.

The work of key workers was more recognised during Covid-19, Scott provides an example that reflects the culture of Ashley Street.

> …There was one weekly bin collection. So [neighbour] next door took it upon herself to cook the bin men bacon sandwiches in the morning, she was

> baking cakes for them… she ended up getting a letter of commendation from the council for her lockdown service! … it gives you an indication of the sense of the place... (Scott)

Some of the impact of Covid-19 was neutral and Anthony jokes about missing the restart of garden waste collections resulting in him still having his Christmas tree in July. However, for Rebecca waste that built up in her garden and seeing a dead rat was a health concern. Like local authority actions to support litter picking, waste collection is identified by participants mostly when things go wrong.

The everyday health practices around bins and street bin culture in some ways exemplify what this research is about. It is a topic that could barely seem worthy of attention, however, there are health impacts, which can be intense, related to both semantic and latent understanding for participants.

Theme 3; neighbourly things; processual component: health practices, resisting violence and drugs

This component relates to violence and drug dealing.

Six participants relate experiences of violence all of which either happened in the street or impact upon health practices in the street (Robyn, Luke, Rania, Julia, Rebecca, Ann). Three instances were directed at other people (Robyn, Rania, Julia), one was directed at property and then resulted in an attack on the participant (Rebecca), one instance was directed at property only (Luke), Ann is a survivor of domestic violence and this affects how she uses the street. The negative health impact of these experiences is intense and long-lasting.

Participants, all women, intervene in these situations in varied ways (Rania, Rebecca, Samantha, Robyn). Robyn shelters a neighbour’s child in her house when faced with racist threats and knives by a group and this has a long-term health impact on her. For Rebecca such an action resulted in her being physically assaulted.

> …we went through a phase of gangs of children smashing the windows in my next-door neighbour's. …they were only pensioners… and they drove

> them out in the end. …I can remember going out and confronting them the one night and they all attacked me [small laugh] so that wasn't my best move.
>
> Physically attacked me… I managed to get back in the house… I was quite shaken up by it to be honest cause some of these children couldn't have been older than twelve. And my door was knocking, I'd been there maybe five, ten minutes and I didn't open it, I just said who's there, and it was one of my neighbours. And they said, "are you ok Rebecca don't worry we saw everything, we'll tell the police". So they sat there and watched me get attacked but they didn't come out and do anything. (Rebecca)

Rebecca goes on to describe the long-term lifecourse impact of this.

> …for years… I wouldn't go anywhere after dark. …as soon as it was dark that was it, my blinds'd be shut, my front door'd be locked… knowing that my neighbours have witnessed it all and not done anything, I think that's what really did it for me. Mmm. (Rebecca)
>
> In contrast to intervening Julia notes that just being in the street can be enough action to make a difference.
>
> "…this sounds really grim somebody was stabbed, and …I don't think the stabbing was as serious as it might have been because all of the neighbours came out…." (Julia)

For Rania and Samantha intervening is a normal, if infrequent, health practice which they have developed to the extent they have a set of approaches they use including assessing: the situation; if they can make a difference; whether it is safe for them to intervene; and for Rania where possible acting jointly with other neighbours.

> Ann describes the lifecourse impact on her as a survivor of domestic violence. This affects her engagement with the street and she identifies that a healthy street must account for ecologic, lived experiences.

> I was the victim of domestic abuse. So, I've moved here to move away from that situation and sometimes I think people… don't realise how important it can be to have a safe house when you move. …that goes back to that idea that there would be a block for people interacting in their street… To have a healthy street you have to have a healthy house and there are some people, for the first three years after I moved I couldn't do what I could do now which is let people know my name and where I live. It would have been too dangerous. …your concept of a healthy street is, not limited that's not the right word, or restricted, assumes, makes assumptions that everybody can walk outside their house and let their neighbours know who they are. (Ann)

Ann reflects on the importance of her front garden, "…just having that space does make a big difference psychologically…".

Drug dealing is mentioned by 70% of participants including for its impact on other health practices. For Katrin drug dealing is a normal part of the street social environment.

> … I know when the dealer comes, I know what his car looks like, I know what time of the day he arrives, and I know which weeks he will turn up. (Katrin)

For Jessica at Hoggan Street, the police only visibly act on heroin dealing after coordinated action by residents. Drug distribution networks are complex and only partly manifest at the street scale (May and Hough, 2004) therefore police action may similarly only partly be visible at the street scale. The evidence from this research is that it is not the police but mums who are the first to act at the street scale and directly confront dealers and taxi drivers facilitating the trade. Jessica notes the health impact of fear this creates especially for children living at Hoggan Street.

This component captures the impact of when people act in the totally opposite way to being neighbourly, including violence and drug dealing. These health practices of others become the street social environment for participants.

Theme 3; neighbourly things; processual component: health practices, political social

Political, democratic activism is a particular group of health practices that certain participants engage in, yet which also affects everyone on the street to some degree.

Ann is passionate about politics and irrespective of political position helps neighbours with voter registration.

> I think that's important that people have a voice. Whether they vote for the Labour party or not, that's not a condition of us helping people… I have registered Tory voters before now, yeah [small laugh] it happens... (Ann)

She notes how the street environment makes it easier or harder to contact certain groups, specifically those living in apartment blocks who are harder to physically access from the street.

Julia is an elected politician and so is directly involved in politics and campaigning, as well as the role of advocating for her constituents throughout the year. This brings a particular type of social connection for Julia which informs her views about the street.

> I guess as a councillor you do get to speak to a lot of people that you wouldn't normally get to speak to in the normal course of your life. …it's quite a privilege actually to speak to that many neighbours. (Julia)

Several participants take action in the streetscape through placing posters, flags, and printed messages supporting different causes or political parties in their front gardens and windows (Rania, Julia, Ann). This indirect form of social interaction helps to build wider social connection in the street as Ann explains.

> …you want people to feel that you're going… have empathy for people with different problems. …the NHS one… a nurse said, "I see that poster every time I walk past your house on my way to work, you know, it makes me feel good that you've done it."

Political health practices appear polarised resulting in people either being ‘in’ or ‘out’. The effect of this is unclear, arguably however such polarisation has the potential for negative health impact by diminishing the street as a social environment. This has implications for practice and health interventions such as Low Traffic Neighbourhoods (LTNs) and 15-minute neighbourhoods which have become politicised in the UK.

Theme 3; neighbourly things; processual component, latent meanings

A range of more latent meanings are reported from analysis. Being neighbourly has potential health impact both for the person conducting the practice and also the person toward whom that practice is directed. People who are experiencing the health practices of others may have little control over this which may intensify the impact. For Rebecca, the violent assault she experiences is traumatic: the lack of action by her neighbours intensifies this. For Luke the presence of dog mess is something he has little control over which compounds the negative health impact of this. In contrast the positive actions of others can have strong positive impact. As Luke identifies it is the efforts of conscientious residents that he values in his street.

Neighbourly health practices do not just happen with neighbours but with a wider group of people and can include strangers. Both form part of the norms of the street culture. Strangers can be temporarily co-opted as neighbours for the purpose of performing neighbourly health practices. In this way, considering Lofland’s three “Realms of City Life” (Lofland, 1998, p.10), this cluster of health practices can be seen to be occurring both in the street as a *private* social space, a *parochial* social space, and as *public* social space.

People have different motivations that affect how much resource they are willing to commit to doing neighbourly things. Ann sees Cadwaladr Street as her “forever community” which is therefore worth investing in. Hoggan Street and Holman Street stand out as two particularly resilient and close-knit streets where the street culture is one of neighbourliness and a very close-knit community. At Hoggan Street Jessica relates this to social class. At Holman Street, Aisha relates this to a shared ethnic and religious identity through her Welsh Somali and Muslim identity.

Theme 3; neighbourly things; other processual aspects

Other aspects identified to do with how the processes in this theme operate are: the street culture, a sense of community, practices as projects, and the actions of public bodies.

Taking these in turn, street culture influences health practices: fly tipping compared to leaving out un-needed items are health practices that are spatially somewhat similar: it is then the intention and street culture that defines which is viewed as neighbourly and which un-neighbourly.

Neighbourly health practices are linked to the creation of an overarching sense of community. This sense is separate to the individual practices and relates to the culture and norms of the street, such as being a helping street and a friendly street (Gus, Aisha, Jessica). No street in the research completely lacks a sense of community however some were identified by participants as having a particularly intense one.

Like being in green space and nature, in this theme several health practices were very big and required substantial commitment from participants. There could be future research potential to apply personal projects analysis to these. Some were so significant that they in fact turned into paid employment or formal volunteering (Rania, Robyn, Gus, Rebecca, Jessica, Samantha).

The actions of the Local Authority when mentioned are mostly negative. Some positive aspects identified were related to refuse collection services. Participants actively seek to distance some health practices (e.g. planters) from being related to the local authority as opposed to a community-led initiative. The local authority supports litter picking initiatives and this was a positive health practice for a number of participants but they did not mention the local authority's role in this. Police are present in several situations, usually after an event such as violence. Police are notable in relation to drug dealing by their absence at a street level, so far as participants observe. At Hoggan Street it was noted that it takes large, coordinated community effort to get police a response to drug dealing.

Theme 3; neighbourly things; theme health impacts

Key health impacts under the theme of neighbourly things to do are:

- Mental health: particularly related to litter and fly tipping being negative, but then positive action through litter picking health practices;
- Chronic stress: as experienced by Luke which he describes as not being able to be carefree and relaxed in the street;
- Mental and physical health, and injury: related to drug dealing and related activities: mental health, worry about violence (Beth), children terrified (Jessica); and
- Overall health: related to employment and satisfaction in looking after things in the street.

Theme 3; neighbourly things; theme ecologic and population group aspects

There are a set of experiences and health impacts related to violence and relationship breakdown that affects women and mums in the sample with strong intensity and across the lifecourse. The impact of trauma on how people use the street environment is an important finding. There are many positive health practices in the street too, some that emerge from experiences of trauma. Some practices become large projects, even providing employment, and are ambitious in their scope.

It is also noted how the street population evolves over time such as children of a similar age growing up together and in this way the street itself can be said to have a lifecourse.

Theme 3; neighbourly things; theme Covid-19 impacts

Key impacts of Covid-19 on neighbourly things to do are:

- Increased swapping and sharing health practices;
- Waste: negative fly tipping, burning of waste. The impact on waste of Covid-19 such as incinerating recycling (Andrew *et al.*, 2022);
- Loss of neighbourly support, face-to-face contact not possible, technology such as WhatsApp groups, such as for swapping home school ideas, becomes more important.

Theme 3; neighbourly things; theme street physical environment characteristic links

Street environment characteristics identified as closely linked to neighbourly things to do include:

- Dead end / cul-de-sac: related to fly tipping (Katrin, Robyn);
- Spatial restrictions / opportunities on neighbourliness: flats, care home-related to voter registration / political canvassing / mutual aid (Ann); small streets with increased neighbourliness (Scott);
- Having a front and back street (Abdi): changing health practices;
- Tenure (Mabon): related to ability to improve front garden;
- Common stairwell (Ima): lack of control, unsafe; and
- Common front garden (Ima): lack of control, negative heath impact of landlord.

In this analysis it was identified that participants refer to the negative health practices of others as part of their wider street environment, like a fixed part of it. Drug dealing is the most common example of this. This is an important finding and a formative stage in the analysis which has identified that the health practices of others become the street social environment for participants and visa versa. This finding is discussed further at Chapter 4.5 Ecological Pathways to Health Impact).

Theme 4: the streetlives of children, parents, and adults

Theme definition

This theme is about health practices that involve children. It is about children, parents and caregivers, and the relationships adults have with children and youth. It includes lifecourse aspects such as memories of childhood and the impact children can have even on adult strangers, so not just children and parents / caregivers. It is not a theme about children as a population group but rather the health practices identified through analysis under this theme.

It is a limitation that key actors in this theme (children under 18 years old) were excluded as participants therefore the data represents adult perspectives on this theme. For this reason and practical considerations this theme is reported only as a summary and highlighted as an area for future research. Nevertheless, this theme is identified as important for adult health. In a sample that did not include children, their influence is so intense that it manifests in the lives of many different adults. The components for this theme are shown in Figure 61 below.

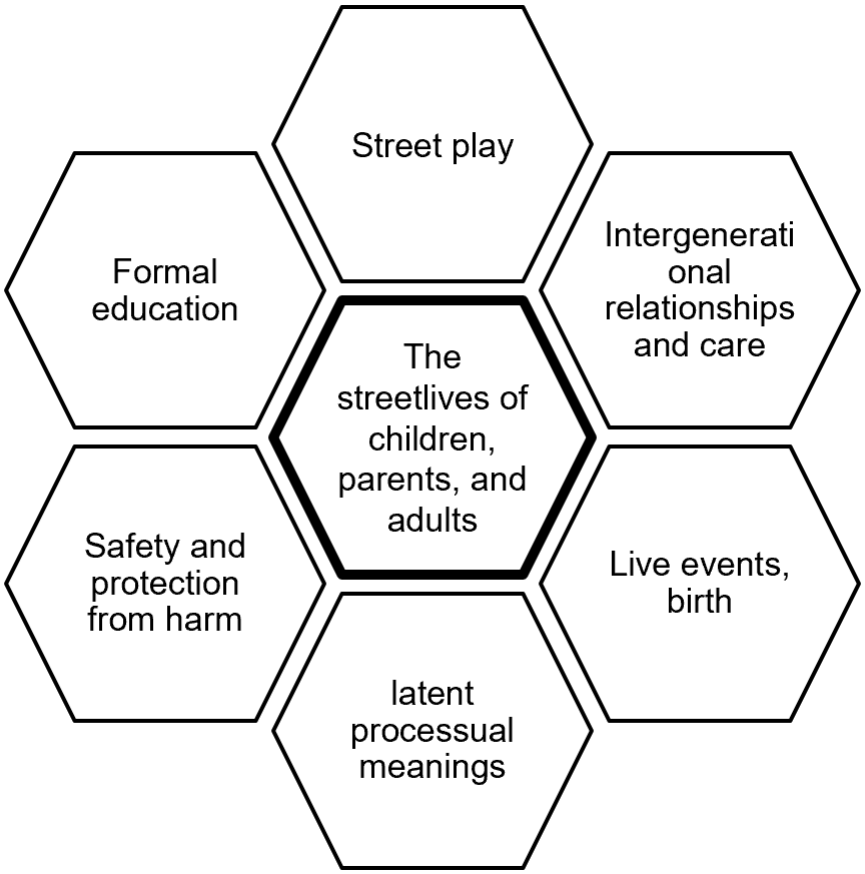


Figure 61: Processual components, theme the streetlives of children, parents, and adults

Theme 4 streetlives of children and adults; processual component: health practices, street play

This component relates to children playing in the street. Jessica identifies what matters to children: going to the park, doing creative activities, exploring, and learning new things. Street cultures vary, in Hester Street Julia thinks it is sensible that children are not seen playing: Jessica identifies it would be “quite worrying if you don't see a child” in Hoggan Street.

Theme 4 streetlives of children and adults; processual component: health practices, intergenerational relationships and care

The role of children in the lives of adults is a key component in this theme. This component reflects the importance in adults’ lives of children including the caring relationships between them (Robyn, Luanne, Julia, Gus, Jessica). These reciprocal caring relationships, especially for adults not living with children (Robyn, Luanne), were materially negatively impacted by Covid-19.

Theme 4 streetlives of children and adults; processual component: health practices, life events - birth

Many health practices are associated with birth as a life event. For Luanne as a new grandparent and Luke as a new parent these health practices that might otherwise have happened privately inside their homes now moved into the street due to Covid-19.

Theme 4 streetlives of children and adults; processual component: health practices, safety and protection from harm

For Jessica the role of an adult is keeping children safe from harm. Her children are terrified by the drugs and potential for violence that has recently manifest in Hoggan Street. This has a negative impact on mental health and potential for physical harm. It was children who assaulted Rebecca outside her home and this had a long-term negative impact on her mental health as well as physical injuries.

Theme 4 streetlives of children and adults; processual component: health practices, formal education

This component relates to formal education and childcare at school or nursery which is the cause of travel to school (Katrin, Paul, Jessica, Scott). Gus thinks walking to school is great. Doing this by cycling however has intense negative health impact for Luke due to the safety concerns arising from drivers of motor vehicles. Samantha notes negative health impacts from the closure of alleys which make the journey much longer and she observes in others this being a cause of significant stress.

The intensity of these health impacts for participants is found to derive from this being a health practice *with* children. This is what intensifies the pleasure that Julia and Robyn get from walking children to school and the negative stress and fear for Luke for his own children.

During Covid-19 schools in Cardiff were closed for extended periods with children being home-schooled (Appendix 10 maps this against the timing of participant and street observations). The street would appear to be a logical extension of the home school learning environment but was not found to be so and is notable for its absence in observations. No examples of home-

schooling as a norm (not due to Covid-19) were included in the sample. People who home-school should be considered in future research as an identifiable population group, both children and adults, who may experience different health impacts.

Theme 4 streetlives of children and adults; processual component: health practices, latent meanings

Intergenerational relationships is an important latent meaning identified, particularly the value that participants place on these health practices which appears to intensify these impacts. Cultures in the street related to children are also more latent: where children are expected to be or not welcomed.

Theme 4 streetlives of children and adults; other processual aspects

Other processual aspects include:

- Temporal: school termtime and Covid-19 restrictions on schools being open;
- My Street: Ima's definition of My Street is defined by where she is happy for her children to play;
- Community expertise: several participants demonstrate deep knowledge and expertise of facilitating play;
- Adolescents and youth: were not participants and adult perceptions toward this group of older children are mostly negative.

Theme 4 streetlives of children and adults; theme health impacts

Key health impacts identified under the theme streetlives of children, parents, and adults include:

- Mental health: negative impact from stress of cycling on school run, mainly related to driving of others;
- Mental health: positive impact from caring relationships and children's health practices in the street;
- Physical health: walking to nursery several times a week;
- Physical health: negative impact for children due to removal of infrastructure at sports pitches.

Theme 4 streetlives of children and adults; theme ecologic and population group aspects

The theme is very connected to other themes. Lifecourse aspects include: growing up in a street over time (Abdi) and change over time linked to the impact of a whole street moving at once (Abdi), the street population having a cyclical lifecourse. Population groups identified in this theme are: children, parents, and caregivers. Differences between groups by educational setting should be considered in future research (e.g. school setting / home-schooling).

Theme 4 streetlives of children and adults; theme Covid-19 impacts

Covid-19 has a major impact on this theme and health practices in the street. This includes for a variety of reasons including school closures and restricted social interactions which negatively impact not just parents and children but important intergenerational health practices also.

Theme 4 streetlives of children and adults; theme street physical environment characteristic links

Key characteristic links under this theme include:

- Dead ends / cul-de-sacs;
- Being on a main road;
- Car parking / play conflict;
- Design for play;
- Closing alleys / gulleys; and
- New development.

This theme is not a theme about children as a population group but rather the health practices identified through analysis under this theme. No children were included as participants which is a limitation, therefore this theme has been reported in summary and highlighted as an area for future research. Nevertheless, in a sample that did not include children, their influence is so intense that it manifests in the lives of many adults.

Theme 5: getting everyday necessities done in the street

Theme definition

As identified in the chapter introduction (Figure 57) the next two themes presented are *semantic causes and consequences* in contrast to those presented so far which are *big latent* themes. They are important however because they relate to things that people to some degree *must* do and are enablers of the preceding themes.

This theme is focused on everyday necessities in the street. Necessity means here that there would be some practical or punitive repercussion of not doing them: for example, to eat people need to get food, dog owners are expected to care for them. Certain processual components reported already in other themes can be argued to have elements of necessity (bin culture, moving practices). They are not repeated here but the link to this theme is highlighted. It is reiterated that ecologic complexity is recognised across all themes. What places a component in a particular theme is the interpretation of observation data, in other words, what was most important for participants. The components for this theme are shown in Figure 62 below.

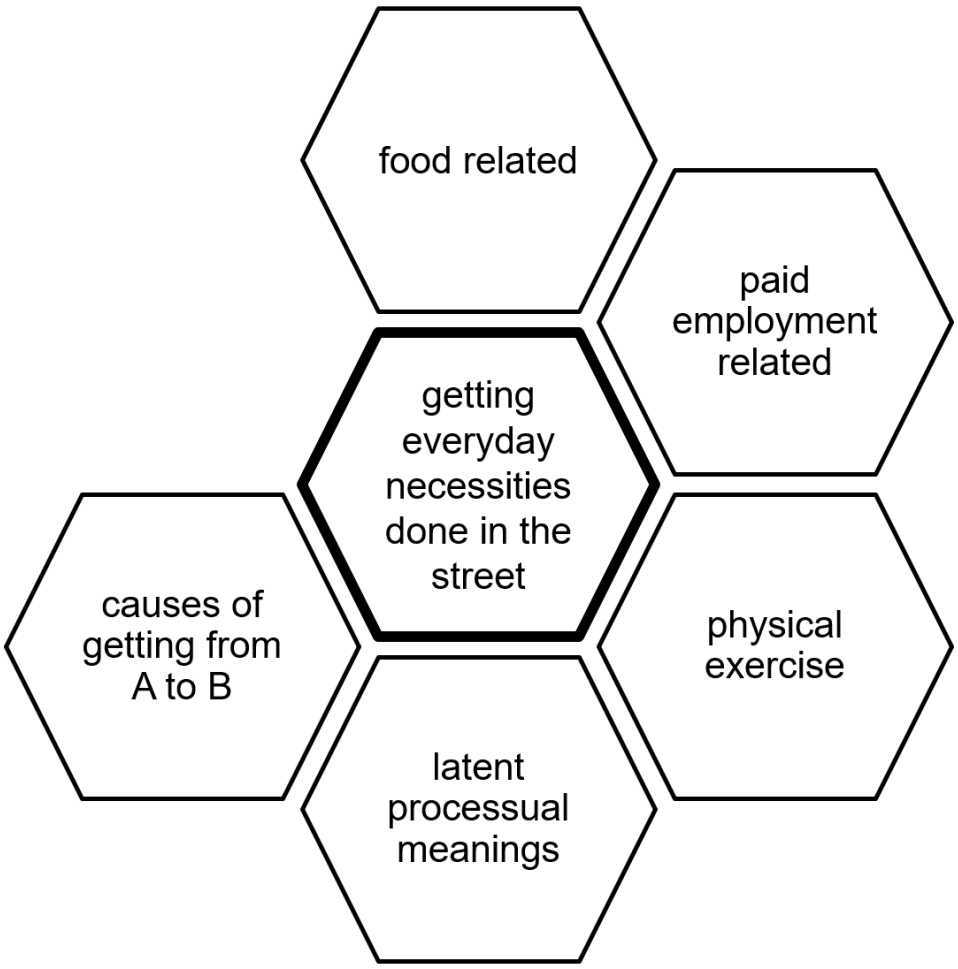


Figure 62: Processual components, theme getting everyday necessities done in the street

Theme 5 everyday necessities; processual component: health practices, food related

Food related necessities in the street are varied. They include going to the local shop, which in some cases is on the street or are the cause of starting a journey in the street. Food may also be delivered to the street (Luke, Scott). Health practices extend to distributing food to reduce food waste or even running a street foodbank. Covid-19 significantly affected these health practices.

An everyday health practice for Luke, Beth, and Aisha is going to the local shop for groceries. Local shops are part of the street social environment. At Kinsey Street the shop owner is “the

fulcrum of the street" (Gus) and they are part of a sense of belonging: no participant relates supermarkets to a similar sense of belonging. For Aisha they are the shops "I've been seeing since I was young… the same shopkeepers" and these shops are important to her for religious and cultural reasons, "we have the halal butchers there… it's tailored to our needs and what we want".

Some participants go to the supermarket, a health practice that starts in the street. Some try to downplay their supermarket shopping, "I don't really like going to big supermarkets but I do" (Beth). Supermarkets are linked to doing a large shop which participants then link to driving, "I have to drive, because carrying the stuff" (Luanne). For Shiva this determines that her husband does the food shopping because he has the car mainly for running his small business. The meaning varies between people however, during Covid-19 lockdowns when going to the supermarket was one of a limited number of legal reasons to leave home Anthony went to lots of different ones for a change. Ann thinks she is not typical when she says, "if I never had to walk into one of the major supermarkets again I'd be happy", she relates this partly to her street-based health practices of growing food and other non-street based ecologic reasons including participating in a community allotment, a food cooperative, and being vegetarian. Scott also has "*no* desire to go back to the supermarket" but this is not related to where the food comes from but rather because he has a delivery to his house on a Tuesday morning, a physical manifestation of the supermarket in the street.

Robyn currently lacks space for chickens and is keen to find space for this through a community garden on the street to keep them for eggs. Distributing excess food such as to reduce food waste is something Rania did on her street, Luke regularly travels from the street to collect excess food from a local shop, a digital app service enables this health practice. Some food growing happens in the street however this health practice is mainly interpreted as related to the themes of being in green space and nature and of the street as a social space for people. Food production at sufficient scale might be a practically limited in the street, such as for Ann, it requires more space which she has at the community allotment. Cultivation space can be accommodated at the street-scale, Robyn and Jessica are aiming to do this in street-based

community gardens. In both these cases the actions of the local authority in their role as landowners are found to have materially restricted these health practices from happening.

Food banks might normally operate at a neighbourhood scale; however Hoggan Street has created its own street food bank just for residents (Jessica, Samantha). This health practice crosses over closely with neighbourly things to do, a specific part of it relates to food access.

Food related necessities in the street are varied and not just limited to provisioning. Local shops and other activities play an important role in the street social environment and the value of these to participants is ecologic. Covid-19 significantly affected these health practices.

Theme 5 everyday necessities; processual component: health practices, paid employment

This component relates to the health practices that arise from paid employment and formal learning by adults. It is a process that most participants identify with one code label particularly: work, going to, including working from home, being made redundant, going to training course, student studies, travel for work (77% women / 71% men).

This component is not about all work, which would include unpaid work and it is important to identify that volunteering as a health practice is differentiated in the sample by gender (62% women / 14% men). This paid employment component includes employment as a workplace location and / or as a source of income. No informal or shadow economy activity was identified directly by participants, for example drug dealing.

Luke, Scott, and Robyn worked from home before Covid-19, “I've been working from home for a long time, so lockdown wasn't much of a change” (Robyn). Whilst not commuting, for face-to-face meetings this does require Robyn to pass through the street. One of Robyn’s main work activities is creating a community garden in the street. Other people’s route to work informed Robyn’s placement of a planter in the street, “I know it's lots of people's route into work and into their jobs so we put the planter [there]”.

Ima's household car is her husband's work vehicle as a taxi driver. It is parked in the street and also used for household activities. Covid-19 had an intense impact on her husband's work and concern for the family using the car.

> [sighs] he was so desperate, he was so [.] hopeless, it was so difficult for him through the beginning of Covid but he got through it and he's doing well now. Trying to. (Ima)

Like Ima's husband there are groups of people whose work as a health practice does not happen a lot in their own street but is intrinsically linked to street environments. Health visitors were in Ashley Street several times for the purposes of checking Scott's new baby. Field observations highlighted roles, especially caring professions, as requiring health practices to be undertaken in the street including in response to Covid-19, such as needing to put PPE on in the street or disposing of a bucket of cleaning water.

As a social prescribing link worker, working from home during Covid-19 was a large change for Rebecca both professionally and practically. She saved time commuting however her role which includes dealing with traumatic situations requires professional peer support and this now happens online and access to outdoor space is important for her mental wellbeing when working from home.

Other health practices related to work mainly start in the street but do not fully take place there. This includes going to a workplace (Paul, Abdi) and car share pickup for work (Katrin). Commuting links to other themes and health practices like taking children to school, this affects parents and other caregivers.

The portion of these commutes that happen within the street is small but still present. Abdi provides an example of how his mental state differs depending on the different jobs he has been doing.

> …when I was at [engineering company] I used to leave in good time, get there early… however at [bank name] I was more of a last minute person so I'll be walking really fast because it was on the dot, it was not flexi, I had to

> be there at eight o' clock so if you saw me at seven fifty something I would be walking extremely fast not looking left or right [small laugh]. (Abdi)

From this it is argued that an influence on health practices in the street can arise from health practices that are largely conducted away from the street. This also is an example of why methods of gaining participants' understanding was important as what Abdi describes could not have been accessed just through researcher observations in the street.

Theme 5 everyday necessities; processual component: health practices, physical exercise

This component is about intentional physical exercise. What is important is the inequitable access to space for exercise such as women only spaces and the absence of physical exercise in the street environment.

Physical exercise for some participants is an activity that happens away from the street. This is a cause of travelling through the street to those places of exercise, it is also notable for the relative absence of physical exercise practices in the street. Going to the gym (Anthony, Gus), exercising in the wider neighbourhood, and going to a Park Run or a running club (Anthony, Luke, Gus) are all things that happen away from the street. During Covid-19 when Gus' gym closed he did not move his exercise into the street but rather the back garden away from the street. Gus' interview in August 2020 is the first day his gym at the local leisure centre has opened since March 2020. This highlights how long Covid-19 restrictions affected access to facilities such as gyms beyond initial stay at home restrictions which first ended during May 2020. Indoor gyms, swimming pools, spas, leisure centres, and children's indoor play areas were not permitted by Welsh Government to reopen till August 2020. Aisha highlights the unequal health impact on her due to a lack of indoor exercise facilities and women only spaces during these restrictions as well as more generally. She describes running around the shared courtyard area at her maisonettes at night.

> me and my aunty and my cousin... We just ran around, did circuit training and stuff there… because of religious reasons because of our clothing we were doing it at night so if it was a closed area we wouldn't have to think

> about that but because it's an open space… we were doing it when it was out of hours because… we cover or we dress in a certain way and we do that for a reason… to maintain our modesty and to feel safe at the same time… there was three of us… we were literally just jogging around the sheds. (Aisha)

During field observation at Simpson Street in June 2020 a group of neighbours were identified doing a daily dance exercise class in the street as a new health practice resulting from Covid-19 lockdowns. Participants did not identify such health practices however and there is surprisingly little evidence in this research for physical exercise in the street. Similar to home schooling, physical exercise health practices during Covid-19 lockdowns are notable for their absence.

Theme 5 everyday necessities; processual component: health practices, causes of getting from A to B

The components in this theme are often the cause of journeys which in turn are the health practices in the theme, getting from A to B in the street. This component comprises all the other causes of journeys not included in the preceding components. It relates to their more direct and semantic role necessitating a journey rather than as more latent health practices. These practices have their start in the street and most continue beyond the street.

Practices identified include dog walking (Rebecca); walking to a dog groomer (Rebecca); participants being negatively impacted by other people walking dogs (Ima, Ann) due to fear or allergy, “I'm really scared of dogs. And I don't like being in dog shit… it's not the dogs' fault. …the streets are probably cleaner than the pavements… And if I'm on my bike I can outrun a dog…” (Ann). Other health practices are: going into town (Mabon, Scott), notably absent during Covid-19; going to the library as a hobby (Shiva), absent during Covid-19; going to the barbers (Anthony); the school or nursery run (Katrin, Luke) as an everyday necessity, mainly addressed under the streetlives of children theme but can also be considered a necessity; shopping in another city because unable to get necessities in Cardiff, Aisha goes to Birmingham for Islamic clothing.

Overall, the materiality of these practices in the street is small but they are necessities in different ways for each person. Dogs exemplify this in that it is a necessity for dog owners like Rebecca to care for their dogs whilst at the same time the potential presence of *any* dog in the street directly causes Ann and Ima to change their health practices.

These health practices are the causes of someone being present in or moving through the street. There are implications for practice from this both considering the diversity of health practices and their differential impacts across groups.

Theme 5 everyday necessities; processual component, latent meanings

Even in a mainly semantic theme there are latent meanings. An initial observation of some participants (Katrin, Rania, Aisha) is that they don't do much in the street. This reflects how people do not think about the street as a setting for their health practices. This view is related to necessities as these are sometimes the first thing people consider when asked what they do in their street.

Mabon observes Chamberlain Street is "a handy street" which encapsulates the concept of what a health supporting street might be when it comes to necessities – one with local shops and amenities like the doctors' surgery which is important for Mabon with long-term health conditions. There would arguably therefore be unequal health impacts where these facilities are not available. This has relevance for practice such as considering approaches to walkable neighbourhoods such as proposed in the 15-minute city concept (Moreno *et al.*, 2021).

Theme 5 everyday necessities; other processual aspects

Other aspects of how these processual components operate include the overlap of street and neighbourhood scales. Going to the local shop as a street-scale based practice or a neighbourhood-scale based practice varies by where the shop is located. Gus, Luanne, Paul, and Katrin all have shops on their street but not all use them or include them within their definition of My Street. By contrast Jessica and Mabon's definition of My Street is extended to include their local shop. There is consistency of motivation around perceived importance of local shops as part of the social environment at both scales and in contrast to supermarkets.

Micro-aspects of health practices are particularly identified within this theme which may be linked to the frequent repetition of them, such as precisely where someone walks in the street or a specific time-based routine. These micro-aspects are therefore both spatial and temporal.

Tools or aids form part of these health practices, for example, Mabon has made a special trolley to move bigger things into his house allowing him to incorporate walking into his health practices whilst managing his health conditions and living in a terraced house with a narrow front door. Ann uses a bicycle trailer as a tool to support her health practices as she is disabled by the street environment.

Theme 5 everyday necessities; theme health impacts

Clear patterning of health impacts was not identified under this theme. This may be related to participants describing these health practices more for their practical utility and not directly linking them to health. That is not to say there is no health impact from these. Individual impacts such as fear of and allergy to dogs were identified. Other impacts identified were: the health benefits of not commuting; impact on women's health due to a lack of spaces for physical exercise and this inequality being increased during Covid-19; and the health impact of health visitor services for new-born babies and mothers. For health practices that start in the street but are mainly done elsewhere the main health impact is at those other locations such as the gym and not therefore street-based. The health impacts of mode of travel are not included in this theme. Participants with pre-existing health conditions (Mabon) or who are disabled (Ann) focus more on how they adjust their health practices to complete everyday necessities.

Theme 5 everyday necessities; theme ecologic and population group aspects

Ecologic aspects identified within this theme include:

- Multi-stop journeys: such as for Katrin who does the school run but only if also driving (not getting a car-share lift) to work;
- Supermarket shops: being linked to doing a big shop and therefore undertaken by car (Gus, Luanne);
- Local shops: being linked to doing a small shop or even just a pint of milk and therefore by walking. (Gus, Luanne)

- Local shop social role: these shops are particularly linked to being a social setting. (Beth, Gus)

Whilst not quantified through this research, understanding of the ecologic causes of journeys such as for Katrin adds to understanding to address health inequalities including gender-based ones. For example, women are more likely be responsible for home-making, childcare, and shopping, whilst also being in paid employment, and this results in women making more multi-stop journeys compared to men (Greed, 2016).

Many of these health practices form daily routines and participants notice change over time, such as Beth recalling “in the good old days”. Changes in health with age can impact on health practices over time too such as Mabon experiences.

Theme 5 everyday necessities; theme Covid-19 impacts

Covid-19 affects many of these necessities of everyday life. For example:

- Working from home: for some people this is a large change, for others it is not. It is distinctly in contrast to pre-Covid-19 approaches taken by organisations, for example Luanne was made redundant prior to Covid-19. This was after she had requested flexible working part-time from home. Months later organisations have mandated employees only to work from home.
- Retail: there is a major impact on activities related to shops and shopping including what is considered as essential or non-essential by Welsh Government.
- Indoor exercise facilities: as identified have been closed for extended periods negatively affecting all users and with an unequal negative impact on women.

Theme 5 everyday necessities; theme street physical environment characteristic links

Key street environment characteristics linked to this theme are:

- A safe place for deliveries, such as a veg box (Luke);
- Micro-scale aspects such as which side of the street people walk on;

- Street shops: the presence of a shop on the street;
- Doctors' surgery: the presence of a doctors' surgery on the street (Mabon);
- Presence of small industry (Robyn): which provides opportunities for different health practices than exist on most other streets;
- Parking: availability (Ima) including for husband's taxi.

Theme 6: getting from A to B in the street

Theme definition

This theme is about health practices that involve mobility and moving around. It focuses on all modes of movement as health practices. It includes not just the movements of participants but of other people in the street too. It is different to other themes because it is not focused on the health practice that causes the need to move but rather the movement itself – cycling, walking, mobility “scooties”, horse and cart as a health practice. The components for this theme are shown in Figure 63 below.

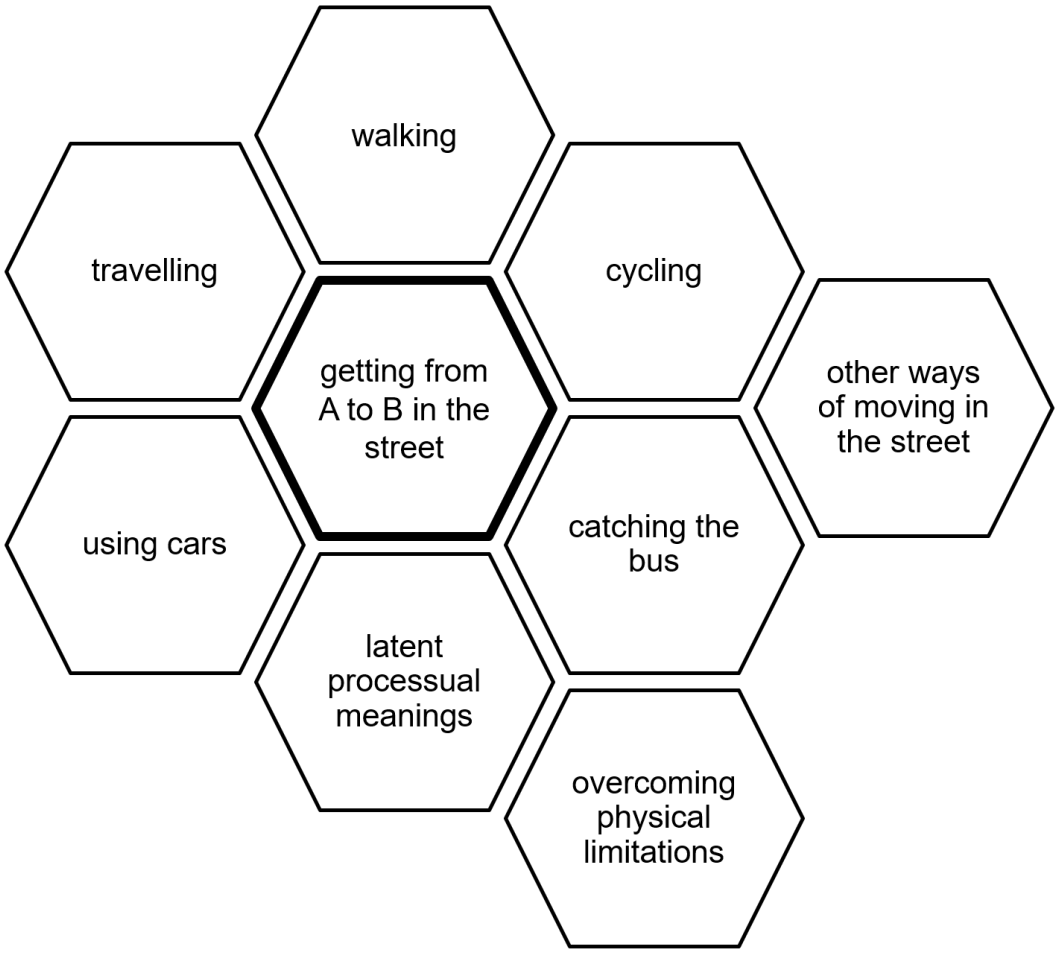


Figure 63: Processual components, theme getting from A to B in the street

Theme 6 getting from A to B; processual component: health practices, walking

Walking in the street is a health practice identified by most participants. Much walking is related to health practices in other themes that *cause* the participant to be walking.

For some people, walking to local places is the norm (Anthony, Mabon, Julia, Rebecca, Paul, Gus) but some people actively avoid walking (Katrin, Ann). Katrin is “not a good walker” by which she means a health condition limits her walking though she does not describe herself as disabled. Ann who does describe herself as disabled notes that “the pavements are rubbish if you haven't got very good balance” which combines with an intense fear of all dogs to mean Ann also avoids walking.

There are specific health practices associated with walking, for example, Abdi often listens to music and is in his own space when walking. This is partly related to the negative street social environment of drug dealing and the “concrete jungle” of his wider area that Abdi has tried to get the local authority and police to respond to but has now given up trying to change. The negative social environment is part of the norm and Abdi adjusts his health practice accordingly.

> …tunnel vision… you're not looking left or right. You're not even analysing your surroundings… you keep on walking, you get accustomed to it.
>
> I more or less become accustomed to it so I no longer had any feelings towards it. I *accepted* the fact that it was there because of numerous campaigns and… community patrols…, but you end up just becoming desensitised from the situation and that's why… I said just become tunnel vision and you just see it as a normal thing. (Abdi)

Abdi is the youngest participant (18-30 age group) and walking is an important social activity with his friends who often meet at his house to walk together and socialise. Due to Covid-19 however Abdi has been going for walks more on his own.

Short distances are more common but several participants walk long distances starting in the street (Paul, Luanne). One reason Luanne moved to Cardiff was for hill walking in the Brecon Beacons and she also joins the Ramblers group doing city walks of up to six miles in Cardiff.

This comes down to the street scale through a processual chain: she met a neighbour through her front garden health practice of greeting people, the plants she has grown prompted a conversation, and after talking she describes how she took her neighbour on a long walk as they had not experienced this before and were interested to.

Beth (a white British woman) and Aisha (a Somali Welsh woman) describe health practices related to walking and personal safety. Beth has increasing anxiety about safety, Aisha has safety concerns, particularly as someone who wears Islamic dress. These concerns impact on Aisha and Beth's health practices: Aisha avoids walking after dark, and Beth is increasingly nervous when walking.

Theme 6 getting from A to B; processual component: health practices, cycling

Most participants identify cycling as a mode of movement. The causes of cycling (health practices in other themes) include cycling for leisure (Robyn) as well as getting from A to B (Rania). Julia does not cycle regularly and identifies the speed of traffic as a key reason for this. Rania views cycling as a means to get from A to B and does so regularly, "I must have cycled about four thousand, five thousand times up that street." Both Rania and Robyn identify how interactions with other people are enabled by cycling.

> ..funnily enough on the bike one of the things that happens is you… say hello to people. (Rania)

Ann extends the things she can do when cycling by using a cycle trailer which allows her to move larger quantities of things.

> …it's really good for neighbourly stuff because if somebody's got a water butt they want it [thumps table] shifted and if I have to race to find a friend with a car who can do it, it's gone. But I'm like, oh I'll be there now [small laugh]! (Ann)

Learning to cycle is an important aspect of cycling that is undertaken in the street for several participants both for their children (Katrin, Luke) and as adults (Aisha). For some people they are consciously part of a cycling culture. This is manifest in Cadwaladr Street through Ann's

front window display, “I'm a cyclist, British Cycling stuff is up.” For Aisha cycling is also about accessibility in several dimensions including as a Somali Welsh woman wearing Islamic dress.

> Doesn't matter what you think a cyclist looks like so it's trying to tackle some of those barriers and misconceptions and it's literally about convenience because I'm saving money, lots of money on buses and taxis when I'm cycling everywhere. (Aisha)

Unlike car storage, bike storage is more directly pragmatic. Bike storage is a problem in different ways related to the street environment: for Luke in a terraced house with a small front yard and no on-street storage; for Ima in a house of multiple occupation; and for Aisha in a maisonette. At Legall Street where the houses have larger gardens bike storage is not a problem for Shiva and similarly for Mabon who lives in a terraced house with his wife and therefore needs less space for storage. Rebecca and Anthony own and store a bike at home but do not ride it. Aisha makes use of bike rental and there are several stations near to her home. Ima previously lived in The Netherlands which in urban design practice is held up as an exemplar of cycling infrastructure.

> the only thing I miss about Holland it's safer to cycle in the street and you have your own path for cycling, your own stop light for cycling, and even if you going for a long distance it's quite safe. (Ima)

There is more than this semantic meaning however, the latent meaning is that cycle lanes are the *only* thing that Ima as an Arab African immigrant would bring from The Netherlands where she experienced problems not being permitted to access education due to language regulations. In Wales Ima has better access to education but misses cycle lanes.

Theme 6 getting from A to B; processual component: health practices, catching the bus

Most women participants and one man identify bus travel as important and this is a difference observed by gender. There is a particular culture to catching the bus and travel by bus has been impacted more than some other modes of movement by Covid-19. For Ann there are certain people she would see on the bus who she hasn’t seen since before the Covid-19 pandemic.

> I've got a bus pass and a railcard cause I'm disabled. But… I've only been on public transport once since March. I don't really consider it particularly safe at the moment. …I miss the interaction with other people: waiting for the bus, on the bus, there's a whole little community of interest. …I miss that actually, I hadn't thought about that. (Ann)

Mabon has also avoided buses due to Covid-19. Rebecca provides a contrasting case, she has used buses a lot in the past but uses her car, “I can definitely get anywhere in Cardiff without a car… The transportation is really good. But I love my car.”

Theme 6 getting from A to B; processual component: health practices, driving and using cars

Nearly all participants drive a car even if they do not own a car and other people’s driving practices affect the street social environment.

Anthony will walk to church but if it is a day when there is a shared lunch he will drive to take food. For Luke in his previous employment driving was an unthinking choice, “I think maybe it was just easy?”. Anthony’s walk to work as a doctor at the hospital is short but he often drives noting “I'm not good in the morning's… [small laugh] I'm not a morning person”. Katrin has a car-share so gets picked up in the street by a colleague sometimes.

Some participant’s mobility health practices are explicitly defined by *not driving*. Robyn uses tools such as a trolley and bicycle to move larger things, Ann and Mabon choose not to drive informed by their view that the norm in a city should not be to drive.

> …I don't think people should run cars if they live within a mile of a city centre and the public transport network to the world. (Ann)

> …we're half-way people, we're vegetarian, we haven't got the guts to go vegan that's the thing. …until two years ago we had a car but we did have a very eco-friendly car… we got rid of the car and now we walk, we bike, or we take the bus… (Mabon)

In contrast Rebecca who *loves* her car, she notes it creates a sense of “total freedom” which is partly linked to being able to visit friends and family. She relates her car to her health and it “…definitely improves my wellbeing, being able to have access to a car.” For Anthony it is not so much driving as the car itself as an object that gives him a sense of satisfaction, “I don't wash it enough, but I do wash it, I'm always pleased it looks more shiny.” These meanings have important implications for practitioners who might, for example, wish to encourage use of different modes of mobility.

For most participants who drive it is their own private car. Rania sometimes rents a car. Separate to driving, car parking has its own health practices. It is the norm to park in the street, including on private front driveway space as well as on the public carriageway. Due to the typology of streets in the sample parking is mostly on the carriageway. Car parking can be an extension of household storage (Luke) which is an example of how distinct the health practices of parking and driving are.

Parking health practices include parking generally (Katrin, Gus, Luke); parking a rental car (Rania); other people parking on the pavement (Anthony); students parking to attend university (Anthony, Shiva); parking practices conflicting with play (Aisha); parking “the Bongo” campervan (Jessica). Parking practices are highly structured and reflect norms in the street at Ashley Street, and Scott will move his car, including at night in the rain, to allow a neighbour to park directly outside their own house. Anthony has a private driveway at Beddoe Street meaning he can offer the space to a colleague to attend a university course nearby.

Health practices associated with car maintenance also happen in the street, this links to helping neighbours (Jessica) and car washing leads to social interactions for Anthony.

Some motor vehicles related to paid employment are also stored in the street. This is a need that can be linked to identifiable population groups: Ima’s husband as a taxi driver; Shiva’s husband running a pizza shop; and Rebecca’s neighbours including a florist and removals company worker. For two women, Ima and Shiva, their husbands drive the household car for work so driving is not an option for them. For Ima this affects how she travels to school with her children.

Several streets within the study are within walking distance to venues for major events in Cardiff and both Gus and Katrin notice the impact on their streets which are used for free and cheap parking with a negative impact on them.

Theme 6 getting from A to B; processual component: health practices, travelling

This small but material component is the health practice identified of travelling for its own sake. Travelling was completely stopped at a whole population level during the Covid-19 pandemic including due to stay at home lockdowns and restrictions on international travel. Travel is something Ann greatly values and has not done since before the Covid-19 pandemic. The latent link to the street environment is that every journey for Ann starts from Cadwaladr Street.

Theme 6 getting from A to B; processual component: health practices, overcoming physical limitations

Katrin and Ann both use cycling as a mobility aid although neither describes it semantically as this. Mabon uses tools like a trolley to enable him to do more by walking with his existing health conditions. Both Ann and Katrin use cycling to overcome the obstructions that exist for them in the street physical environment. In Katrin's case this is a health practice specifically to avoid serious injury which she has previously experienced.

> So one was ten stitches up there. The other one was a front tooth gone, it's still there but it's dead, a dead tooth, I have bitten through my bottom lip and I have got, that scar tissue you can still feel. …But that's something to do with me and my physical abilities rather than the street [laughs]. But if… there is something wrong with your mobility it's not a good street to be on. (Katrin)

Self-blame regret is noted here as previously for Beth (see Chapter 4.2). What is identified is that two women, Beth previously and Katrin here, who experience intense negative health impacts from the street physical environment blame themselves. An alternative interpretation, but not one applied by participants during observations, is that the street physical environment is the problem, that the local authority has duties in relation to these spaces including to address equality (*Equality Act*., 2010), and that Katrin and Ann's human right to the "highest attainable standard of health" (World Health Organization, 1946, p.1) is being obstructed. This is a clear

example of participants recreating the street environment using their health practices: Katrin and Ann redesign their health practices around the negatives of the street physical environment.

Older adults on “scooties” (mobility scooters) are noted by Ann who observes that this group is excluded from fully participating in the street or doing what they want there. For Ann this is a norm: certain groups are excluded in the street. This has relevance for practice as inclusion is key to creating healthy streets.

Theme 6 getting from A to B; processual component: health practices, other ways of moving in the street

The health practices of movement by others in the street becomes the social environment for participants. A range of different modes not already reported are identified:

- Horse and cart (Julia) youth riding;
- Off road bikes (Julia, Ann) youth riding;
- Deliver drugs by bike (Julia) others riding;
- E-scooter (Julia) others riding; and
- E-bike (Rebecca) considers getting for herself due to hills.

Julia observes these as neutral health practices by others in terms of the impact on her. She does however highlight concerns about safety for riders of off-road bikes; the lack of space for youth, particularly boys, to play in the city; and the potential risks for pedestrians from e-scooters. Julia is frightened for the boys.

> I think it's frightening for them… in a city what young boys do is *really* visible, as are all their risk taking, the mischief they get up to. And their opportunities for mischief are really limited. …it's very public isn't it, so they've got their hands on these bikes and just as soon as they get on them everyone reports them [small laugh]. Suppose that adds to the excitement… and… it's a public safety thing. (Julia)

An apparent tragic example of this processual component, including the involvement of police, is the death of two boys, riding an e-bike in Ely in Cardiff which is within the sample area in June 2023 (Pigott and Fairclough, 2023).

Whilst Holford Street is relatively flat along its length, the surrounding streets are quite hilly so Rebecca considers an e-bike might enable her to cycle more. This is an example of where a neighbourhood-scale environment characteristic is more important to the health practice than the street environment characteristic and where the street scale characteristic (fairly flat) is different to the neighbourhood characteristic (hilly topography).

Theme 6 getting from A to B; processual component: health practices, latent meanings

Each different mode of movement has different cultures around the mode. And even within the mode such as the difference between walking and rambling. During Covid-19 for Anthony this extended to his concern about neighbours' perceptions of him driving too much to the shops and how he should set a good example as a doctor. The health practices of others become the street social environment for participants, for example car crashes at Arfon Street become an accepted norm in the street environment.

Theme 6 getting from A to B; other processual aspects

Other aspects of how the components operate are: actions of public bodies, individual characteristics, the role of the destination, micro-aspects, and temporal aspects. Examples of these are provided.

Actions of public bodies: the inactions of the local authority perceived by Abdi are noted in relation to numerous car crashes on Arfon Street.

Individual characteristics: are an important influence on modes of movement as health practices. Julia drives to the allotment whereas Ann cycles, and Anthony as a doctor is keen to set a good example in relation to Covid-19 but when it comes to walking to work he is not a morning person so often hops in the car.

Destination / motivation characteristics: the destination or cause of the movement can make a difference to the mode of movement. Food shopping is the clearest example of this: a supermarket trip will be driven (Julia, Luanne, Jessica, Rebecca) whereas local shops will often be walked to (Luanne, Luke, Beth, Aisha, Gus).

Other processual aspects identified include micro-aspects such as the side of road people walk on, specific routes, and routines; and temporal aspects such as seasonality, time of day, and term-time for universities.

Theme 6 getting from A to B; theme health impacts

Health impacts identified under the theme of getting from A to B in the street are:

- Injury and mental health impact: falls when walking / not being safe for balance (Katrin, Ann). Self-blame regret (Katrin) and negative mental health impact (Katrin, Ann);
- Family life: negative impact on family life from not being able to walk places together (Katrin);
- Anxiety: worry walking in relation to safety (Beth, Aisha);
- Positive benefits of cars: leading to social interactions and offering help (Anthony, Jessica, Rebecca);
- Sense of satisfaction: from clean car (Anthony);
- Physical and social: positive impact of cycling (Aisha, Ima);
- Asthma link / impact (Ima);
- Lack of bike storage space impact on health and risk of injury (Ima);
- Stress and time to get out of estates with poor walking access (Samantha); and
- Existing health conditions: compounding effect and changes to health practices (Mabon).

Theme 6 getting from A to B; theme ecologic and population group aspects

The health impacts identified are ecologic and several processes link together in sequences as noted for Katrin and cycling to avoid falling. Examples of other ecologic links include:

- Type of employment: affects Abdi's walking speed and mental state;
- Driving license: having or not (Ima);

- Social support services: and their importance for health, which might override decisions around other aspects such as for Ima moving from The Netherlands.

Population groups identified under this theme include:

- Young boys;
- Youth and adolescents of both genders;
- Traveller youth, both ethnic Traveller groups and cultural groups;
- People on low income;
- Single parents;
- People in jobs reliant on vehicle.

Theme 6 getting from A to B; theme Covid-19 impacts

Key impacts due to Covid-19 are:

- No face-to-face work meetings: so not walking or seeing people during journey (Robyn), doing meetings online (Scott);
- Not travelling for work, saving of time (Scott, Rebecca);
- Bus travel: negatively impacted, particularly for someone with pre-existing conditions or wishing to be cautious about Covid-19 (Ann);
- Travelling: as a health practice in itself restricted (Ann);
- Going around the street more slowly and taking time (Luanne) positive impact on interactions and mental health;
- Walking on own more (Abdi) less sociability with friends;
- Less traffic: positive impact;
- Not walking into town (city centre);
- Reduced car ownership (Scott);
- Food shops: doing larger supermarket shops but less often (Rebecca).

Theme 6 getting from A to B; theme street physical environment characteristic links

Key characteristics linked under this theme are:

- Pavement condition;
- Street trees: linked negatively to pavement condition;
- New development in an area impacting on parking, such as flats with few parking spaces;
- Street being a main road: positive for being a bus route; negative for traffic levels and cycling;
- Waste bins: being on pavements on certain days or left out and conflict with walking (Beth);
- Street layout: having a front and back street (Abdi);
- Cycle lanes: poor design resulting in not being used (Abdi);
- Being on a street that is also a main public circulation route: the public part being seen as separate to My Street (Abdi);
- Junction design: related to crashes (Abdi);
- Bench removed: restricts walking especially with existing health condition (Mabon);
- Bike storage: a lack of and safety implications (Ima);
- Allocation of storage between modes: cycle storage compared to car parking;
- Dutch cycle infrastructure: make cycle lanes like in Holland everywhere in Cardiff (Ima);
- Parking: locate away from street like in Holland (Ima);
- Alley closures: negative effect on walking routes to school (Samantha);
- Design / layout of newer streets: poor for walking (Samantha).

4.3.3 Conclusion

In this chapter section, health practices in the street have been identified as part of the street social environment. Their complex, ecologic, multi-faceted impact on health has been investigated. Six themes have been reported, four of which are deep latent themes related to green space and nature; the street as a social space; being a good (or bad neighbour); and the role of children for streetlife. Two, more semantic, themes relate to everyday necessities in the street and health practices of movement and mobility. Due to the methods of analysis employed this is a very detailed and granular presentation of findings. The next and final chapter section of Part 1 of the findings addresses health-related outcomes. Part 2 of the findings and subsequent chapter sections then zoom back out to look at the overall picture and set out the argument for the role of the street environment, both physical and social, as an important health setting.

4.4 Health and Wellbeing-Related Outcomes

4.4.1 Introduction

This chapter section reports health-related outcomes identified through participant observation. *Health-related outcomes* is used as an overarching term for findings that include health outcomes, wellbeing outcomes, risk factors, and other factors that participants identify as being closely related to health. This chapter section aims to relate findings back to the broader socio-ecologic research question and findings are reported against two existing frameworks and synthesised from this. A discussion of a more granular analysis undertaken is also presented.

Participants typically do not use terms like *health outcome*, *risk factor,* or other health research terminology. As described in Chapter 4.3 this is not solely due to participants not having knowledge of these terms, for example Anthony works as a doctor in a hospital yet describes beauty and a sense of calmness in relation to health-related outcomes in the street. The data extracts presented are based on the whole participant observation dataset including specific questions on health practices and street physical environment impact on health in the broadest sense. This includes positive and negative impacts. It includes health-related outcomes in participants and in others, as stated at Chapter 4.3, where outcomes are identified in others (non-participants) the finding is limited and these are identified as potential areas for future research.

The findings include broad health outcomes such as *mental health* through to more specific health-related outcomes like a *severe fear of dogs* that represent a processual link in a longer and complex pathway to health impact. Many of the identified topics can be described as the causes of causes, or the wider, wider determinants of health. This section provides a partial response to the research question:

> How can any pathways to health impact linking health practices and street environment be understood within the socio-ecologic paradigm of population health?

Findings for health-related outcomes are presented at two levels of analysis:

- Analysis 1 – thematic coding
- Analysis 2 – seeking patterns, synthesis with reference to two existing frameworks

This section ends with a discussion of an extended analysis comparing code labels to the International Classification of Diseases system (World Health Organization, 2022a) (Appendix 11). This reports differences between this framework related to the healthcare field and participant perception of health-related outcomes.

4.4.2 Findings and discussion

Analysis 1 – thematic coding

Health-related outcomes are reported as code labels (n=24). All code labels are presented in Table 19. Some codes have potential for more latent interpretation, such as those related to grief, but all have semantic meaning too, the health impact can be positive or negative.

Code labels for health-related outcomes are diverse and range from very specific (autism) to very broad (health, wellbeing); are complex, sometimes incorporating several different aspects of health; include positive health benefits and negative health impacts; and include impacts observed or noted in relation to others (e.g. suicide) as well as experienced by participants themselves (e.g. confidence).

At the level of code labels, a majority of both men and women participants identify positive mental health impacts. Positive mental health impact is the only code label for a health-related outcome that a majority of men in the sample identify. Gender differences within the sample include that only women and no men identify codes related to: fear; feeling safe or unsafe; a general effect on health. Noticeably more women than men identified the codes relating to: social connectivity and cohesion; negative mental health impact; physical health including exercise and weight.

Table 19: Health-related outcomes and topics

Health-Related Outcome or Topic (W_ prefix denotes wellbeing / health codes)	Women, count, n=13	Men, count, n=7	Total, count, n=20	Women %, ≥50% highlighted	Men %, ≥50% highlighted	Total %, ≥50% highlighted	% Difference women-men, +/- ≥25% highlighted
W1_MENTAL	10	6	16	76.9	85.7	80.0	8.8
W_Autism, neurodiversity, impacts on	1	0	1	7.7	0.0	5.0	-7.7
W_Confidence, impacted	2	0	2	15.4	0.0	10.0	-15.4
W_Fear, being scared in a primal sense, scared of dogs, allergic to dogs, worried and scared for someone else, parent worry for children	5	0	5	38.5	0.0	25.0	38.5
W_Feeling safe, having a secure base, feeling unsafe in street	6	0	6	46.2	0.0	30.0	46.2
W_lack of control or permission, being able to take control of health, using your voice and power, having some control	4	1	5	30.8	14.3	25.0	-16.5

W_mental health, +ve, feeling hopeful, positive, sense of achievement, satisfaction, feeling good	7	5	12	53.8	71.4	60.0	17.6
W_mental health, -ve, stress, anger, anxiety, depression, suicidal thoughts, frustration, upset, stress from separation from family	8	3	11	61.5	42.9	55.0	-18.7
W_relatives who passed, reminder of, remembrance, depression from grief	1	1	2	7.7	14.3	10.0	6.6
W1_PHYSICAL (excluding injury and violence)	9	3	12	69.2	42.9	60.0	-26.4
W_Covid-19, having, vulnerability to	2	0	2	15.4	0.0	10.0	-15.4
W_Food, healthy, affordable	2	0	2	15.4	0.0	10.0	-15.4
W_Mobility, difficulties walking	1	1	2	7.7	14.3	10.0	6.6
W_physical health, exercise, weight	7	3	10	53.8	42.9	50.0	-11.0
W_Respiratory problems	1	0	1	7.7	0.0	5.0	-7.7
W_Rubbish impact on health, dead rat	1	0	1	7.7	0.0	5.0	-7.7
W1_INJURY AND VIOLENCE	6	2	8	46.2	28.6	40.0	-17.6
W_Domestic abuse, emotional abuse	2	0	2	15.4	0.0	10.0	-15.4
W_Injury, from falling	2	0	2	15.4	0.0	10.0	-15.4
W_Injury, from violence, stabbing	1	0	1	7.7	0.0	5.0	-7.7

W_Suicide	1	0	1	7.7	0.0	5.0	-7.7
W_Traffic injury, fatality	1	2	3	7.7	28.6	15.0	20.9
W1_SOCIAL	7	2	9	53.8	28.6	45.0	25.3
W_social, connectivity, cohesion, being included, having friends locally, feeling homely; isolation, being alone, relationship breakdown - splitting up, peer support at work	7	2	9	53.8	28.6	45.0	25.3
W1_OVERALL HEALTH	7	1	8	53.8	14.3	40.0	39.6
W_Generally affect health, somehow	6	0	6	46.2	0.0	30.0	46.2
W_Ill health, generally, being ill	0	1	1	0.0	14.3	5.0	14.3
W_Satisfaction, life priorities, work (latent, or explicit)	2	0	2	15.4	0.0	10.0	-15.4

Note to table: presentation of numbers – this table should be read in conjunction with the methodological considerations stated at 3.2.5. This is a numerical presentation of qualitative data. They are not generalisable beyond the sample in this research and are themselves the output of an interpretive process.

Analysis 2 – seeking patterns

The aim of seeking patterns in the data was consistent with previous sections however the analytical method was recursively adjusted in response to the research question and the data. Codes were allocated by the researcher into categories using two frameworks. The first framework (Table 20) links to a WHO definition of health including: physical health; mental health; and social health; with the addition of overall health outcomes. The second framework (Table 21) uses the categorisation of disease used by The Institute for Health Metrics and Evaluation (IHME) (2021): communicable disease; non-communicable disease; injury and violence; again with overall health outcomes added. Following these analyses code labels have been grouped (Table 19) into categories of: physical health (excluding violence and injury); mental health; social health; violence and injury; and overall health outcomes.

Table 20: Health impacts by health domain

Health Domain	Women, count, n=13	Men, count, n=7	Total, count, n=20	Women %, ≥50% highlighted	Men %, ≥50% highlighted	Total %, ≥50% highlighted	% Difference women-men, +/- ≥25% highlighted
Mental	10	6	16	77%	86%	80%	-9%
Physical	12	4	16	92%	57%	80%	35%
Social	7	2	9	54%	29%	45%	25%
Other - General health	7	1	8	54%	14%	40%	40%

Note to table: presentation of numbers – this table should be read in conjunction with the methodological considerations stated at 3.2.5. This is a numerical presentation of qualitative data. They are not generalisable beyond the sample in this research and are themselves the output of an interpretive process.

When grouped using this first framework it is identified that for the majority of men and women in the sample mental and physical health are the most identified health domains. Noticeably more women than men identify physical health-related outcomes. Social health and wellbeing is identified by a majority of women but not men. A majority of women also express health and wellbeing links in terms of overall health whereas men do not. From the findings in this research it is argued from the evidence presented that social and mental health-related outcomes are present in the street environment and should be addressed as well as physical health in research, practice, and policy.

Table 21: Health impacts by disease domain

Disease Domain (Institute for Health Metrics and Evaluation (IHME), 2021)	Women, count, n=13	Men, count, n=7	Total, count, n=20	Women %, ≥50% highlighted	Men %, ≥50% highlighted	Total %, ≥50% highlighted	% Difference women-men, +/- ≥25% highlighted
Non-communicable disease	12	7	19	92%	100%	95%	-8%
Communicable disease	3	0	3	23%	0%	15%	23%
Injury and violence	6	2	8	46%	29%	40%	18%
Other - General health	7	1	8	54%	14%	40%	40%

Note to table: presentation of numbers – this table should be read in conjunction with the methodological considerations stated at 3.2.5. This is a numerical presentation of qualitative

data. They are not generalisable beyond the sample in this research and are themselves the output of an interpretive process.

The second framework identifies that in this research non-communicable disease-related outcomes are identified noticeably more than other domains. This has implications for practice because i) non-communicable diseases account for most of the burden of ill health (Institute for Health Metrics and Evaluation (IHME), 2021) both globally and in Wales, and ii) built environment indices such as in architecture already have been identified as insufficiently addressing non-communicable disease outcomes (Rice and Drane, 2020). However, it is also reported that communicable disease-related outcomes are present at the street scale. These are not solely related to Covid-19. So it is important that all domains are addressed.

It is also argued that what matters for health-related outcomes at the street scale is not just the separate outcomes but also their interactions. Covid-19 has been argued to be a syndemic not a pandemic (Horton, 2020) with syndemic health outcomes resulting from: the presence of multiple diseases at once, which can include communicable and non-communicable diseases; the interaction of these; and the amplification of them due to the social environment (Mendenhall, Newfield and Tsai, 2022).

A noticable minority of participants identified health-related outcomes under the injury and violence group. Chapter 4.3 has set out the health practices related to violence including differences by gender in experiences of violence. At a code label level it was women who identified: domestic and emotional abuse; injury from falling; and injury from violence. Evaluating these findings together violence and injury have been synthesised as a separate group in Table 19 and for the overall presentation of health-related outcomes at the street scale. The arguments for this include: first, affects a noticable minority of participants; second, the potential for intense and long-lasting health impact over time; third, to support investigating health inequalities including by gender; fourth due to the ecologic interaction with other health domains; and fifth due to reflexive consideration of the researcher’s positionality including as a man.

The findings from analyses using two existing frameworks inform synthesis (Table 19) under headings of: physical health (excluding violence and injury), mental health, social health; violence and injury; and overall health concepts. As in previous chapter sections this analysis aims to identify patterns and not to reify the data or apply an logic of inference to it. Health-related outcomes that were only identified by a small number of participants are also important for population health. What is important in these findings is that: mental health is a key health outcome identified and is identified by most participants; physical health is also identified for most participants and a key outcome; injury and violence affect a sizable minority of participants; fewer health-related outcomes are identified related to the social wellbeing domain. There is a difference between women and men with a small majority of women identifying social health-related outcomes; and more women than men identifying overall health as an outcome.

Comparison to International Classification of Diseases

This section concludes with a discussion resulting from further analysis undertaken. The above frameworks utilise broad domains of health, an analysis was undertaken to test the grouping of code labels using the more granular International Classification of Diseases (ICD) (World Health Organization, 2022a). This framework is used globally for classifying health, or specifically disease, outcomes. As well as being used to analyse the findings this is important for public health policy and practice as whilst the ICD framework does not drive these it does underpins collection of certain routine healthcare data and this affects policy decisions. For governments globally healthcare is by far the largest portion of health budget spending even though healthcare contributes an important but relatively small proportion of overall health while social, economic, and environmental factors contribute much more to overall health. Jacobs (2021) for example identifies that the social determinants of health are underrepresented in the ICD system accounting for less than 1% of the total proportion of codes.

In Wales health and social services in fact account for nearly half (49%) of all of Welsh Government's resource and capital budget (Welsh Government, 2024). Much of this healthcare resource is directed toward treatment of conditions which are given detailed consideration in ICD codes whereas wider determinants of health are less recognised. If the underlying ICD

framework has limitations this could affect allocation of funding or policy priority given to address important determinants of health.

From tabular analysis (Appendix 11) the following key points are identified as most important to highlight.

A number of health-related code labels are readily relatable to ICD terminology:

- 06 Mental, behavioural or neurodevelopmental disorders
- 25 Codes for special purposes (Covid-19)
- 12 Diseases of the respiratory system
- 23 External causes of morbidity or mortality (unintentional, assault, intentional self-harm)
- 05 Endocrine, nutritional or metabolic diseases (certain aspects of weight component of physical health)

Some code labels are not framed as health outcomes by ICD classification but rather a *problem* or *diagnosis* or something to be considered at the level of individual functioning:

- 24 Factors influencing health status or contact with health services, including:
    - W_relatives who passed, reminder of, remembrance, depression from grief;
    - W_Food, healthy, affordable;
    - Exercise component of physical health;
    - W_Domestic abuse, emotional abuse (noting wording is not clear on psychological aspects and primarily concerned with how someone might present to health services); and
    - Relationships aspect of social health.
- V Supplementary section for functioning assessment;
    - W_Confidence, impacted; and
    - W_Mobility, difficulties walking.

Some health-related code labels are found to be absent within ICD:

- Feeling safe, having a secure base, feeling unsafe in street;

- Lack of control or permission, being able to take control of health, using your voice and power, having some control;
- Loneliness; and
- Aspects of social health.

What is important in this research is that some health-related outcomes reported are clearly identified within ICD classification. Others however are not fully recognised or not included at all within the ICD disease classification system which is one of the main systems used globally for clinical diagnosis. Further than this however it is important due to the role of this framework in how data influences policy and investment decisions. This is important for research, practice, and policy and ensuring that all impacts on health are addressed. An approach that only uses terminology from one perspective risks overlooking links to health that are important for residents. Addressing health promotion requires resource including funding so it is important that the data upon which decisions are based takes account of all relevant factors that affect health in reasonable proportion to their impact. As Jacobs (2021, p.3206) identifies, if there is space for "…turtle-related injuries and combustible water-skis" in the ICD then there is no excuse for other important wider determinants of health not being recognised in this system.

4.4.3 Conclusion

This chapter section has detailed the diverse health-related outcomes identified (n=24) through the research. More non-communicable disease-related outcomes are reported than identified through the systematic review (which focused on these outcomes). The street environment including health practices is mainly linked by participants to domains of mental and physical health. Street physical environment characteristics are considered by participants mainly for how they help or hinder health practices, in other words as indirect impacts through a pathway as opposed to direct health impacts. These health-related outcomes have been reported against two existing frameworks for health and synthesised into categories of physical health, mental health, social health, and injury and violence, plus overall health outcomes. This section has focused on the discrete outcomes identified whilst noting the importance of potential interactions between them within a wider socio-ecologic system and it is this complex ecologic system that the next chapter section will now address.

Findings and Discussion Part 2

So far this thesis has presented findings at a granular level for street physical environment (Chapter 4.1 and 4.2) and street social environment (Chapter 4.3). Health-related outcomes have also been reported (Chapter 4.4). The arguments presented now shift from a more disaggregated level of reporting of findings to an aggregated approach linking together the pre-requisite and co-requisite questions to address the overall research question:

> What are people's everyday health practices in their residential street environment; which street environment characteristics impact those practices; and how are these both to be understood within a socio-ecologic paradigm of population health?

The next three chapter sections address specific areas and arguments:

- Chapter 4.5 addresses health in the street as part of an socio-ecologic system;
- Chapter 4.6 argues the street as a health setting; and,
- Chapter 4.7 argues for health in the street as a field of transdisciplinary knowledge.

Before those sections, it is important to highlight that the impact of the Covid-19 pandemic is woven throughout the findings including in this Part 2. As much as this thesis is a study of streets and health it is also a study of streets and health during a Covid-19 pandemic. This is a major factor that situates the knowledge created in a specific context although not the only one.

The context of the pandemic had an impact throughout the research. The street setting itself was affected by Covid-19 and how health practices in the street were affected has been detailed at a granular level (see Chapter 4.3.2 Analysis 3). Covid-19, including through the impact of lockdown regulations, also created a further set of impacts across the fieldwork timeline which are plotted at Appendix 10. These include restrictions on retail, schools, and other facilities such as leisure centres which also interact with other temporal variations such as school term times and seasonality.

Health practices most clearly impacted by Covid-19 include new health practices and changes to existing health practices. New ones can mostly be viewed for their positive health impacts, for

example: receiving and giving support, street WhatsApp support groups, and mutual aid. Changes to existing practices have a more varied health impact: existing practices such as swapping and sharing with neighbours increased with beneficial health impact. However most other changes due to Covid-19 have at least some negative impact and intense negative impacts came from practices where they were beyond the participants' control such as increased drug dealing and fly tipping during Covid-19.

Panning out, the aim of the research has been to evidence the residential street environment as a health setting. The research design and methodology aimed to gain ""telling" examples" and "flashes of insight" (Mason, 2018, p.71). Covid-19 and government response to it resulted in conditions that created major change and often stress for people in their everyday lives – conditions that would be unethical if they were proposed as part of a research design. For some participants this was potentially more generative around the topic as they were already thinking about their street space and aspects such as nature but for others this was not the case and there are equally examples of participants not having engaged with their street much before at all.

In a different way Covid-19 was also generative for insights through its interaction with systemic inequalities. For example, racism and misogyny existed long before the pandemic and these forms of structural and institutional discrimination intensified health impacts during the pandemic (e.g. First Minister's BAME COVID-19 Advisory Group, 2020). For some participants this was the context of their lives and the large amount of time in field methods given to recruitment and working to participants' timeframes was crucial to gaining access in the field. The data generated contributes to findings on processual mechanisms for structural inequalities at the street scale.

While the findings have specificity to Covid-19 during 2020-2021 they also have wider relevance, not least because the impact of the pandemic continues to be felt across sectors and societies today. A simple example of this wider applicability is the recommendation (see Chapter 6.5) that this research could inform future pandemic preparedness.

The context of Covid-19 gives a specificity to the findings related to the timing of the research during the pandemic. This limits the generalisability of the findings but is also a strength giving the findings a nuance and specificity that would otherwise not be present. This Part 2 now presents findings and discussion that pan out to consider the wider theoretical findings of the research.

4.5 Ecological Pathways to Health Impact in the Street

4.5.1 Introduction

This chapter section addresses health in the street as part of a socio-ecologic system in response to the final pre-requisite research question which also is a linking question across the research:

> iv) how can any pathways to health impact linking health practices and street environment be understood within the socio-ecologic paradigm of population health?

This research set out to investigate health practices in the street environment as an ecologic and complex problem. This focus influenced not only the research question but also the wider philosophy of the research, aligning it with the contemporary paradigm in public health of an eco-epidemiological, or socio-ecologic conception of health.

Figure 2 in the Introduction chapter set out three components of the research question: the setting of the street environment both physical and social; the phenomenon of health practices; and the paradigm of health being socio-ecologic. Figure 64 illustrates how these components were initially conceived as linking at the outset: the impact on human health being along a pathway through the phenomenon of health practices and that the street physical environment would act along this pathway. What is found and reported here is a more complex series of pathways to health impact.

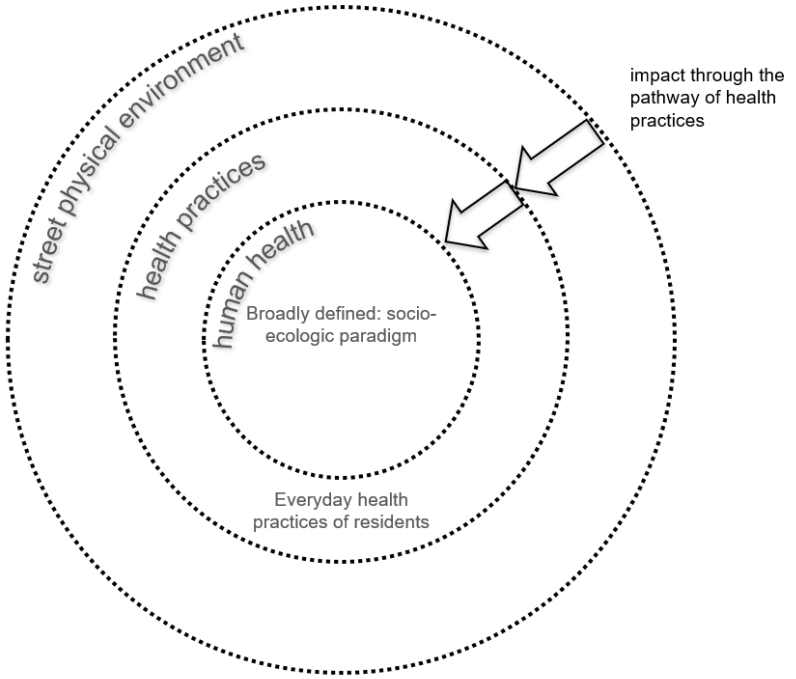


Figure 64: Conceptual illustration of impact pathways, research design stage

4.5.2 Findings and discussion

Figure 65 illustrates how this understanding has been developed through empirical investigation resulting in new knowledge being created.

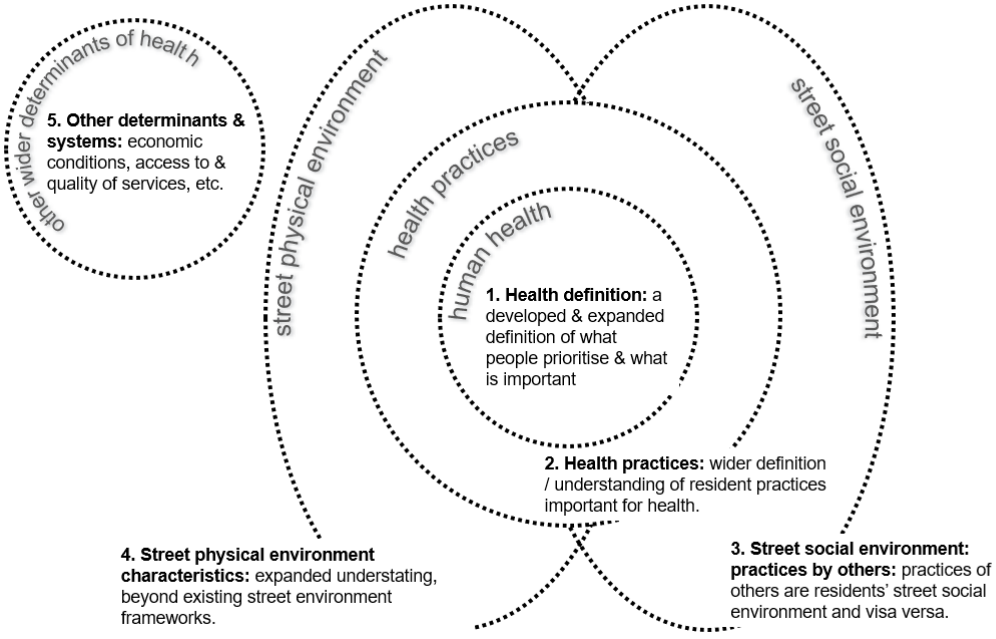


Figure 65: Conceptual illustration of impact domains, analysis stage

First, understanding of the component parts has been developed through empirical research. Findings have been reported related to the concepts of: health-related outcomes, health practices, and street physical environment characteristics (#1, 2, 4 at Figure 65). These have been reported in earlier chapter sections: street physical environment (Chapter 4.1, 4.2); health practices (Chapter 4.3); health-related outcomes (Chapter 4.4).

Second, and more unexpected, health practices were identified not only as a phenomenon carried out by participants but also as being *part of* the street environment, specifically the street social environment (#3, Figure 65). The change this results in is that health practices by one person or group are health practices for them but also simultaneously become part of the street social environment for other people. This changes the understanding of the street environment as a physical space to a multi-faceted environment that includes both physical and social dimensions. What this research adds is understanding of how these are integrated through the concept of health practices. In Figure 65 these are presented as separate domains as they are distinct from one another. They can act separately or in combination along a pathway to health impact. Reflexively this change arguably expands and shifts my disciplinary understanding as an architect and design practitioner to comprehend the street environment as both a social as well as a physical space. Applying this same reflexive logic it is likely that future research could investigate other dimensions of the street environment that impact health, for example the digital environment.

Third, the pathway to health impact at the research design stage (Figure 64) was sequential as part of a causal chain. These findings change this understanding and identify that health practices; the street physical environment; and the street social environment can all operate directly in their own right or indirectly. They can also act in combination with each other on health. The health impacts can be positive or negative.

To represent all of these pathways visually in an illustration risks obscuring rather than clarifying the point. A principal concern of this research is the pathway to health impact from street physical environment and this set of pathways is overlaid at Figure 66, comprising: direct impacts (#a,Figure 66); indirect impacts through the pathway of health practices (#b, Figure 66); and indirect impacts through processual chaining of multiple health practices (#c, Figure 66).

Interactions with street social environment (#d, Figure 66) are recognised, as are interactions beyond this system (#e, Figure 66).

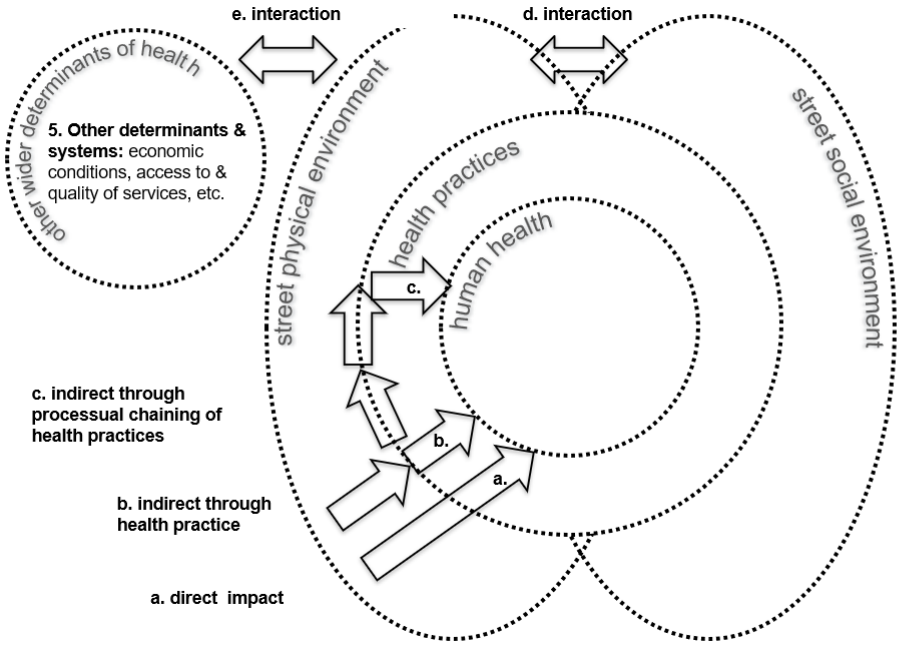


Figure 66: Illustration of impact pathways for street physical environment only

Similar pathways to impact exist for the street social environment and also directly for health practices on health. So overall, based on empirical research, this is a more nuanced and complex understanding than the original conception.

Based on these findings it is argued that health in the street is a socio-ecologic system and this thesis presents empirical research findings to evidence this. This is a contribution to new knowledge. This system is understood and evidenced to be a complex and adaptive system (HM Treasury, 2020) that demonstrates characteristics such as emergence, feedback, adaptation (Rutter *et al.*, 2017), and additionally, self-organisation (Skivington *et al.*, 2021). The formalised methods of complex systems have not been used in this research however, mapping of the component parts of the system and setting out their relationships at a high level is a vital first step and a contribution this research makes to future such analyses. This ecologic system connects beyond the boundary of this research to other systems (#5, Figure 65) which are also wider determinants of health.

Figure 67, is a further level of analysis using relatively simple complex system mapping methods (see Chapter 3.2.5) of the research findings and illustration of the system (without impact pathways). The use of complex system mapping or modelling in public health is broadly described to help conceptualise "poor health and health inequalities as outcomes of a multitude of interdependent elements within a connected whole." (Rutter, *et al.*, 2017, p.1) The levels of the system are based on the findings presented in this thesis at the thematic level for street physical environment; health practices; and health-related outcomes. This focuses again on the dimension of street physical environment, acknowledging interactions with the street social environment.

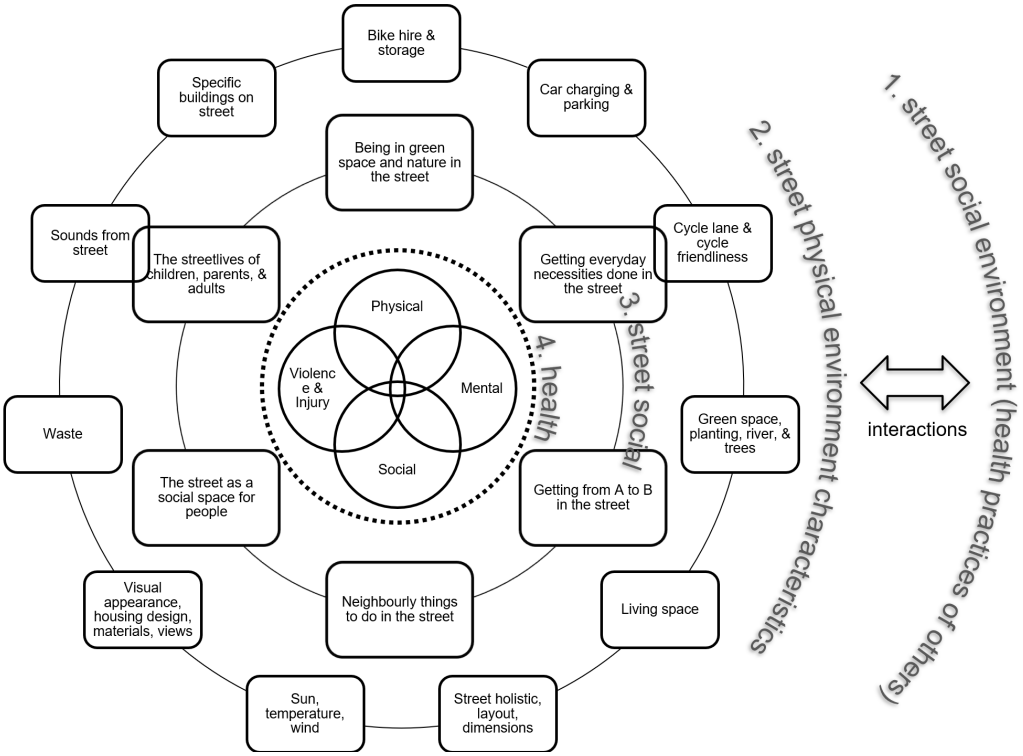


Figure 67: System components at thematic level for (1) street social environment (health practices of others); (2) street physical environment characteristics; (3) street social environment (health practices of individuals); and (4) human health-related outcomes

This is a simple form of system mapping and whilst it is important to go beyond the level of mapping (Rutter *et al.*, 2017) this is an important first step. Figure 68 and Figure 69 provide illustrative examples of this how this mapping could be applied to two theoretical street-scale interventions.

The method has been used in this research as a preliminary assessment of the street as a system. It is posited as an area for future exploration and has potential utility for policymakers, practitioners, and scholars. As a method it has been used effectively by the candidate in practice work with public health organisations and for engaging with cross-sectoral stakeholders on topics including climate change and circular economy (e.g. Andrew, *et al.*, 2022) and the method for example is accessible by diverse stakeholders who can readilly understand where their realm of influence is and where there are gaps. Stansfield *et al.* (2021) identify a number of objectives that such mapping can support including: engaging with teams or stakeholders on a particular topic and to gain shared understandings; to map influences including for analysing policy gaps and interventions; and building knowledge and capacity on addressing complex systems. A development here is the use of complex system mapping within a structured framework based on evidence at each level and linking to human health as a holistic and complex concept in its own right. A future development (not shown here for simplicity) would be the integration of population vulnerability at the boundary of the inner human health domain. This could fruitfully build on work by the Joseph Rowntree Foundation whose conceptual framework for “socio-spatial vulnerability” (Lindley *et al.*,2011, p.9) is used to investigate climate disadvantage but has wider potential application and brings in the aspect of differential impacts across population groups allowing these to be analysed and investigated.

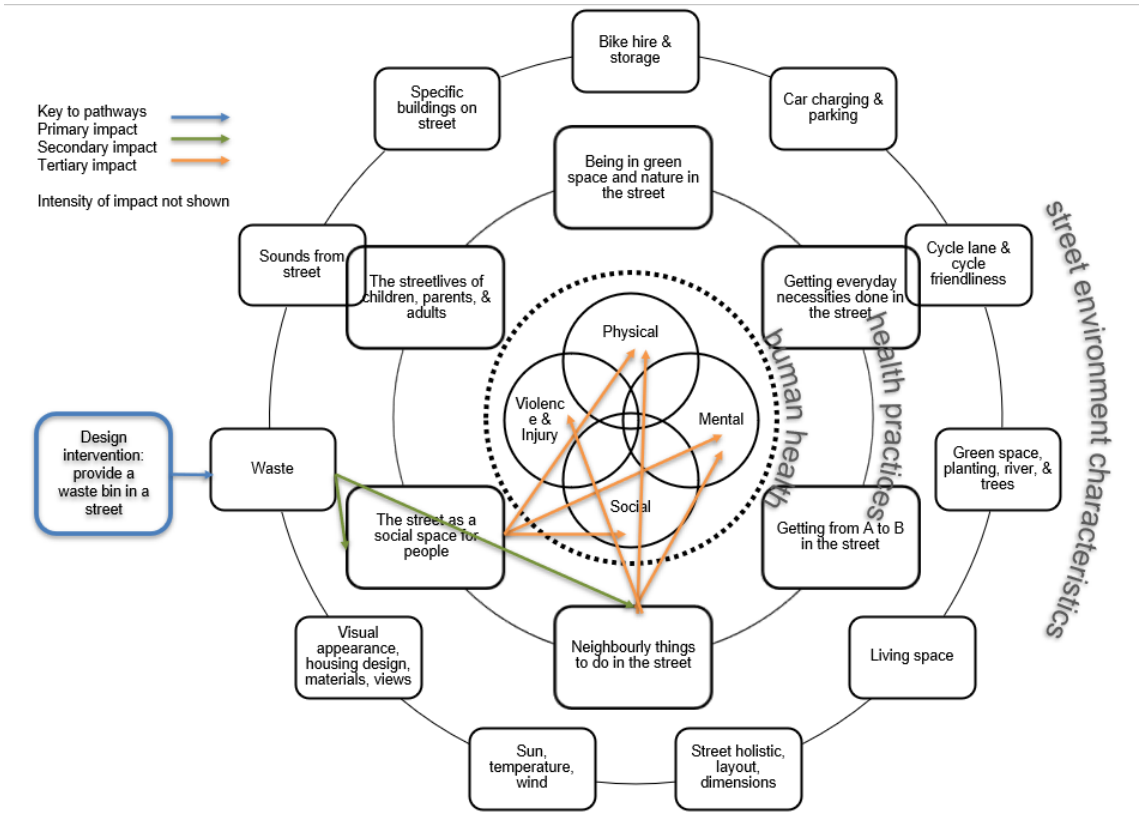


Figure 68: Impact pathways, worked example of a simple design intervention

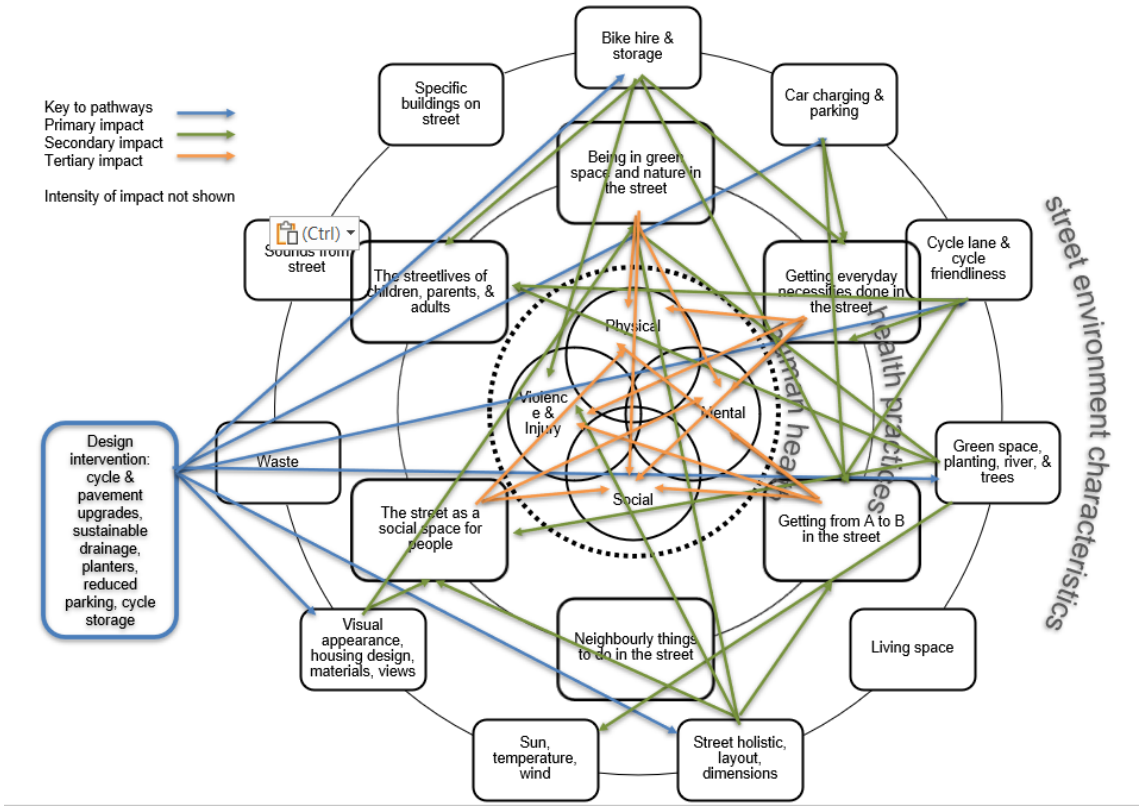


Figure 69: Impact pathways, worked example of a complex design intervention

4.5.3 Conclusion

This chapter section has addressed the research question of the street environment as part of a socio-ecologic system of health. System mapping has been used to evaluate and discuss this further demonstrating how the empirical research has developed the understanding of this system. These findings respond to Susser and Susser's "eco-epidemiology" paradigm (1996b, p.674) and to McMichael's call to look upstream and "extend our focal length" (McMichael, 1999, p.891) when it comes to addressing population health. The next chapter section will set out the argument for the street as a health promoting setting.

4.6 The Street as a Health Setting

4.6.1 Introduction

An important aim of the research has been to investigate evidence for the residential street environment as a health setting. This chapter section focusses first on the argument for the residential street as a health setting and second reports findings and discusses the concept of My Street. My Street is the participant-defined focus of where most health practices happen, a new and important concept in operationalising the street as a health setting. This chapter section does not re-state findings in previous sections, it draws together the strands of the argument at a high level. This chapter links closely to Chapter 5.6 which includes recommendations for future actions to operationalise the street as a health promoting setting.

4.6.2 Key findings

The key findings in this section are that: residential streets are a valid and justifiable setting in which to consider health; My Street has been evidenced through a new method creating a new definition of how people perceive the street environment where they live related to health which goes beyond existing concepts in the literature. It is also reported that the street is not always obvious to residents as having an impact on health and through participation in this research some participants recognise its potential as a setting for health; and, operationalising the street as a health setting, incorporating the concept of My Street, has several benefits for health including increasing understanding of the residential street as important health infrastructure.

4.6.3 Findings and discussion, streets as a health setting

Health settings are integral to the Ottawa Charter for Health Promotion (World Health Organization, 1986) and are recognised in the Jakarta Declaration as being, "…the organizational base of the infrastructure required for health promotion." (World Health Organization, 2023d)

Health settings are broadly defined by the WHO as:

> The place or social context in which people engage in daily activities in which environmental, organizational, and personal factors interact to affect health and wellbeing. (World Health Organization, 2023c)

The residential street environment is argued to be encompassed by this definition: it is a definable place and a social environment (Chapters 4.1, 4.2, 4.3); everyday health practices are activities undertaken by people in the street setting (Chapter 4.3); and health-related outcomes have been evidenced (Chapter 4.4). The pathways for health impact are complex and ecologic (Chapter 4.5), they include interactions between the street physical environment (Chapters 4.2, 4.5), street social environment (Chapter 4.3, 4.5), and everyday health practices (Chapter 4.3). They also interact with other wider determinants of health (Chapter 4.5) beyond the scope of this system. The logic to this justifiable claim is relatively simple and straightforward and is supported by rigorously and empirically developed evidence reported in this thesis.

Without the underpinning evidence to this logic a potential critique could be that many settings could be described as health settings. What makes the claim valid at more than a conceptual level is it's potential for translation into practice and effective impact on health. A health setting approach in the residential street has been evidenced in this thesis as having potential to be effectively operationalised for health benefit. Whitelaw et al. (2001) identify benefits of a settings-based approach for health promotion. These are listed in the left-hand column of Table 22 and developed for the street setting in the right-hand column of Table 22.

Table 22: Health promoting street setting benefits

Health settings benefits (Whitelaw *et al.*, 2001, p.341)	**Potential health promoting street setting benefits** (developed from Whitelaw *et al.*, 2001)
"increased awareness of health issues…	Greater recognition of health concerns at the street scale.
…health promoting policies and creation of dedicated health promotion budgets…	Creation of funded street level policies for health promotion: street governance.
…improvements in 'structural' and 'psychosocial' environments…	Improvements in the street environment in many dimensions including: physical, social, and structural.
…more frequent and better partnerships…	Opportunities for improved partnership working at the street scale, including co-design with residents.
…development of discrete health promotion/education projects…	Clearer understanding of the design of interventions in the street environment to benefit health. Opportunity for health as a criterion to prioritise interventions and investment. Creative interventions for community activation in the street environment.
…changes in various individual attributes, behaviours and functioning…	Benefits for residents across various health domains.
…economic benefits."	Economic value and cost-effectiveness at the street scale.

The residential street as a health setting is argued to be both conceptually coherent and have the potential to be effective for addressing health promotion. It is also a definable setting separate to other scales such as the neighbourhood or city although these boundaries have

been evidenced to be complex, such as for environmental determinants of health like noise. A wide range of health practices have been evidenced to happen in the residential street setting making these an important pathway or processual mechanism to address.

The contextual and situated findings in this research cannot be generalised to other settings. The concept of the residential street as a health setting is argued to have potential for application in other street settings where there are residential uses, including mixed use streets. The research design has developed new combinations of methods to investigate the street as a health setting.

The street as a health setting has value for translation into policy and practice (see recommendations at Chapter 5.6). The governance of streets as health promoting settings has the potential to support partnership working by a broad range of actors and stakeholders, many of whom have ethical and legal duties to address population health. This is both an opportunity and a challenge: multiples systems are involved with many actors and there is no one system (such as healthcare for illness) to address health in the street and this is a challenge overall for health promotion (Dooris *et al.*, 1998). The street scale is also argued to be more open to co-design interventions with residents. It is well placed to overcome norms in governance where residents are often excluded (Community Voices Cardiff, 2023) and to support health through the pathway of creating community agency (What Works Centre for Wellbeing, 2023). One critique of health settings approaches such as Healthy Cities (Dooris, 2013) is that they can be or can be perceived as too top-down. Streets as a health setting could deliver on the need to balance top-down and bottom-up approaches (Toyne and Khan, 1998) if linked with other settings such as the city scale. Streets have significant potential to address the principle of citizen empowerment and support "…local people having increased control over their own lives and being able to set the agenda…" (Heritage and Dooris, 2009, p.i51).

The residential street, as evidenced through this research has been argued to be an important health promoting setting. The second part of this chapter section reports and discusses findings related to how, through the new concept of My Street, the street is defined by participants.

4.6.4 Findings and discussion, My Street

A co-requisite research question was:

> How do residents define ‘My Street’, their perceived boundaries of the street where they live?

This relates to the street social environment and contrasts with the street physical environment which is defined in this research by street names on Ordnance Survey mapping – the physical extents of the street. The two are brought together by overlaying the mapping with participant responses to the question:

> Where do you feel that your “street” extends to; in other words, what do you see as your territory or home patch? (developed from: Barton, Grant and Guise, 2010; Appleyard, 1981)

This definition is called My Street and the findings are visually described in Appendix 1. My Street is the focus of where most participant health practices happen in the street and therefore it is spatially where health related-outcomes are being impacted, for example: Paul observes nature in his own front garden, not at the other end of Philippa Street as shown on an Ordnance Survey map, he doesn’t perceive that as his street; Rebecca was violently attacked outside her own house, not at the other half of Holford Street, she rarely goes there. Further findings about My Street include:

- In no instances does a participant’s My Street definition match with the street names as defined by Ordnance Survey map data;
- In most cases My Street is smaller than the street as defined by Ordnance Survey map data. In one case is it bigger (Jessica, Hoggan Street), notably to extend to include a post office and a shop;
- The factors affecting the definition of My Street are ecologic, for example, traffic busyness was important for Luanne but not identified as a material factor by other participants. This is notable considering previous studies, with different design, which have evidenced a reduction in personal territory as traffic volume increases (Hart, J. Parkhurst, 2011; Appleyard and Lintell, 1972);

- My Street presents a new interpretation of the street social environment in relation to the existing literature which posits streetlife as part of the public realm (Jones, 2018; Lofland, 1998). My Street evidences a scale of social territory that spans across the social realms of private, “parochial” (Lofland, 1998, p.10), and public. Where public realm streetlife meets with My Street health, impacts are often manifest.

This section now discusses some of that ecologic complexity of My Street as a spatial definition. First the impact of traffic as an example of that complexity is discussed. Subsequent discussion addresses: the street as distinct from neighbourhood; the importance of neighbourliness and knowing people for My Street; the role of housing types on street types and in My Street definition; and concluding with a refined definition of My Street based on this empirical research. This further definitional discussion contributes to setting the boundaries of the street as a health setting.

First, the ecologic complexity of My Street is notable as it prima facie appears divergent from previous studies (Hart, J. Parkhurst, 2011; Appleyard and Lintell, 1972) that identify an association between traffic volume and “home territories” (Hart, J. Parkhurst, 2011, p.11). The wording of the interview protocol was partly developed from this terminology however the research aims and design of these previous studies were different. The utility of this terminology (*territory* and *home patch*) in this research was to open up discussion with participants and not to define My Street. Regarding traffic quantity, in this research the largest My Street areas include both a main road with a bus route (Rania, Nia Street) and a dead end which therefore has no through traffic (Jessica, Hoggan Street): the smallest My Street areas include both a main road with a bus route (Luanne, Steer Street) and a dead end (Rebecca, Holford Street). Direct comparison with these previous studies is not possible due to differing methods and contexts: the streets in this sample likely have materially lower traffic volumes for example. The impact of Covid-19 restrictions on traffic and different research aims further confound direct comparison. What is justifiably arguable is that My Street is a broader ecologic definition of street territory closely linked to health practices and health-related outcomes in the street and that street busyness has a role within this but as one factor among others.

Second, the validity of the street as distinct from neighbourhood scale is further informed through participant observations (Paul, Luanne, Beth, Aisha). Paul's My Street area is a specific part of the street and whilst distinct from the neighbourhood it is linked to it. Comparing street and neighbourhood Paul reflects:

> …in a way they are one in the same and they overlap. But of course, our street runs from sort of [Street name] to in the sort of Northerly direction, beyond the [hostel name] is and beyond. It's rather falsely divided up into [...] three really because it's sort of intercut by a number of other roads… so when I say our street I'm talking about this third of it really that you know, that our house is situated on. …but …I engage with it as part of something which is situated within our neighbourhood and yes I do see our neighbourhood above and beyond the street. (Paul)

Third, neighbourliness and knowing people is important for My Street for some participants. Julia, Gus, Beth, and Ann define My Street linked to the people they know. Ann reflects at Cadwaladr Street:

> I consider my patch really to be my block. And the block opposite. Those are the people I interact with in terms of taking in parcels and that sort of, the nitty gritty, neighbourliness. (Ann)

Community or belonging is important to how My Street is defined for some participants and what provides that sense of shared community varies: it can be ethnic or religious identity such as for Aisha, or for Mabon it is about shared connection with Welsh speakers. Mabon can specify from memory precisely where Welsh speakers live on Chamberlain Street. This could sound exclusive but for Mabon it is the opposite: a representation of diversity as part of the culture of Chamberlain Street:

> …it's a very very cosmopolitan street with a lot of Welsh here, we've got neighbours on one side who are Welsh speaking, across the road they are, about four doors down, three doors down maybe, most of our conversations in the street are in Welsh, but then there's people here speaking Somali,

> Arab, Hindi, the language which is probably least heard here is English actually. And it's a lovely cosmopolitan place to live it's really nice. …linguistically there's something in common there. (Mabon)

> The importance of knowing Welsh speakers is so integral to how Mabon interprets My Street that he has a Welsh term for it: a fesur (yardstick) of the street.

> I think in large measure it would be a sort of circle round the house including the houses of most people who I know who live there. That would be a sort of be'di ffon fesur [translation: what is yardstick?], a sort of yard stick for it really.

Fourth, housing types are closely linked to street types and both impact on My Street. Aisha is the only participant who lives in a maisonette and for her the sense of the street starts outside the door of her flat at an upper level. The My Street plan can only represent this in a limited way as the Ordnance Survey base map does not represent internal building layouts or vertical spatial organisation. The street infiltrates spaces like Aisha's private balcony which provides a semi-private space between the home and the street, Aisha notes:

> Literally outside my door. Yeah, …talk to my neighbour, sit in there with my neighbour, going downstairs and seeing my other neighbour. I feel like yeah, we're just one big group of people that just happen to live in different houses. (Aisha)

When reflecting on whether her balcony is part of her home space or street, Aisha's thinking evolves, an example of the process of joint construction of meaning through the research:

> It's home I think in terms of living because my neighbours also come out and sit on their chairs as well in front of their houses. So the ones on my side there's the lady and her husband usually are there on their chairs, garden chair... I'm on my traditional Somali chair which is made out of, got cow skin on it [small laugh]... we have nice chats there or when I'm putting out the

> washing …So it feels like a street but then at the same time it feels like home. I think it's combined. (Aisha)

Aisha identifies how these semi-private spaces positively support health practices: for Ima the absence of them intensifies negative health impacts on health practices. In her communal stair and front garden in a house in multiple occupation (HMO) her stair is so cramped that she feels this has a negative health impact and the front yard is used by the landlord to store waste:

> It's not good to be honest, …we do share that area with others and it's so crowded and it's so, …we can't move freely we can't put our bikes or stuff like that freely as well. (Ima)

No participants currently live in a tower block although Shiva reflects on her recent previous home in a tenth floor flat near Legall Street where she felt part of the street as she had a visual connection with it.

Fifth and finally, the definition of My Street is refined by these findings. It is also identified that the connection between street and health is not immediately obvious to all participants and therefore increased understanding about this topic is important in addressing the street as a health setting. Abdi reflects on how thinking about this topic is new for him and opens up different ways of thinking about the street space than he has previously experienced. Abdi reflects how the word *territory* did not make sense to him, he provides an alternative understanding:

> …it is a bit of a strange question to be honest with you, …what like this is territory and patch… I had to actually think about [that] but then when you prompted me and broke it down, where I … [am] the most comfortable would be there.

The concept of My Street as defining space and having some control over it is important for some participants, such as Ann having some control with her front garden space as a buffer to the public street space. Anthony is quite a private individual, this also reflects the culture of Beddoe Street where social boundaries are clearly defined, and this is somewhat self-selecting as Anthony has chosen to move to Beddoe Street. In contrast, for Aisha at Holman Street and

Jessica at Hoggan Street the street including these semi-private spaces like front gardens and even inside people's homes are communal space for My Street, they are part of the community sense and street space. Jessica relates this in part to social class. Both senses are separately evidenced in different streets: control over space with My Street viewed as incorporating control over space; and My Street as a much more community or communal shared space. These differences are important for health-related outcomes and it would for example be important for interventions in the street setting to identify the culture of the street and My Street can be used as a method to do this.

My Street is therefore refined to be where residents feel that their street extends to: their territory, home patch, and where they feel most comfortable in the wider street. Future research should be undertaken to further investigate these ecologic differences which are important for health-related outcomes.

4.6.5 Conclusion

This chapter section has identified the residential street as a health setting. The concept of My Street is the participant-defined and ecologic focus of where most health practices happen. Street cultures vary and understanding My Street in context is important in operationalising the street as a health setting. This chapter section has reported findings, recommendations to operationalise the street as a health setting and the implications for policy, practice, and future research are detailed in Chapter 5.6.

My Street is the part of the street physical environment where participants are most likely to be undertaking health practices and is therefore of particular importance for health-related outcomes in the street. My Street rarely includes the whole street and usually in this sample is a much smaller space, therefore it cannot be assumed that an intervention in one part of the street would impact all residents and their health practices.

In line with the constructivist-interpretivist epistemology of this research, My Street is a concept constructed with residents. For the street as a health setting to be effectively operationalised it is important to identify the culture of the street as interpreted by residents and My Street is a new concept that supports this.

4.7 A Field of Transdisciplinary Knowledge

4.7.1 Introduction

This chapter section focuses on how transdisciplinarity has been applied in the research and the results of that. This section discusses the finding that while overall a transdisciplinary research the depth of disciplinary integration varies across research values, epistemology, and methods. In contrast to *transdisciplinarity*, the etymology of the Welsh word *rhyngddisgyblaethol* encapsulates the complexity of this allowing contradictions to be included within this definition. My Street is discussed as a worked example of how transdisciplinarity was deployed in one part of the research.

The research area of urban health, and health in the street as a complex or wicked problem has been identified in Chapter 1 as a transdisciplinary problem requiring a "transdisciplinary knowledge domain" (Lawrence and Gatzweiler, 2017). Transdisciplinarity has been outlined as integral to the research values (Chapter 1), area of research (Chapter 1), related to the existing literature (Chapter 2), and as integral to methodology (Chapter 3). Methodologically this was set out under five headings (Chapter 3.1), discussed here:

Ways in which this research is transdisciplinary	**Findings / discussion**
Addresses a real-world problem, a complex problem, requiring methodology that goes beyond disciplinary boundaries.	The research has addressed the problem of health at the residential street scale in line with the research question(s). Methodology draws on disciplinary approaches from public health, architecture, urban design, urban health, and sociology.

Researcher immersion through training and self-reflection across several different disciplines.	Yes, both in this thesis and through module credits. Systematic review (health psychology) training was undertaken and applied (Chapter 2.2); training was undertaken across research methods including qualitative and sociological methods; reflective learning was undertaken (masters level credits) and recorded in a portfolio. As a solo research, not team research, I was limited to what I could achieve on my own and with a supervisory team purposively selected across public health, environmental science, and architecture.
Integrating knowledge across disciplines, stakeholders, institutions, and actors in the street.	The research has evidenced integration at different levels and the next section goes on to discuss how this varied across domains (Figure 70).
For epistemic justice and addressing actors excluded from creating knowledge about health in the street setting.	The research design throughout has aimed to place participants' perspectives at the centre of the research. The research design is limited in its ability to empower participants – I remained in control and held the power as the researcher. The research methods were however able to empower participants to a limited degree by opening up new ways of thinking (e.g. Aisha, Abdi) about their

	street environment. Whilst this is a small step, by supporting participants to problematise the issue the research can be argued to empower participants and support them in increasing their agency in the street setting.
Rhyngddisgyblaethol: this Welsh word describes transdisciplinarity in this research encompassing spatial, scalar, and temporal disciplinary differences; realised through relationships and conversations between disciplines; and simultaneously recognising both difference and similarity between disciplines.	The research has addressed a wide range of methods and topics including mapping and spatial ones. The approach has involved a recursive and reflective conversation through the analyses. There are differences between disciplines and for example the gap in epistemology between public health and design practice remains.

4.7.2 Findings and discussion

Chapter 2.1 defines multidisciplinary, interdisciplinary, and transdisciplinary and identifies these being on a continuum with ever increasing integration. Figure 70 below illustrates this with three nested definitions, the boundaries are intentionally discontinuous and wobbly. Three lines represent different levels within the research, methods, epistemology, and values. This is not comprehensive and other levels could be added. Three orange shapes illustrate an evaluation of where this research is positioned: overall the research is transdisciplinary but within this there is variation.

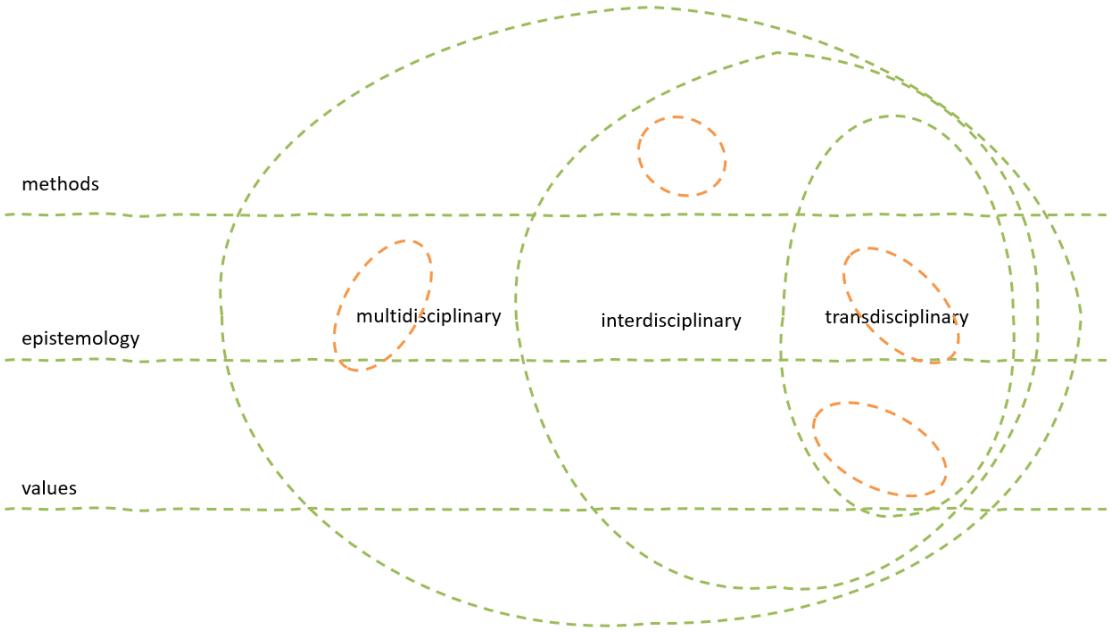


Figure 70: Illustration of continuum of multi-, inter-, transdisciplinarity and analysis of where this research is situated

As identified by Drane and Carmichael (2018) values present a potential bridging point between disciplines, in this research they are integrated drawing on established values including in public health and architecture. Methods of data collection and analysis are drawn from across disciplines and integrated in novel ways within facet methodology. This is a mixing of methods not epistemologies or ontologies (Lincoln, Lynham and Guba, 2018; Denzin, 2010). The nature of truth and knowledge in the research appears less integrated and harder to blend across disciplines: the truth in this research is socially constructed by the researcher and participant together. This act of joint construction of knowledge however, and the fact that it involves residents, is argued itself to be a form of transdisciplinarity working toward epistemic justice.

Metaphors are often used to describe complex concepts such as transdisciplinarity which has been described like a fruit smoothie (Dennison, 2017). For this research that seems too neat – not all the pieces of fruit have been fully blended down to a pulp and there are recognisable lumps of methodology and methods like *reflexive thematic analysis, a street section drawing*, terms like *health impact*, and *population health*, that can still be identified for their discipline. Here the metaphor of a painter's palette seems more apt: the primary colours represent disciplines and these are mixed in different combinations and quantities.

Limitations on transdisciplinarity in the research are also identified: it being sole research rather than a team research; the impact of Covid-19 on data collection methods and the extent to which participants could directly co-produce these; and the practical limitations within a PhD research and thesis.

My Street is now discussed as a worked example of transdisciplinarity in this research considering: research question, methods, epistemology, and research values.

To explore the street as the setting for participants' health practices it is implicitly necessary to define the street from the participants' perspective. The research question places together the street physical environment (a scale of urban design), as a health setting (a public health concept), for health practices (a public health and sociological concept) and investigates this from residents' perspectives.

The fieldwork methods use qualitative, semi-structured interviews. This method has been developed using qualitative research methods which are shared across several disciplines including in qualitative health research. This data has then been graphically transcribed using computer aided design (CAD) software, an architectural and urban design tool. Desktop data from an Ordnance Survey map has been used for the base drawing of residents' streets. The resultant My Street output is a transdisciplinary one.

Transdisciplinarity is reflected in the research epistemology in that participants' lived experience are the main source of truth for My Street however that truth is co-constructed with the researcher using methods detailed above. These methods are used to create a definition of My Street. This transdisciplinary knowledge integrates:

- participants' knowledge and lived experience;
- research methods;
- the research design: the conceptualisation of the street as a health setting related to health practices; and,
- the reflexive positionality of the researcher.

At the level of research values transdisciplinarity is reflected within the My Street definition in that it values participant and therefore community knowledge. The sampling strategy includes people from groups that are systematically excluded and marginalised currently.

4.7.3 Conclusion

This chapter section has described findings and discussed the application of transdisciplinarity in the research. The findings identify that while overall a transdisciplinary research the level of disciplinary integration varies across research values, epistemology, and methods. The Welsh word rhyngddisgyblaethol encapsulates the complexity of this and holds contradiction between disciplines together more holistically than the English language words. My Street has been discussed as a worked example of transdisciplinarity in this research considering: research question, methods, epistemology, and research values.

Taken together with the two preceding chapter sections this part of the thesis has moved from the granular and disaggregated level of analysis of the street environment to higher level, overarching findings: the complex and ecological nature of pathways to health impact in the street environment; the residential street as a health promoting setting; and the street environment as a field for transdisciplinary knowledge creation. All of these have implications for future research, practice, and policy.

4.8 Methodological Findings and Discussion

4.8.1 Introduction

This final section of the chapter focuses on methodological findings. The main methodological contribution of the research is a new combination of methods to evaluate the street as a health setting (Chapter 3), this section also addresses aspects of methodological validity and selected methodological findings that can inform future research.

4.8.2 Findings and Discussion

Overall methodology

The key methodological contribution to knowledge made by this research is an integrated system of data collection and analysis to qualitatively evaluate health practices at the residential street scale. These methods could be applied in future street-based research and some potential refinements, particularly practical and resource related, are discussed here.

The overall methodological framework (Chapter 3.1 and Figure 3) addresses ontology, epistemology, methodology, data collection methods, and data analysis methods. The coherence of this design and successfully operationalising it in the research is central to the study validity. Health practices have been found to be a valid and generative lens through which to empirically investigate the research questions. As implemented, the integrated system of data analysis and collection (Chapter 3.2, Figure 22) successfully addresses the necessary objectives of the research toward the research question.

The biggest challenge in this methodology has been practically the management and synthesis of a large quantity of data across multiple datasets. This is a result of both the research question and Covid-19 restrictions. These rigorously collected datasets are now available for future analysis and the opportunity for data collection in the exceptional circumstance of Covid-19 restrictions has been maximised. Doing so required significant resource and some data collection does not ultimately play a major role in the synthesis, for example: desktop data like historic mapping; calculations of dimensional characteristics of streets; and MAPS survey data.

The analysis is argued to have been completed successfully and as planned, however the number of datasets has increased the complexity of this. It has also increased the complexity of synthesis, for example a 'standard' reflexive thematic analysis report could readily have been developed from the data but within the available space this could only have addressed one dataset and therefore only part of the research question. In contrast, a central strength of this thesis is argued to be that it addresses all the datasets and all the facets. For future this is valuable learning to inform efficient research resource planning and how this is affected from the outset by the research question.

A sample was created that was sufficiently generative of data to respond to the research questions. The sample could be extended to include other types of streets and there would be value in doing this, it would be a resource intensive approach so a condensed methodology could be developed to support this. Comparative analysis by ethnic identity is limited because of the number of different ethnic identities of participants, in part resulting from these being self-described.

Validity related findings

As stated above, overall validity is materially based on the coherent integrated methodology presented at Chapter 3.1 and 3.2 and completion of the research in line with this. This section reports other methodological findings related to validity including: reflexivity; research topic; participant sample; interview methods; ONS Wellbeing Survey; and the use of technology for participant observations.

Reflexivity, position of researcher

Within this qualitative research the positionality of the researcher is included. This is not defined as bias, rather it is an integral part of the "partial, situated and contextual" (Braun and Clarke, 2021a, p.39) knowledge constructed in this research. It is important to detail this positionality, Figure 71 illustrates selected dimensions of this demonstrating that across many domains, as the researcher, I am in a position of privilege and power, something that has been continually reflected on throughout the research.

Figure 71: Wheel of privilege for Mark Drane, (developed from Canadian Council for Refugees, 2023; Duckworth, 2020)

It was a sampling objective to include people of different ethnic identities and this is viewed as a quality criterion to ensure the research question can be answered rigorously and an ethical one to ensure the research is working toward reducing health inequalities. The participant sample is argued to be a demonstration of successfully achieving this and a strength of this research. As one example, Aisha, a Somali Welsh woman reflected that:

> "…the way you [are] asking is, open minded [small laugh] of these issues because I've done other research and they try and lead you and it's so hard for them to even acknowledge and digest the information that the questioning becomes so it feels uncomfortable and really brutal, but I felt really different with this because I just feel like you understand these issues a lot." (Aisha)

This is an example of researcher positionality being carefully addressed in the research. As the researcher however I still held more power than participants. For future research it is argued that team research can support inclusion and diversity in various dimensions and of course that Aisha and others should have the opportunity to be researchers as well as participants.

Research topic and terminology

Validity of the research topic was tested with participants during the pilot observations and retained as an optional interview prompt throughout. For future research, ongoing testing of concepts and terminology is found to be a valuable objective to include throughout not just in piloting. Table 23 summarises participant responses.

Table 23: Summary of responses to topic relatability

Question	Yes	Very	Quite / relatively	Not covered
How did you find this conversation: what did you find easy to relate to and think about?	9 (45%)	4 (20%)	3 (15%)	4 (20%)

Data extracts from Luanne, Robyn, and Abdi illustrate these findings:

> …what it's done it's made me think even [.] more now about where I live… (Luanne)

> …I'm so used to thinking about my street, my interactions with it in terms of my work… bring my normal day to day interaction into that was interesting, I won't say difficult to relate to just different to think about. (Robyn)

> …you opened up my thought process about some stuff that I'd never actually thought about… which is *good*. (Abdi)

Language and wording of questions was refined through observations including the term *territory* which Abdi found hard to engage with and *activities* and *practices* in the street which Aisha found to be quite formal language.

Participant sample and gatekeeper organisations

As a result of Covid-19 restrictions the use of gatekeepers for recruitment increased. One of the gatekeeper organisations through which six participants were recruited has an explicit focus on improving the greenery of the street environment. Throughout recruitment and later analysis it was considered whether there was a risk that the sample was dominated by people who had a particular view in any direction toward their street environment. Thirteen participants were recruited through gatekeeper organisations and these broadly have a social purpose so it is possible that people attracted to such activities are more interested in the street environment and this may have influenced the data collected. Contradictory cases were sought during analyses. Examples include Beth who notes being part of a gatekeeper group but not having actively participated in it, and Scott and Anthony who are relatively uninterested in the street environment.

The sample was sized to be sufficiently generative to provide data to respond to the research question. A methodological recommendation for future research is to expand and systematically sample people with different views on their environment.

Interview methods – what have I missed question

The interview protocol included the question:

> Are there any other aspects of your identity or life that you feel might be important to consider in relation to the street, your activities there, and how they relate to health? Have I missed something glaringly obvious?

This question was developed based on the open approach to the interview protocol with the aim to maximise the range of data collected. For some participants this is a very generative question. Those responses include topics of: neighbour perception of identity and lack of awareness of other ethnic identities (Rania); ecologic sense of belonging (Rania); perceptions of neighbours of differing ethnic identity and religion (Katrin); and heterogenous impacts by gender (Ann). Ann for example outlines in some depth why women don't use the street as much as men for cycling. It is also only in response to this question that Ann identifies that she is a survivor of domestic violence. She provides insight that helps refine the concept of the street space as a social environment as much as a physical one, particularly identifying population groups who cannot access the street in the same way as other groups: asylum seekers; people in social housing; people in flats; people in care homes; ex-offenders and offenders; people on mobility scooties; people who can't walk.

> …so maybe the like your concept of a healthy street is, not limited that's not the right word, or restricted, assumes, makes assumptions that everybody can walk outside their house and let their neighbours know who they are. And what their name is. (Ann)

In contrast for some other participants (Luanne, Shiva, Rebecca, Scott, Gus, Ima, Abdi) this item confirmed that the questioning was relatively complete and supported validating the data collection process.

ONS wellbeing survey questions

This method is the only part of participant observations to use survey questions. The format of these questions follows the published script. The responses are on a scale of zero to ten related to: life satisfaction, life being worthwhile, happiness yesterday, and anxiety yesterday. The scale

is reversed for the last question and in several observations this scale reversal had to be clarified to participants which raises a question about whether the scale in wider use is easily misinterpreted.

The purpose of this survey method is to provide a numerical response however a significant number of qualitative responses to the questions are given with significant ecologic meaning. Aisha links her level of life satisfaction to her religion and this link is a potential area of future research that does not appear from a brief literature search to be addressed by the survey tool.

> …for me as a Muslim …being satisfied with your life, you have to take into account all the blessings that you have and that someone's always in a much worse position than you. (Aisha)

Covid-19 impact on technology / online interviewing

Interviewing participants in the street face-to-face became a potentially illegal activity and health risk due to Covid-19. Table 24 summarises participant responses, where given, to the validity question on online interviews which was mainly tested during pilot observations.

Table 24: Summary of responses to question about interview format

Tech	Yes / Fine	Better	It's normal / everyday	It's different / ok	Phone much easier	Not asked.
How did you feel about doing the interview online rather than face to face?	1	1	2	2	1	13

During recruitment, one participant withdrew due to not being comfortable with a phone call or web-based observation so this is noted as a limitation. The validation question responses highlight that digital inclusion needs considered more broadly than simply access to an operational device. For example, offering a range of options was important and for Ima telephone was, "…much easier for me than a video or a meeting." In contrast, for Rebecca

noted that using an online video call was "…like the new normal now." Robyn reflected that an online observation was actually better and changed the data collected:

> …because I'm in my own space, I almost feel more comfortable to open up, I've gotta say if we were on my street walking up and down, I might be a bit worried about what I'm saying, I might be a bit more self-conscious [small laugh]. …I think I've probably opened up more and found it easier to tell you things in the comfort and safety of my own home. (Robyn)

Overall, the change to online observations did change the data collection and methods. Samantha reflects on the impact of this:

> …it would have been nice to be able to show you these areas and say, "…this is this area, …this is what I meant by this", …I could show you and you could experience for yourself... (Samantha)

Finally, Luanne's observation highlights the simple but important point that with online observations a participant can be anywhere and the large shiny motorbike I initially assumed to be hers was in fact her friend's because she was at their house and not at her home in Cardiff.

4.8.3 Conclusion

Beyond the main findings the research makes methodological contributions to new knowledge. The main contribution is a new combination of methods to evaluate the street as a health setting. Conducting the research, especially during and in response to Covid-19 restrictions, has led to findings that inform future research on streets as a health setting.

4.8.4 Chapter Conclusion

This chapter has presented the findings and discussion, in Part I at a disaggregated level and in Part II drawing the arguments together at a high level and to address theory. Chapter 5.0 Conclusion is the final chapter of the thesis which critically reflects on the contribution and limitations of the thesis and makes recommendations for practice, policy, and future research.

Chapter 5.0 Conclusion

5.1 Introduction

This final chapter to the thesis provides a conclusion and addresses the contribution to new knowledge; limitations; researcher personal reflection; thesis conclusion; and findings for practice, policy, and future research.

This thesis including Appendix 1 comprise the material to be examined, all other appendices are supplementary material. One purpose of the thesis is to address the university doctoral descriptors (UWE Bristol, 2023). Table 25 below tabulates where these are evidenced in this thesis.

Table 25: Tabulation of doctoral descriptor criteria within thesis

Doctoral Descriptor ● - candidate's assessment of where requirement is primarily evidenced within thesis.	Chapter 1.0 Introduction	Chapter 2.0 Literature review	Chapter 3.0 Methodology	Chapter 4.0 Findings and	Chapter 5.0 Conclusion	Appendices
PGR2.2.1R The award of a doctorate of the University requires the postgraduate researcher to demonstrate that they:						
a. have conducted enquiry leading to the creation and interpretation of new knowledge through original research or other advanced scholarship, shown by satisfying scholarly review by accomplished and recognised scholars in the field;			●	●	●	
b. can demonstrate a critical understanding of the current state of knowledge in that field of theory and/or practice;		●	●			
c. show the ability to conceptualise, design and implement a project for the generation of new knowledge at the forefront of the discipline or field of practice including the capacity to adjust the project design in the light of emergent issues and understandings;			●	●		●
d. can demonstrate a critical understanding of the methodology of enquiry;			●	●	●	
e. have developed independent judgement of issues and ideas in the field of research and / or practice and are able to communicate and justify that judgement to appropriate audiences;				●	●	
f. can critically reflect on their work and evaluate its strengths and weaknesses including understanding validation procedures.			●	●	●	●

Chapter 1 detailed the research aim to evidence the residential street environment as a health setting. A research design was developed to address the overarching research question:

> What are people's everyday health practices in their residential street environment; which street environment characteristics impact those practices; and how are these both to be understood within a socio-ecologic paradigm of population health?

The thesis has responded to this question with a coherent methodology producing justified arguments and original contributions. It has addressed this in relation to the existing literature (Chapter 2.1) firstly situating the research topic and the street as a fieldsite across public health, urban health, urban design, and social theory including concepts of health practices, everydayness, and streetlife. Secondly it has (Chapter 2.2) summarised the findings of a systematic review. These findings were used to: refine the rationale of the street as health setting distinct from the neighbourhood and other scales; and to investigate health more widely than an initial focus on non-communicable disease. Chapter 3 has addressed methodology at all levels, a coherent and integrated system which is material to the study validity. Findings (Chapter 4) have been presented first at a granular and disaggregated level. Street physical environment characteristics have been illustrated through an in-depth visual analysis of the streets in the sample (Chapter 4.1, Appendix 1) followed by reporting of street physical environment characteristics (Chapter 4.2); health practices (Chapter 4.3); and health-related outcomes (Chapter 4.4). The findings have then been drawn together at an aggregated level to address the research question reporting findings of ecological pathways to health impact in the street (Chapter 4.5), the street as a health setting (Chapter 4.6), and transdisciplinarity (Chapter 4.7).

This chapter details the original contribution of this thesis (Chapter 5.2); limitations of the research (Chapter 5.3); and recommendations arising for practice, policy, and future research (Chapter 5.6).

5.2 Contribution to knowledge

This thesis makes novel contributions to cocreate health in local places. It makes novel transdisciplinary contributions through an integrative methodology, fusing knowledge across sociology, public/urban health, and urban design.

In the same decade that the Ottawa Charter (World Health Organization, 1986) linked everyday health settings and community empowerment as vital for health, Appleyard (1981) drew attention to the centrality of streets for quality of life. There has been no shortage of street design toolkits since, more recently with an explicit focus on health, however streets remain relatively overlooked in environment-health research. Much literature does not address holistic health and is focused on the physical not the social environment. Research tools prioritise objective survey by researchers who are increasingly disembodied from the street through tools like Google Street View. Practice tools often fail to address systemic drivers of exclusion and urban design practitioners treat local knowledge as secondary to their own expertise. Programmes like Healthy Cities have been too top-down and need to also address the grassroots (Dooris, 2013).

This thesis contributes an outward demand to address the residential street environment for its potential as a health setting: to co-create streets reflective of the diversity, complexity, and interconnectedness of contemporary societies, whilst promoting social justice and community wellbeing. Health promoting streets prioritise the knowledge of people in local places and link to other settings including Healthy Cities from the grassroots. A translational urbanism is proposed to be operationalised through Transdisciplinary CoLabs to foster local knowledge; involve all kinds of expertise; and address multilevel governance from inclusive streets to healthy cities.

The ways in which this research contributes to “new knowledge through original research” (UWE Bristol, 2023) are now summarised. This considers how the research relates to existing knowledge and how disciplinary variations might influence how originality is assessed (Baptista *et al.*, 2015). The contribution is described first for the inward-looking contribution and second for its outward contribution.

Focussing internally on the thesis, whilst transdisciplinary, the research is also qualitative and has an orientation toward social science and humanities approaches which implies a set of

norms for judging originality. Contributions are identified using relevant definitions of originality (Guetzkow, Lamont and Mallard, 2004) including: a new approach, a new method, new data, an understudied area both spatially and temporally, and new findings.

This thesis, healthy streetlife, is a contribution to a new approach and orientation to healthy streets: through the overall research design the street as a health setting, addressing holistic health, is argued and evidenced as an important scale in its own right. This goes beyond and is materially different from existing health-related street checklists including Healthy Streets (2024a), street design guidance, and research into limited health outcomes and risk factors at the street scale. It is a settings-based approach to health, the street setting is evidenced as distinct from other urban settings like Healthy Cities in the same way that for example Healthy Schools are distinct from other parts of the education system and require specific frameworks and approaches.

Aspects which characterise and strengthen the claim to originality relate to: Covid-19, an inductive methodology, a broad definition of health, and transdisciplinarity. The research design responded to field observations being undertaken during the Covid-19 pandemic; conceptualised a holistic definition of health and wellbeing; and used new combinations of transdisciplinary methodologies and methods.

This new approach links to the next contribution that the research makes to new methods. These include:

- An integrated system of data collection and analysis, integrating participant observation, street observation, and desktop data;
- New visual methods for street observations, the combination of these (en plein air sketch, plan, section, materiality and texture photomontage, My Street), and the specific methodological application of these as observational tools in health-environment research;
- My Street: as a method for integrating participant perceptions of the street social and physical environment, being the spatial location where health practices are concentrated;
- Covid-19: development and use of methods to respond to a qualitative study during Covid-19 in Wales adapting existing methods to address issues of: restrictions by Welsh

Government; health and safety of researcher and participants; reciprocation for participants; consent; and interview techniques, particularly focusing on the wellbeing of participants during a time of additional stress; and,

- Ethics: a contribution to methods for safe participant and street observation with an emphasis on participant wellbeing. It also contributes to methods for addressing ethics at all stages and levels of the research beyond institutional and procedural requirements.

The thesis contributes original new data. This comprises new datasets including: street physical environment visual data; street physical environment data from participant observations; and health practice data from participant observations. Extending the practical usefulness of this contribution transcripts and audio recordings of participant observations have been ethically approved and consented for deposit in an academic data repository. This provides a valuable resource of data for future research collected within weeks of the first Covid-19 lockdowns in Wales and over the following year.

The thesis makes a contribution to both an understudied region (the street environment) and time period (during a global pandemic). The street scale is a relatively understudied region or scale of the urban environment: 91% of tools identified by Pineo, Glonti, and Rutter's systematic review (2018) do not address the street scale. The thesis also makes a contribution to an understudied time period, during the Covid-19 pandemic. Whilst the pandemic was beyond the researcher's control, the research was able to be rapidly adjusted enabling this time period to be studied.

New findings are a further contribution made by the research including:

- Systematic review findings: synthesis of existing evidence from multiple existing sources to create original new findings (Chapter 2.2);
- Descriptive findings of street physical environment through the use of visual methods (Appendix 1);
- Health practices: identifying at three levels of analysis (code label, thematic, processual components) health practices in the residential street environment (Chapter 4.3) linked to health-related outcomes (Chapter 4.4);

- Street environment characteristics: identifying at three levels of analysis (code label, thematic, and processual components) street environment characteristics in the residential street environment (Chapter 4.2) linked to health-related outcomes (Chapter 4.4);
- At an overarching level the research has contributed to new knowledge and extend existing understanding of: ecological pathways to health impact in the street (Chapter 4.5); the street as a health setting (Chapter 4.6); and the street environment as a field of transdisciplinary knowledge (Chapter 4.7).

This research does not evidence causality however it does make a contribution as a qualitative research to understanding of causal mechanisms and processes. These have importance for understanding mechanisms related to causation as they "all imply something about why and how social phenomena or processes occur or operate…" (Mason, 2018, p.222). To that extent the thesis contributes "…higher-level concepts and theories that have relevance beyond a particular setting or context…" (Braun and Clarke, 2022, p.145).

As well as these inward facing contributions, the overarching new findings contribute to an outward facing contribution. This outward contribution argues, even makes a "demand" (Bankcroft, 2021) for a change of approach in relation to population health in the street environment. This a call to take the socio-ecologic paradigm of health further to address not just the wider determinants of health but the wider, wider determinants of health and their ecologic complexity in the street setting.

This outward contribution has importance for scholars, practitioners, and residents. For researchers the original contribution sets out a transdisciplinary domain of thinking, justified arguments for the residential street as a health setting, and outlines the street as a socio-ecologic problem, linking health practices, street environment characteristics, and health-related outcomes in new and imaginative ways. It is a modest contribution that builds on and responds to calls for fresh approaches to the public health evidence base (Ogilvie *et al.*, 2020; Rutter *et al.*, 2017; McMichael, 1999; Susser and Susser, 1996b, 1996a; Krieger, 1994) and for greater use of health practices as a way to address environmental determinants and focus wider than individual behaviours (Knöll and Roe, 2017; Cohn, 2014).

For practice the outward contribution includes delineating a new transdisciplinary field of practice at the street scale. For residents of streets this research contributes a small shift toward epistemic justice and demands a continued shift in this direction.

The contributions this research makes is both inward facing as well as outward. The inward contributions include a new approach, a new method, new data, an understudied area both spatially and temporally, and new findings. The contributions are necessarily bounded by various constraints and research design decisions and these limitations are now addressed.

5.3 Limitations

This section sets out limitations assessed as having the greatest potential for impact on the research findings and their ability to address the research questions. It is not an exhaustive list and it does not address issues that are out of scope for the research question, which are intentional design decisions not limitations.

However, to make the implications of these decisions explicit, the research findings are bounded by the methodology based on the rationale described in Chapter 3.1 including that a constructivist-interpretivist epistemology is used. This was selected for its interpretative strength and the need in this research to generate "understanding by interpreting subject perceptions…" (Lincoln, Lynham and Guba, 2018, p114). The research cannot create findings that might be generated through a critical realist approach for example. The research does not aim to investigate a sample representative of a population and no claims of representation, of following a "logic of inference" (Maxwell, 2010, p. 477), or of generalisability. In other words, the findings are "…intrinsically *local*, and… conclusions rely on a different kind of argument from that of quantitative research…" (Maxwell, 2010, p. 479).

The impacts of Covid-19 on the research have been discussed earlier (see Findings and Discussion Part 2). The research is an investigation of streets and health during a Covid-19 pandemic and this situates the knowledge created in this specific context although it is not the only factor. The timing of the research during the Covid-19 pandemic results in a number of limitations and strengths in the research and these are not solely related to methods but also to the specificity and wider application of the findings. In addition to limitations this creates strengths including a degree of nuance and specificity to the findings. Certain findings, particularly in Part 1 of the findings at a granular level are specific to the context of the pandemic (e.g. social distancing health practices). Others have wider applicability that can be drawn such as the Part 2 findings which address conceptual and theoretical contributions.

Additional specific limitations include: language; practical constraints; researcher positionality; recruitment; Cardiff as a fieldsite; the use of remote interviews; timing of observations; and participant characteristics not sampled for or collected.

The researcher only has fluency in English and a limitation of the research is that it was conducted in English at all stages;

Practical constraints of time and resource were limitations, particularly for methods where repeated review or coding can be undertaken. In the systematic review a 10% sample of inclusion decisions were validated by a second reviewer in line with a previous review (Pineo *et al.*, 2017). Coding for reflexive thematic analysis was done with a single complete pass and not multiple passes, in this case 94% of finally included code labels were identified after 60% of transcripts had been coded. In both cases further iterations of validation and coding may have affected the results.

Chapter 4.4 has addressed researcher positionality, the limitation arising is that the interpretation and construction of findings are contextual and situated, this affects both the researcher's overall positionality in the research as well as the researcher interpretation applied to the data which is integral to the findings.

For recruitment the researcher invested significant time in recruiting a range of people from different backgrounds, with sampling specifically addressing gender and ethnic identity, however a limitation is that in spite of these efforts it may not have been possible to access certain potential participants.

Participant sample: gatekeeper recruitment was used more as a result of Covid-19, this has been considered within the findings, nevertheless there is a possibility that the resultant sample may have had more people with an interest in volunteering, particularly environmental and street focussed activities and this could have affected the data collected.

Street sample: the city of Cardiff as the fieldsite limits the available range of street types to be investigated. Whilst Cardiff has some similarities with other locations, cities are heterogeneous which as Pineo identifies limits generalisability of findings and "…makes it difficult to compare urban health challenges and solutions internationally." (2022, p.22). One implication of this is that housing types not represented in the sample are: tower blocks (these can be found in Cardiff, indirectly included with Shiva); 1960s-2000s planned housing estates (these can be found in Cardiff, particularly to the East of the city however this is a practical limitation during

Covid-19 restrictions); deck access apartments (the researcher is not aware of any of these in Cardiff); and contemporary volume housing developments (present in Cardiff but plausibly less prevalent in the sample area focused on 50% most deprived areas).

As discussed at Chapter 4.9, due to Covid-19 online or telephone observations were conducted with participants with an impact on both recruitment and data collection. For recruitment this is a limitation in participants, notably one participant withdrew for this reason and there may have been further unobserved impacts on recruitment. For data collection the impact is both a strength and limitation: Robyn felt psychologically safe at home which changed the data she shared: other potential participants may not have been able to be accessed because they did not feel safe at home, for example as Ann, a survivor of domestic violence, notes she would never previously have joined such research whilst in that situation.

A further potential limitation is the different timings of participant and street observations which are plotted on a timeline at Appendix 10. Factors which may have affected these observations include: status of Covid-19 restrictions, school term time or holiday time, and seasonality.

Participants were sampled by age, gender, and ethnic identity. By not including other characteristics as sampling criteria the experiences of certain population groups may not be included in the research such as disabled people or people of different faith groups. This is also an ethical and legal consideration that was required to be balanced with: the context of Covid-19 and the additional pressure this created for all participants; and the data protection principle of personal data minimisation.

The strengths of this research also define its limitations and set the boundaries of what can be claimed. The limitations have been outlined to arise from a range of methodological and practical reasons in the research, in particular the impact of Covid-19.

5.4 Researcher personal reflection

As a qualified architect what inspired me to start this PhD was the potential I saw for integrating research into practice. I also wanted to use this understanding to put my professional values into action, to keep people healthy in the places where they live, work, learn, and play. The Grenfell Tower disaster and my experience of risks to health being created in architectural practice as logical outcomes of the current system made me question how I could evidence any claim to be creating healthy places in practice.

There were probably quicker and easier ways to learn about research methods than a part-time, self-funded PhD over seven years whilst also leaving secure employment to start a new professional practice focused on health and urbanism. However, the main personal and professional aim in doing so was to bring research into practice and parallel working in PhD and practice has attempted to model this.

A logic model of the PhD that I prepared in 2017 demonstrates how my understanding has developed. It also shows how I actively responded through the research design to the outcomes of the literature review and refined the design from a focus on quantifying the health impact of street physical environment characteristics identified in existing literature toward qualitatively investigating which characteristics mattered to residents. This initial logic model – and my understanding at the outset – was more focused on the problem of health in the street being deterministically driven by the actions and decisions of designers and the physical interventions they made. This thesis has shifted my focus to systemic drivers such as discrimination; to the wider determinants of health; to the social as well as the physical street environment; and to the role of residents as active agents. The outcomes of the logic model included to increase understanding of the built environment in health; to contribute to joining up discussion between designers, planners, and public health practitioners; and integration of practice and evidence base. These outcomes remain similar however the necessary future steps to achieve these have developed and changed. This places me in a better position to effect the change that was my initial professional and personal aim. The thesis recommendation (Chapter Section 5.6) of a Transdisciplinary CoLab is central to my future direction. This is focused on practice-based research that is co-produced with residents and communities and includes their knowledge. In

preparing a plan for postdoctoral activities a further logic model has been developed that reflects this development. The overall aims and scale of ambition are largely the same but my understanding of the problems and proposed methodological approaches to these has evolved. The original 2017 logic model and a revised forward looking 2024 version are included in Appendix 13.

It remains the case that there are few practitioners with experience and training across both research and practice *and* population health and built environment. This *translational urbanism* is where I can now best contribute in future and the work represented by this thesis means I am well placed to develop practice-based research to address population health and work toward health justice.

5.5 Conclusion of the thesis

This thesis has aimed to investigate the residential street environment as a health setting and has found it to be a distinct, valid, and important setting within which to address population health. The street has not been prioritised as a scale or a social setting, it is one setting within which health should be addressed as part of action for health at all scales and in all policies.

The thesis has taken a specific approach, through several facets, to address the topic. These facets are clear in the research question: what are people's everyday health practices in their residential street environment; which street environment characteristics impact those practices; and how are these both to be understood within a socio-ecologic paradigm of population health? The findings in this thesis provide an original and deeper understanding of these different facets and the street setting overall. The thesis has empirically evidenced, argued for, and justified a number of original and new contributions to knowledge. These findings have limitations and cannot be generalised, this includes the researcher's positionality within this qualitative study.

This research is practically oriented with a professional and personal aim for the researcher to promote population health and address reducing health inequalities. In this final chapter section of the thesis, findings for practice and policymakers are also presented as well as ideas for future research. The human right to the "highest attainable standard of health" (World Health Organization, 1946, p.1) is not one that can be delivered by any one sector or discipline alone and requires multi-sectoral and transdisciplinary action. The streets where people live are part of the wider, wider determinants of health and evidencing the street as a health setting can support action for health promotion. The street environment, both physical and social, is a setting where that right to good health and to health equity can be created *with and by* the people who live there.

5.6 Recommendations for practice, policymakers, and future research

This section presents recommendations for practice, for policymakers, and for future research.

First three headline recommendations are foregrounded. These address the problem identified including that:

- streets remain relatively overlooked in environment-health research;
- some literature does not address holistic health and is focused on the physical not the social environment;
- research tools often prioritise objective survey by researchers who are increasingly disembodied from the street through tools like Google Street View;
- practice approaches address inclusion and equity through a shallow focal length and often do not extend this to consider systemic drivers of exclusion;
- urban design practitioners tend to treat local knowledge as secondary to their own expertise; and
- programmes like Healthy Cities have been too top-down and need to also address the grassroots.

A health settings approach

The first foregrounded recommendation is that the street should be addressed as a health setting. Detailed recommendations follow for how this should be developed through frameworks, governance, and systemic action that builds on existing knowledge and addresses known gaps. A salutogenic or positive health orientation is integral to a health settings approach and settings-based approaches should be more widely mainstreamed (Bauer *et al.*, 2020). This mainstreaming should include addressing critiques of prevention and upstream approaches that are frequently the focus of policy, practice, and research.

Transdisciplinary CoLab(s)

This second key recommendation reimagines Community Technical Aid for today's poly-crises. It addresses practically and conceptually how to link the social and physical environment with local knowledge. The recommended Transdisciplinary CoLab is a scalable methodology to address more localised co-production, in context, down to the street scale both socially (street communities) and physically (e.g. street layout and design). This can address implementation gaps such as calls for good health and community empowerment within policies ranging from the Ottawa Charter to the Well-being of Future Generations (Wales) Act (2015). This recommendation is for local knowledge to be fostered; for the involvement of all kinds of expertise; and for multilevel governance to be addressed from inclusive streets to healthy cities. Implementing this recommendation can help address limitations of existing programmes such as Healthy Cities being overly top-down (Dooris, 2013) and the need to include bottom-up approaches (Toyne and Khan, 1998).

Ethical and evidence informed built environment practice

This third foregrounded recommendation is for practitioners to co-create streets to be reflective of the diversity, complexity, and interconnectedness of contemporary societies, whilst promoting social justice and community wellbeing. Streets are part of the built environment sector within which the Grenfell Tower inquiry has revealed systemic failings: ethical ways need to be developed for practice to deliver on professional duties toward health. This requires a position toward the use of knowledge and it is recommended that a good starting point is to draw on existing public health codes for use of best available evidence relevant to the particular context. Integration of practice and research is recommended: in fields like medicine this is more common yet in design and built environment it is the exception. This recommendation includes opportunities for skilled and professionally rewarding integrator roles creating opportunities for positive action across practice/policy/research and transdisciplinary dimensions, for example within Transdisciplinary CoLabs.

These highlighted recommendations can help to close implementation gaps and support policy innovations, including in the context of austerity and pressures on public services. The economic and societal benefits from these recommendations are material: to date this research has already contributed evidence submitted to the House of Commons young people and the built environment parliamentary inquiry (Bray *et al.*, 2024) and evidence submitted to the Future Generations Commissioner for Wales leading to recommendations for public bodies to support, “communities to redesign their streets to improve their health” (2023).

These recommendations require significant investment and action across systems, sectors and policies. Nevertheless, if successfully delivered the long-term impacts of achieving the systemic change that these recommendations call for could be for the built environment what Bevan achieved for healthcare in creating the NHS.

The rest of this section presents a more granular and detailed set of recommendations. Most of the topics overlap and require action by each group so are presented in tabulated format organised by strategic and tactical recommendations (Table 26).

Table 26: Recommendations for practice, policy, research

Recommendation	Detail	Type of recommendation	Chapter reference	Relevance for ● direct relevance ❍ be aware of		
				Practice	Policy	Research
Strategic recommendations						
Address the street as a health setting	The street should be addressed as a health setting based on the principles described (see Chapter 2.1) and in response to priorities for urban health including addressing health equity through health promotion in local and city settings (World Health Organization, 2023b). Implementing this recommendation can help address limitations of existing programmes such as Healthy Cities being overly top-down (Dooris, 2013) and the need to include bottom-up approaches (Toyne and Khan, 1998). Strategic frameworks and models – theoretical and operational – should be developed for healthy streets as has been done for other settings to support this. Address health holistically and the governance context of	Strategic, health setting	Ch. 4.6	●	●	●

	streets within this: good governance would be participatory governance (World Health Organization, 2023b). Action should build on existing knowledge and address known gaps including the need for the street setting to demonstrate "…connectedness 'outwards', 'upwards' and 'beyond health'". (Dooris, 2013, p.48) and how salutogenic approaches can continue to be mainstreamed (Bauer *et al.*, 2020). Practice guidance should be developed that addresses the street as a health setting. The decision to "deprioritise" (Department for Transport, 2023) the production of Manual for Streets 3 for UK practice is an example of this not being given priority. Existing UK guidance does not address the street holistically as a health setting. Guidance should be supported by policies.					
Transdisciplinary practice and research	Transdisciplinary approaches are important to pursue in research, as identified in Improving the Health of the Public by 2040 (Academy of Medical Sciences, 2016). Transdisciplinarity requires skilled practitioner integrators with skills across practice, research and multiple disciplinary fields, for the street setting this particularly means public health and urbanism. This could be termed *translational urbanism*. Competencies,	Strategic, methodology, transdisciplinarity	Ch. 3.1, 4.7	●	●	●

skills, and ethical frameworks should be developed to support this.

Drawing on examples of community grounded practice (CoLab Dudley, n.d.; CoLab Exeter, n.d.) such a space could be called a *Transdisciplinary CoLab*. Figure 72 illustrates one potential convergence of disciplines and fields of practice for the street setting: a *Transdisciplinary CoLab*.

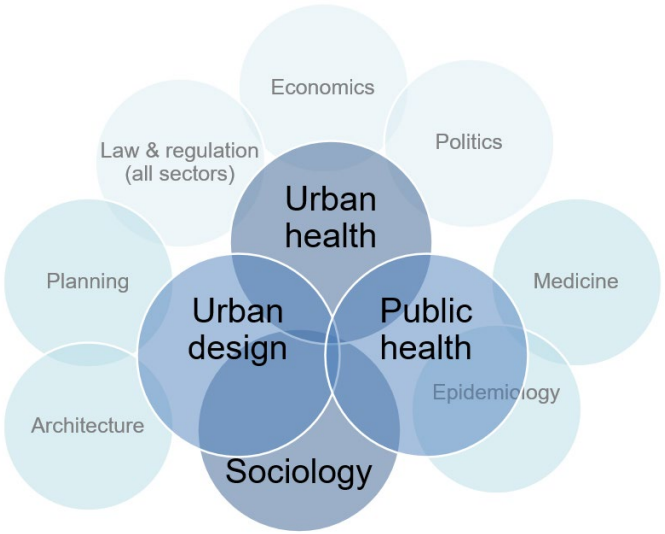


Figure 72: Health promoting streets, a transdisciplinary CoLab

Integrated system of duties for population health in design practice	Codes of practice and ethical codes for design practitioners should incorporate promoting human health as a duty for practitioners. Public health ethical frameworks provide a template. For example a duty to, *"…protect and improve the health of populations… based on the best available evidence..."* (Faculty of Public Health, 2016, p.4). The inclusion of a position toward evidence and its ethical use is important within this. Systemic action is needed across all sectors, actors, and policies in the street environment including: practice guidance, workforce, commercial, legal, procurement, financing, and insurance levers. That workforce should also be representative of the population.	Strategic, design practice, ethics	Ch. 2.1. 3.1	●	●	❍
Creating with residents	The research base for agency as a wider determinant of health should continue to be developed including studies focused on the street setting. Practises and policies at the street scale should also address this evidence base. For transdisciplinary practice new forms of practice are needed, one recommended form is a reimagining for the present day of Community Technical Aid Centres (*Spatial Agency: Community Technical Aid Centres*., n.d.). This recommendation is for local knowledge to be fostered	Strategic, co-production	Ch 2.1, 4.0	●	❍	●

	and for all kinds of expertise to be involved. Implementing this can help address limitations of existing programmes such as Healthy Cities from grassroots.					
Street governance, role of local authorities	City governance including at the street scale is vital to addressing the street as a health promoting setting. Good urban governance for health is "…participatory governance built on multisectoral action and civic engagement." (World Health Organization, 2023b, p.1) Local authorities have a special and important role to play. Multilevel governance is needed from inclusive streets to healthy cities and healthy streets should be integrated across all policies and all sectors not siloed as is evident in some examples given in this thesis. A Health in All Policies (HiAP) approach should be taken (World Health Organization, 2014). Activities and service areas of particular importance for local authorities to consider at the street scale are: household waste collection, benches and sitting places, litter bins, pavements, street cleaning, children's playgrounds, youth services, sports facilities, street trees, planning authority, regeneration, street enforcement and powers of legal	Strategic, governance	Ch. 4.2, 4.3	❍	●	❍

	prosecution, tacet control of the street, land ownership, parks, highways, street planters, litter picking, political and democratic processes, and engagement and consultation. Addressing these could support Cardiff Council's policy to implement "streets for health" (Cardiff Council, 2020, p.21). Local authorities should address their tacet control by giving explicit permission for residents to act in the street as the city of Paris has done (La Ville de Paris, n.d.). It is important for local authority workforce to be representative of the citizens it serves. Local authority activities in household waste collection, litter picking, and community planters have value for health and this value may be underestimated as citizens tend not to link benefits to actions of the local authority.					
Inclusive streets	Creating inclusive street environments is a priority for practice and policy. From this research it should be recognised and addressed that many groups can be excluded as the norm from the street environment. Findings from this research should be addressed alongside other		Ch. 3.1, 4.0	●	●	●

	population group tools (e.g. Public Health Wales, 2020) to address exclusion including due to structural discrimination.					
Tactical (methodological) recommendations						
Findings	The detailed findings in this research should be considered and addressed for their implications in practice, policy, and future research. The findings should be promptly presented and published through various channels and media for different audiences.	Tactical, findings	Ch.4.0	●	●	●
Methods	Plan for open approaches to data collection, allowing participants to describe health-related outcomes for themselves. Allow that they may not use recognised terminology for these.	Tactical, health research	Ch.5.2	❍	❍	●
Methods	Research on street settings has the potential to expand resident knowledge and agency about the street setting where they live. Observation methods should avoid leading questions and allow participants to develop their own interpretations.	Tactical, field methods, reciprocation	Ch. 3.2, 4.2, 4.3	❍	❍	●
Future research methods	Future quantitative research should address issues identified through systematic review of the literature. Risk of bias tools should assess important confounders for street setting studies. Future research should seek to address methodological weaknesses which was identified in all	Tactical, methods, risk of bias	Ch. 2.2, App 2	❍	❍	●

	included studies. Studies should do more to minimise risk of bias in selection, confounding, and data collection.					
Methods / topic: role of tenure	Housing tenure should be addressed in future research to investigate further its impact on issues such as being in green space and nature. Such research should inform policy and practice to address issues such as tenants in rented properties being financially penalised for providing green space and seemingly unequal access to outdoor space which can impact on health practices.	Tactical, methods, topic	Ch. 4.3	●	●	●
Street activation opportunities	Street activation opportunities may exist through health practices related to physical exercise and children's learning and play. Action in this area could also address health inequalities such as by gender and ethnic identity.	Tactical, intervention design	Ch. 4.3	●	●	❍
Pandemic preparedness	Streets should be recognised as a health setting and for their potential to support health protection, for example through maximising street activation and ensuring equitable access.	Tactical, health protection	Ch. 4.2, 4.3, 4.6	●	●	❍
Issues of scale	The street scale should not be conceptualised as a hard boundary but overlapping with others such as neighbourhood and house scales. Action	Tactical, health practices	Ch. 3.2, 4.2	●	●	●

	for health should be coordinated across different scales and health settings.					
Polarisation of the political sphere	Practitioners and policymakers should develop political awareness and awareness of community level conflict. A polarised sense of belonging potentially results in people either being 'in' or 'out' and that polarisation has the potential to reduce the effectiveness of the street as a health setting.	Tactical, health practices	Ch. 4.3	●	❍	❍
Latent meaning and motivation	Practitioners and policymakers should avoid oversimplification of complex topics and seek to understand mechanisms and norms in the street. Practice should focus on health-related outcomes using methods such as HIA (Chadderton *et al.*, 2012).	Tactical, health practices	Ch. 4.3	●	●	❍
Pace / permanence of change	In the street as a health setting, physical environment change can be slow and happen over years, once made, changes are often long lasting. Practice should develop approaches that are able to act on health-related outcomes over the long term; and evaluate short-term interventions for long-term impacts.	Tactical, street physical environment	Ch. 4.2	●	●	❍

Community expertise	Identify individuals within communities who have a high level of knowledge about the street setting, they may help speed up community co-design whilst rapidly accessing existing knowledge to create change.	Tactical, street physical environment	Ch. 4.2, 4.3	●	●	❍
My Street extent	The My Street definition should be integrated into thinking as it rarely includes the whole street. To benefit all residents it may be necessary to undertake interventions in several places in a street.	Tactical, street physical environment	Ch 4.1, 4.6	●	●	❍
Complex systems approaches	Complex systems methods should be included in transdisciplinary approaches to evaluate health interventions in the street setting. Two worked examples are included at Chapter 4.5 (Figure 68 and Figure 69). The wider methods of complexity science could be applied which McGill *et al.* (2021) have categorised as: system mapping, network analysis, system modelling, and system framing. Such methods should be employed in tandem with strategic recommendations, this would be like approaches such as Griffiths *et al.* (2023) who propose a framework for obesity as a complex problem integrating: coproduction, systems thinking, quantitative systems modelling, systems approaches, evaluation, and shared learning.	Tactical, methods, evaluation	Ch.4.5	❍	●	●

This research has had a practical orientation to inform future health promoting practice. This final chapter section which concludes the thesis has presented recommendations for practice, for policymakers, and for future research. This sets out an initial series of forward actions. These are not proposed for research, policy, and practice separately but rather delivering on health promotion in the street requires systemic integration across all of these. Combined with the evidence in this thesis about healthy streetlife these recommendations are a clear and actionable call for health promoting streets.

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Appendices

The following appendix is part of the body of work to be assessed (included as an appendix as confirmed by email with UWE Graduate School 11/07/2023).

Appendix 1	Chapter 4.1 Street Physical Environment Visual Analysis

The following are relevant appendices (per UWE Graduate Handbook PGR 13.10.1).

Appendix 2	Supplementary Material to Systematic Review (Chapter 2.2)
Appendix 3	Table: Critical Appraisal.
Appendix 4	Fieldwork and Analysis Methods Tables.
Appendix 5	Fieldwork Risk Assessment.
Appendix 6	Fieldwork Protocol.
Appendix 7	Participant Observation Interview Protocol.
Appendix 8	Participant Information Booklet.
Appendix 9	Table: Comparison of Potential Analytical Methods.
Appendix 10	Cardiff Covid-19 Timeline, with Fieldwork Observations Mapped.
Appendix 11	Table: Chapter 4.2 Street Environment Characteristics – Illustrative Photographic Examples.
Appendix 12	Table: Health-Related Outcomes compared to Disease Classification.
Appendix 13	Logic Model for a PhD

The following is a copy of a publication arising from the research not otherwise included in the body of work to be assessed (per UWE Graduate Handbook PGR 13.10.1).

Appendix 14	Conference Paper: Typologies of knowledge for healthy streets: the need for an interdisciplinary paradigm for public health and design practice.

Appendix 1 | Chapter 4.1 Street Physical Environment Visual Analysis

Appendix 1

Chapter 4.1 Street Physical Environment Visual Analysis

Healthy streetlife: an ecologic exploration of residents' health practices in the street environment

Mark Drane
UWE Bristol
Rev C May 2024

Front cover image: fieldwork photo from street observation at Tomos Street, February 2021, Covid-19 lockdown status: stay at home lockdown.

contents:

Word count: 988 excluding text on drawings

revision notes

Revision	Notes	Issued
Rev -	First draft issued to supervisors.	25/11/2021
Rev A	Additional street materiality figures added.	21/11/2021
Rev B	Final materiality sketches added, rephotographed sketches added, page layouts adjusted, street photos added per street, OS / Digimap copyright note adjusted.	11/08/2023
Rev C	Single typo in introduction corrected.	27/05/2024

introduction

This chapter section comprises part of the material to be examined. It is presented as a separate artefact due to the format of the material and combines the outputs of visual analysis. Its purpose in the thesis and toward the research questions is descriptive and illustrative, providing the reader with some of the context and understanding about the streets that I as the researcher was able to observe during fieldwork.

Whilst descriptive this output also represents the outcome of analytical steps such as where to point the camera or where to cut a section line through a street plan. These are all methodological decisions, they transform and create new data, and represent a new interpretation of the street environment. What is shown here is the street physical environment yet traces of street the social environment and health practices can nevertheless be found within it.

street pseudonyms

To anonymise streets a pseudonym was selected. Historic gender-biased street naming conventions are identified in many countries globally (Forrest, 2018): in this research all streets are named for women using the following protocol:

Name selection, all starting with same letter as street, either:

1. Wales Equality Network 100+ Welsh Women list (WEN Wales, 2018) or,

2. Specific research related to a street to create a relevant name.

All street names have the second part as 'Street' irrespective of actual name being Crescent / Road / etc.

No street name is repeated.

Table 1: Street Pseudonym List

Street Pseudonym	Named after	
Arfon Street	Lady Megan Arfon Lloyd George	Member of Parliament
Ashley Street	Laura Ashley	Businesswoman & designer
Beddoe Street	Deidre Beddoe	Historian
Cadwaladr Street	Elizabeth 'Betsi' Cadwaladr	Nurse
Campbell Street	Betty Campbell	Head teacher
Chamberlain Street	Brenda Chamberlain	Artist & poet
Dillwyn Street	Amy Dillwyn	Factory owner
Hester Street	Hester Millicent Mackenzie	University Professor
Hoggan Street	Frances Hoggan	Doctor
Holford Street	Karen Holford	University Professor & Engineer
Holman Street	Martha Musonza Holman	Charity founder
Kinsey Street	Christine Kinsey	Painter
Legall Street	Gaynor Legall	Cardiff Councillor
Nia Street	Nia Rees	Footballer
Philippa Street	Philippa of Hainault	Queen
Simpson Street	Jane Simpson	Engineer
Steer Street	Irene Steer	Swimmer
Tomos Street	Angharad Tomos	Welsh Language Campaigner

street descriptive data

From the Computer Aided Design (CAD) drawings prepared certain dimensions were evaluated in relation to the street morphology. My Street Area is a measure that combines participant observation and desktop data to produce the new concept of My Street which can be spatially described.

Table 2: Street Descriptive Data

Street Pseudonym (sorted alphabetically)	**Participant Pseudonym**	**Front Garden / Yard**	**Street Era**	**Street Predominant House Type**	**Carriageway Width (m)**	**Public Street Width (m)**	**House to House Width (m)**	**My Street Area (msq)**
Arfon Street*	Abdi*	Yes	2000-2010	Terraced House	14.7	59.61	63.25 (to railway)	282
Ashley Street	Scott	Yes	1918-1945	Terraced House	11.74	18.62	23.48	850
Beddoe Street	Anthony	Yes	1945-1960	Semi-Detached	6.17	15.34	30.1	5,740
Cadwaladr Street	Ann	Yes	1880-1918	Terraced House	10.41	15.37	19.75	1,432
Campbell Street*	Abdi*	Rear Garden	2000-2010	Terraced House	5.33	19.66	29.2	952
Chamberlain Street	Mabon	Yes	1880-1918 (participant part) 1930-1950 (other part)	Terraced House	8.24	12.42	18.16	1731
Dillwyn Street	Beth	Yes	1880-1918	Terraced House	9.96	14.29	17.75	1,620
Hester Street	Julia	Yes	1880-1918	Terraced House	8.42	12.71	16.52	664

Hoggan Street	Samantha	Yes	2000-2010	Terraced House	5.65	9.38	17.52 (see section)	2,994
Hoggan Street*	Jessica*	Yes	2000-2010	Terraced House	5.65	9.38	17.52 (see section)	6,211
Holford Street	Rebecca	Yes	1918-1945	Semi-Detached	2.61	4.59	21.9	653
Holman Street	Aisha	Balcony	1970s	Maisonette	n/a	14.32	30.61	454 + 766 (shared)
Kinsey Street	Gus	No	1880-1918	Terraced House	9.81	15.12	15.12	1,019
Legall Street	Shiva (self)	Yes	1945-1960	Semi-Detached	5.45	8.96	25.85	1,975
Nia Street	Rania (self)	Yes	1880-1918	Terraced House	8.03	12.09	16.1	6,837
Philippa Street	Katrin	Yes	1880-1918	Terraced House	8.46	13.92	19.96	2,752
Philippa Street	Paul	Yes	1880-1918	Terraced House	8.46	13.92	19.96	4,242
Simpson Street	Robyn	No	1880-1918	Terraced House	8.32	12.27	12.27 (no garden)	5,809
Simpson Street	Luke	Yes	1880-1918	Terraced House	8.37	12.38	15.16	1,789
Steer Street	Luanne	Yes	1880-1918	Terraced House	12.41	18.56	23.1	184
Tomos Street	Ima	Yes, shared	1880-1918	Terraced House	8.84	12.68	35.55 (to river)	3,009

* 3 Streets have 2 participants (Simpson, Hoggan, Philippa); 1 participant (Abdi) has 2 streets, one to each side of house.

street drawn information

For each street the following were produced and are presented, the overall purpose of these methods was to generate a diverse range of interpretations of the street physical environment in order to present a range of understandings of the street rather than one single method:

Drawing Title	**Drawing Scale**	**Purpose**
Street Photograph	Not to scale	A general orientation / view of the street.
Sketch En Plein Air	Not to scale	A fieldwork drawing representing a view of the street.
Street Plan	1:2500	An architectural plan based on Ordnance Survey Data showing the street morphometrics from a birds' eye view.
Street Section(s)	1:500	An architectural section extracted from the plan showing street morphometrics / structure in section. A slice cut through the street. The section also allowed measurement of key dimensions at Table 2 to be calculated.
My Street, Participant Street Territory	1:2500	Combines street plan with participant description of My Street.
Street Materiality Collage	Not to scale	A different visual analysis of the street looking at materials, colours, and patterns.
Street Painting *(Philippa Street Only)*	Not to scale	A one-off pilot of further interpretative use of painting as a visual method. Acrylic on paper.

Photographs and views are representative of the street not the participants' specific location.

Ordnance Survey MasterMap (2023) is used in accordance with EDINA Digimap educational license.

Street Photograph

Arfon Street

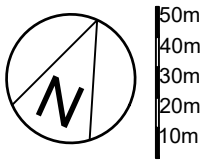
Street Photograph

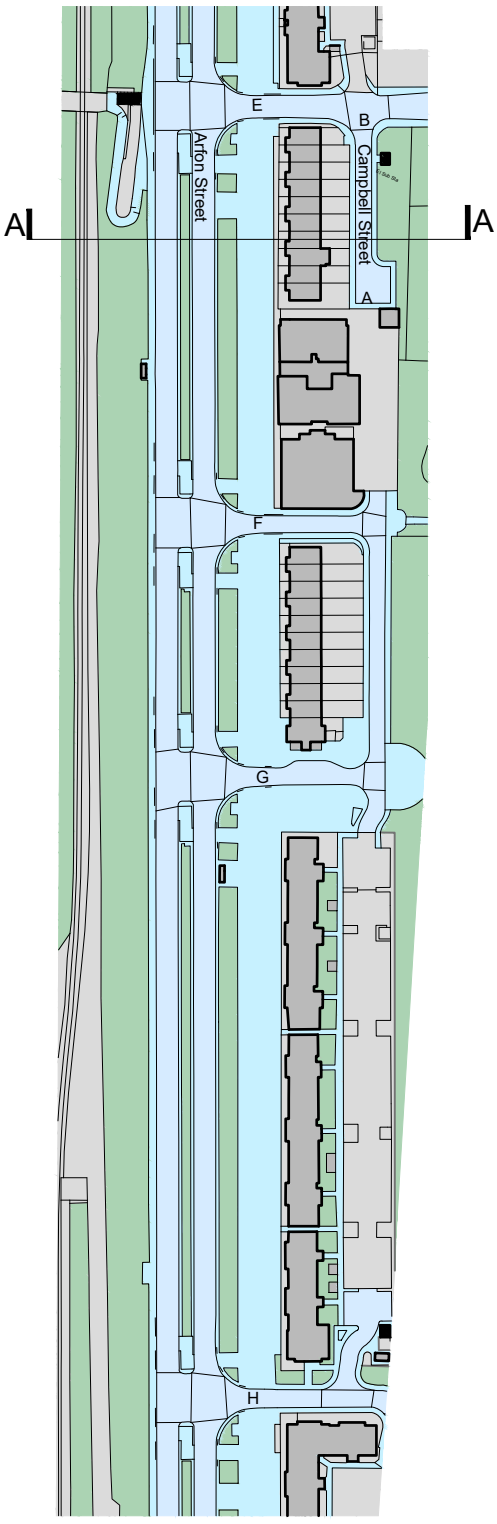
Campbell Street

Arfon Street

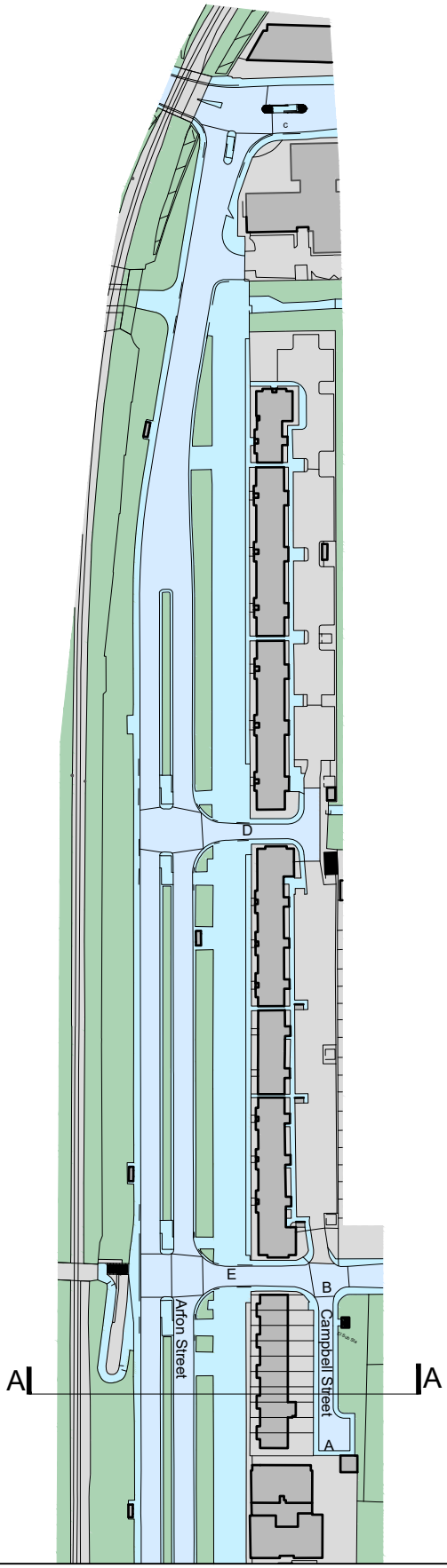
REV F 11-08-2024

Sketch – En Plein Air



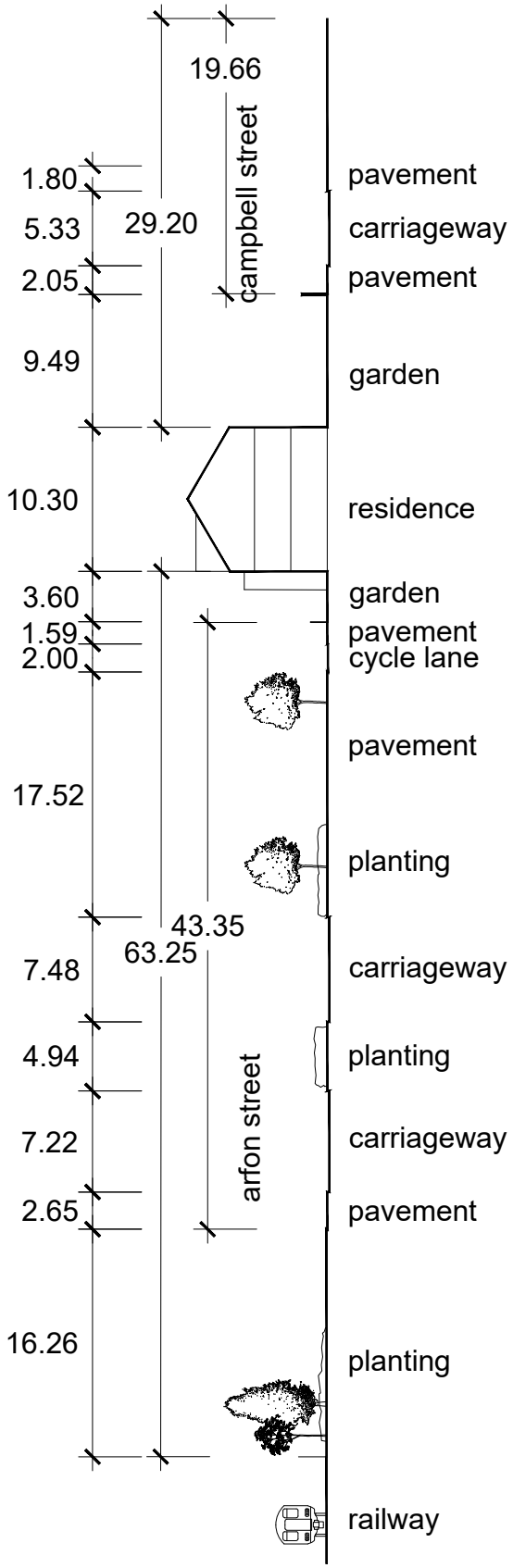


Street Plan (South) 1:2,500 @ A4



Street Plan (North) 1:2,500 @ A4

Arfon Street & Campbell Street



Street Section A-A 1:500 @ A4

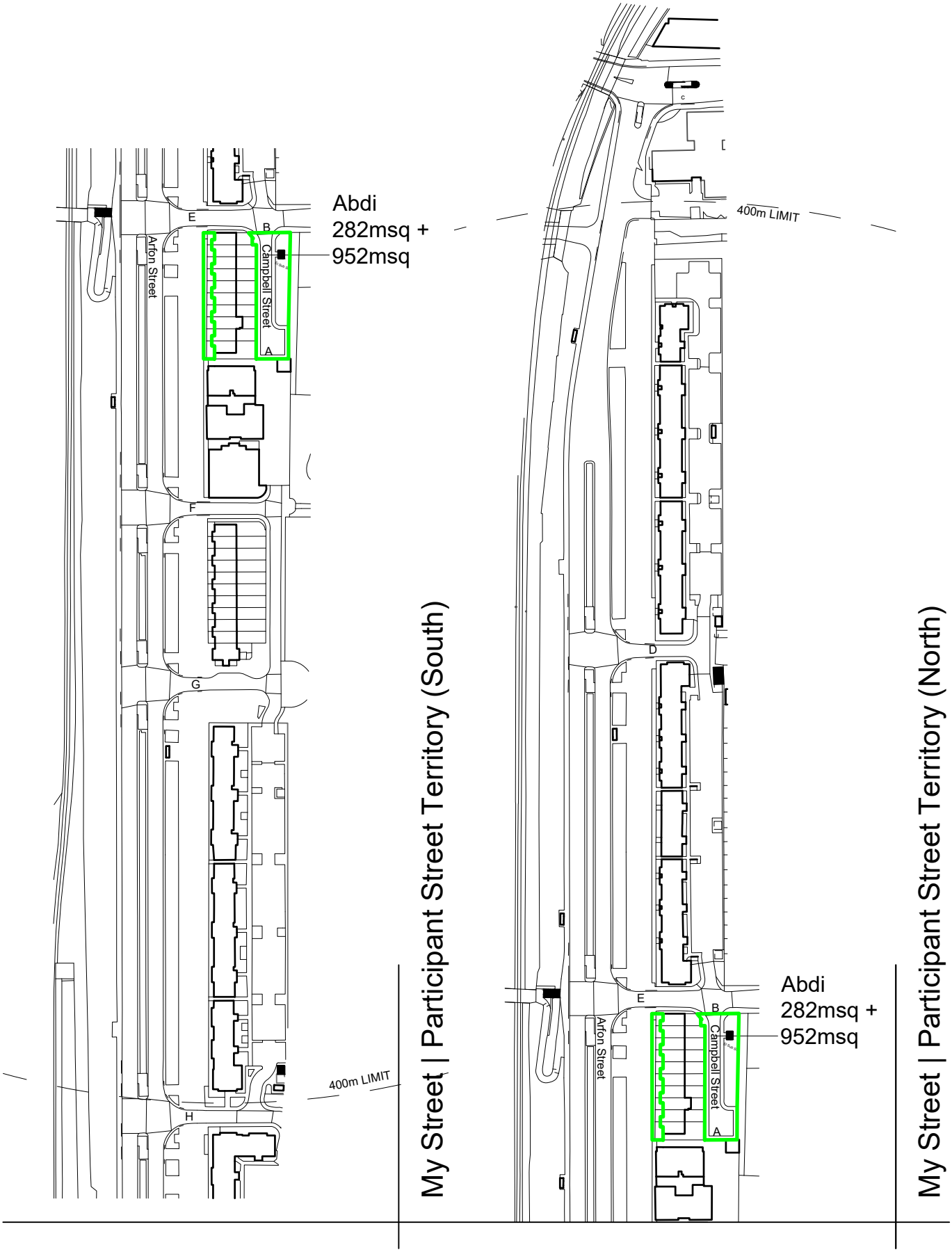
Arfon Street & Campbell Street

Materiality & Texture

Arfon Street

Materiality & Texture

Campbell Street



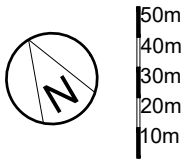
Arfon Street & Campbell Street

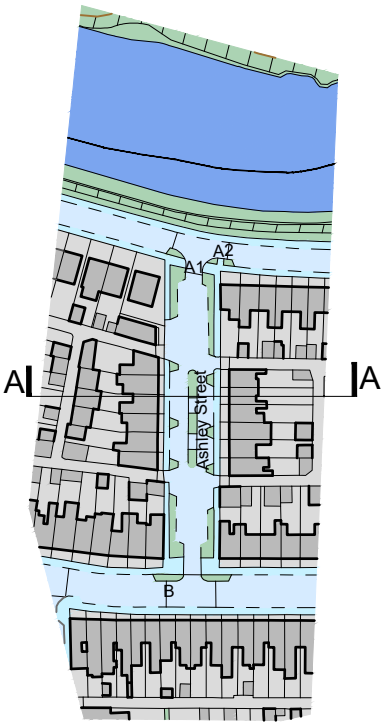
Street Photograph

Ashley Street

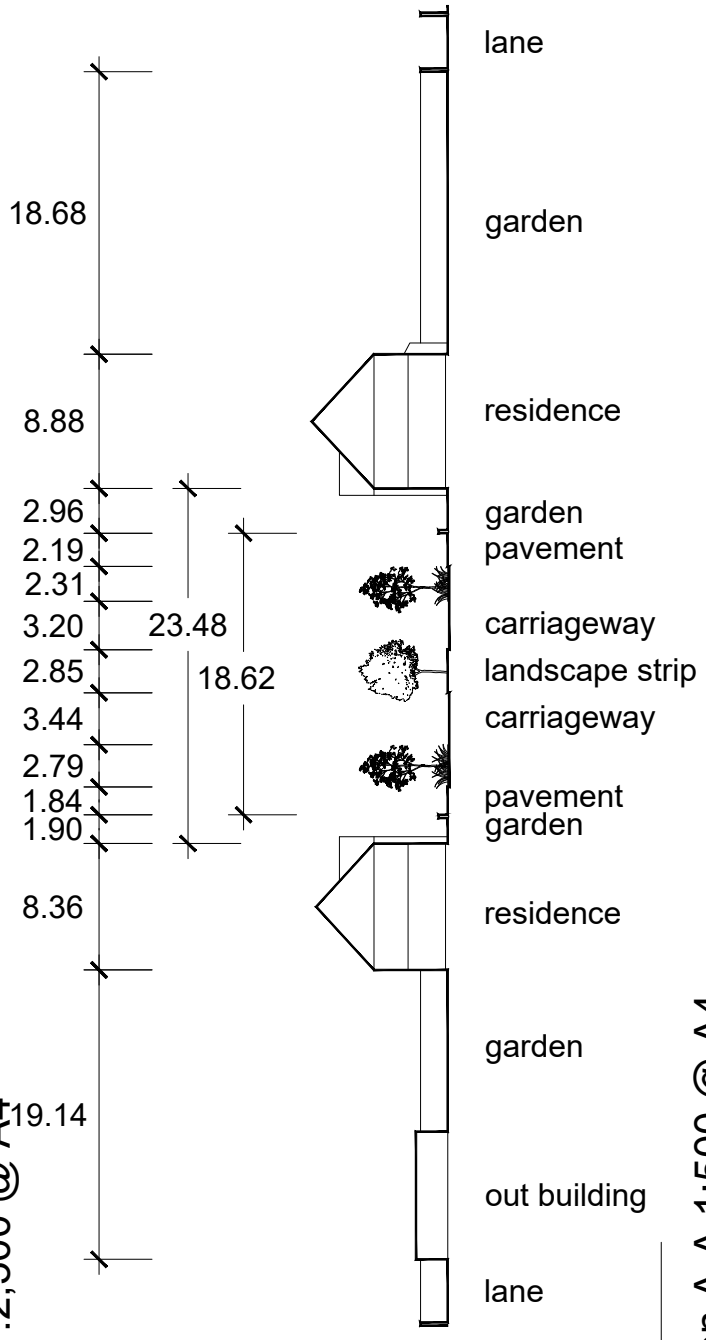
Sketch – En Plein Air

Ashley Street





Street Plan 1:2,500 @ A4



Street Section A-A 1:500 @ A4

Ashley Street

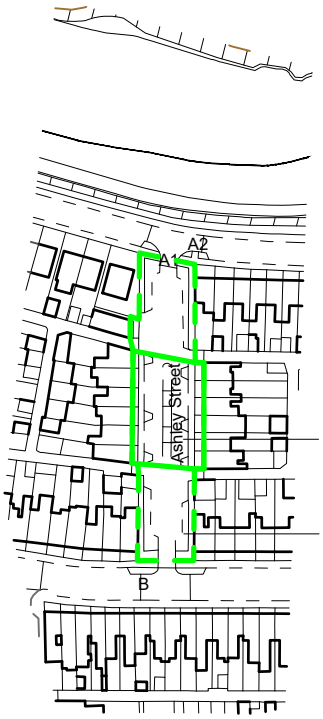
Materiality & Texture

Ashley Street

"Oh yeah, and I, the whole thing, I think that's probably because there are only twelve houses in it and you know it is think it's the second smallest street in that block kind of [street name] one street along kind of has ten houses on it but you know, we'd, it's, yeah, feel quite possessive of."

...

"I mean, [...] I don't know that I draw the semantics in the sense that I for example and I'll, I'll be perfectly honest, I've come as an occasional runner and somebody that at one point was kind of doing half marathons and stuff like that, you know, once I'd been for an eight mile run I can tell you now that kind of the minute I see the you know the minute I see Ashley Street from either side I feel like I'm home!" (Scott)



Scott
850msq

Scott
(on a run)

My Street | Participant Street Territory

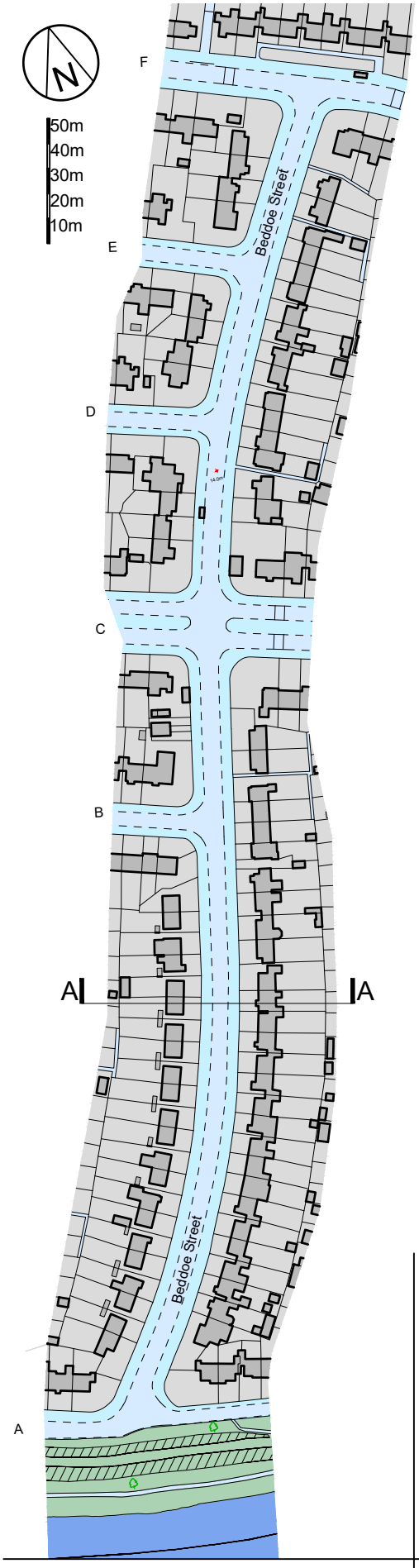
Ashley Street

Street Photograph

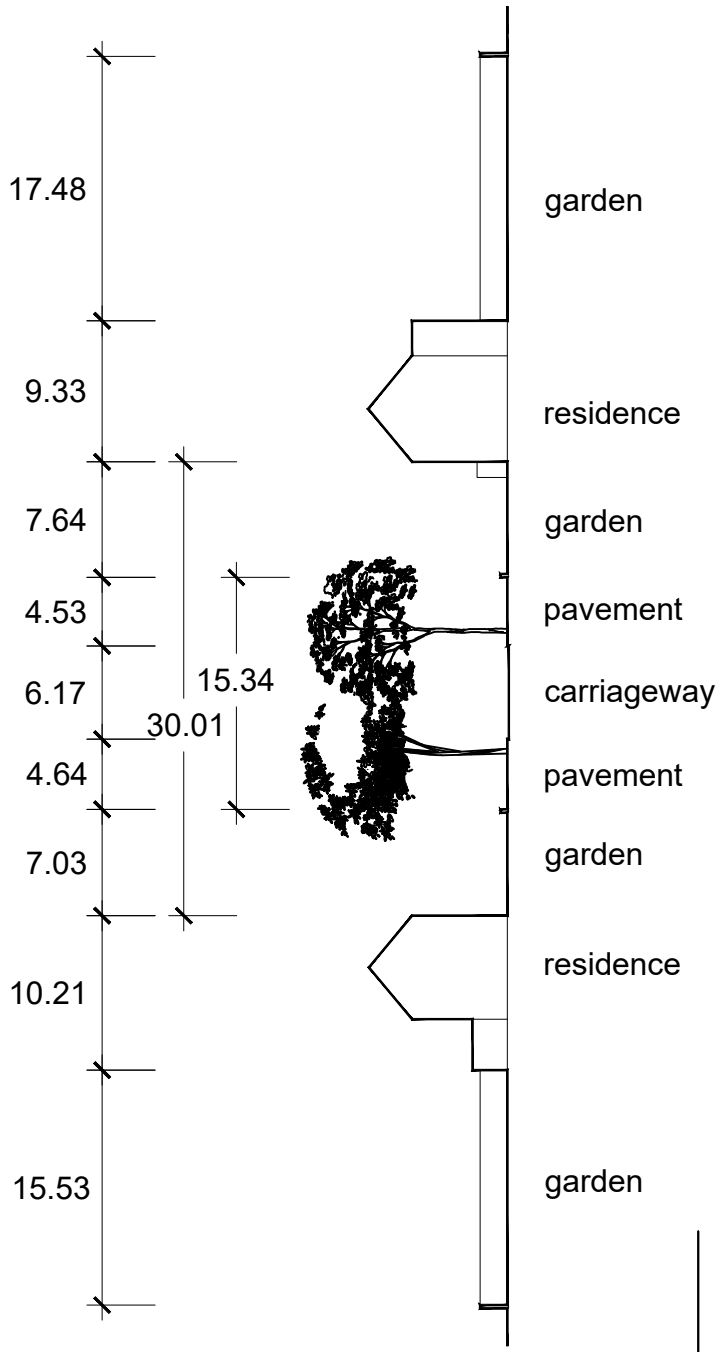
Beddoe Street

Sketch – En Plein Air

Beddoe Street



Street Plan 1:2,500 @ A4

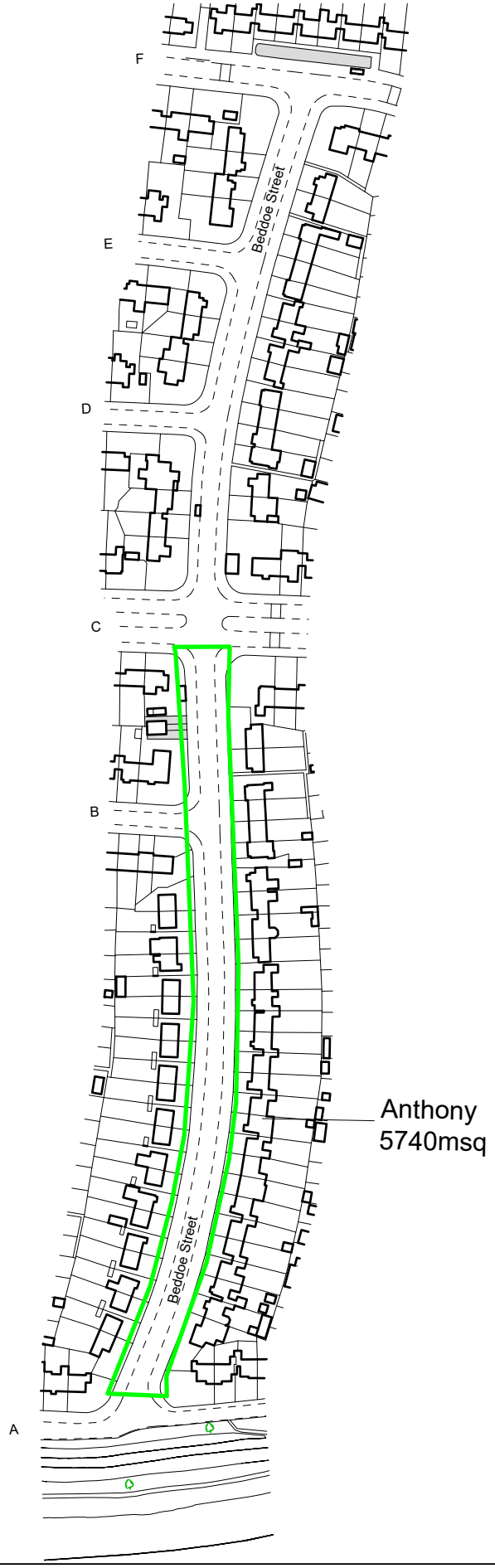


Street Section A-A 1:500 @ A4

Beddoe Street

Materiality & Texture

Beddoe Street



My Street | Participant Street Territory

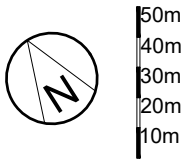
Beddoe Street

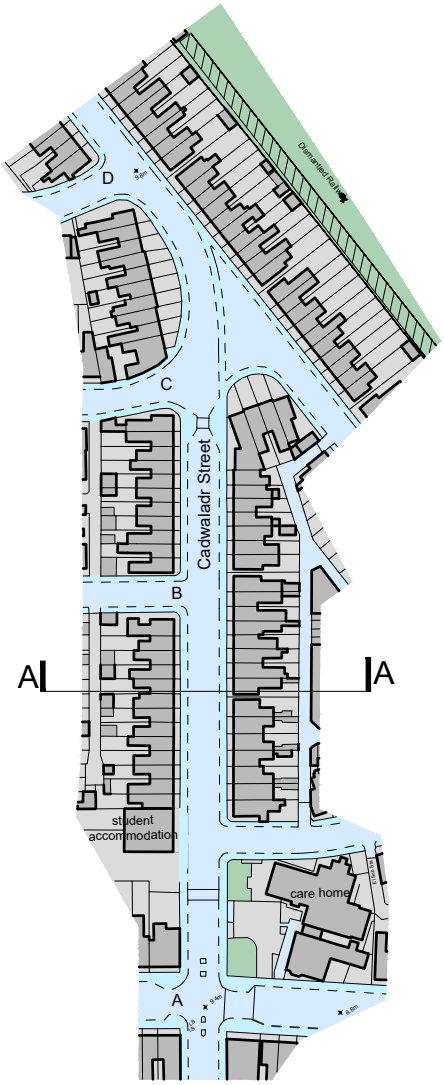
Street Photograph

Cadwaladr Street

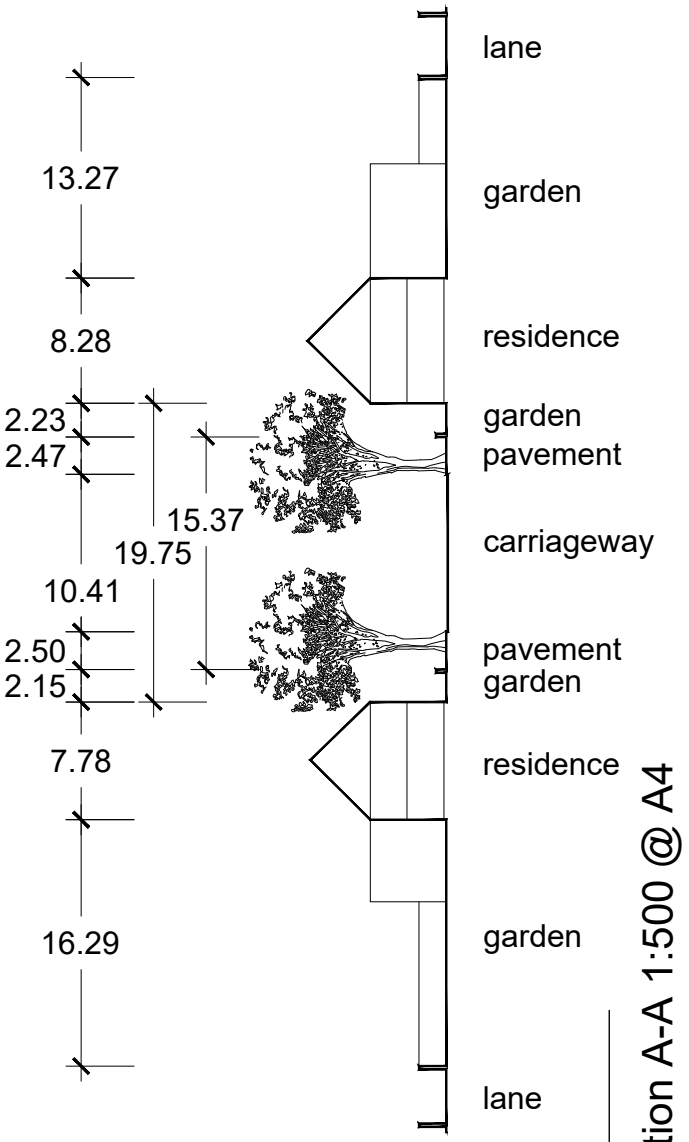
Sketch – En Plein Air

Cadwaladr Street





Street Plan 1:2,500 @ A4

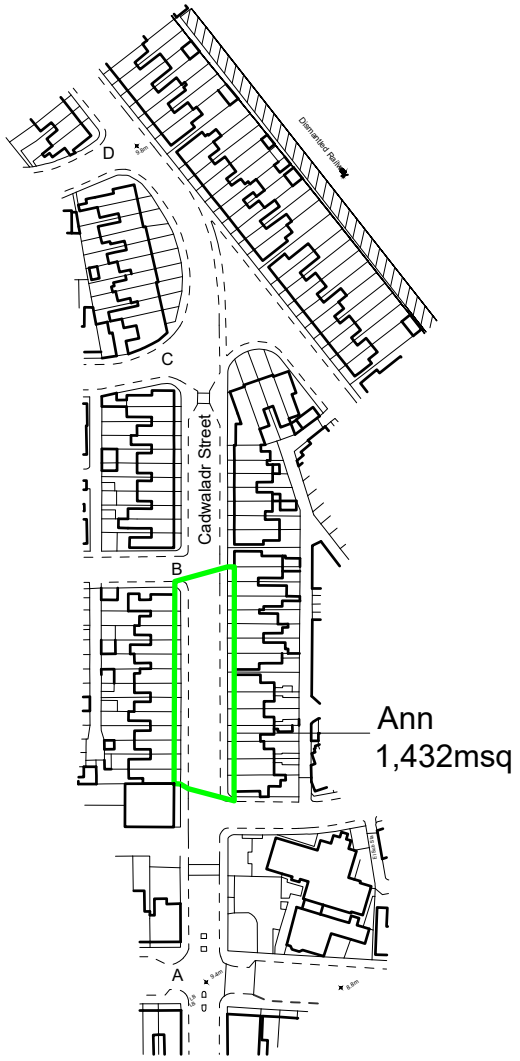


Street Section A-A 1:500 @ A4

Cadwaladr Street

Materiality & Texture

Cadwaladr Street



My Street | Participant Street Territory

Cadwaladr Street

Street Photograph

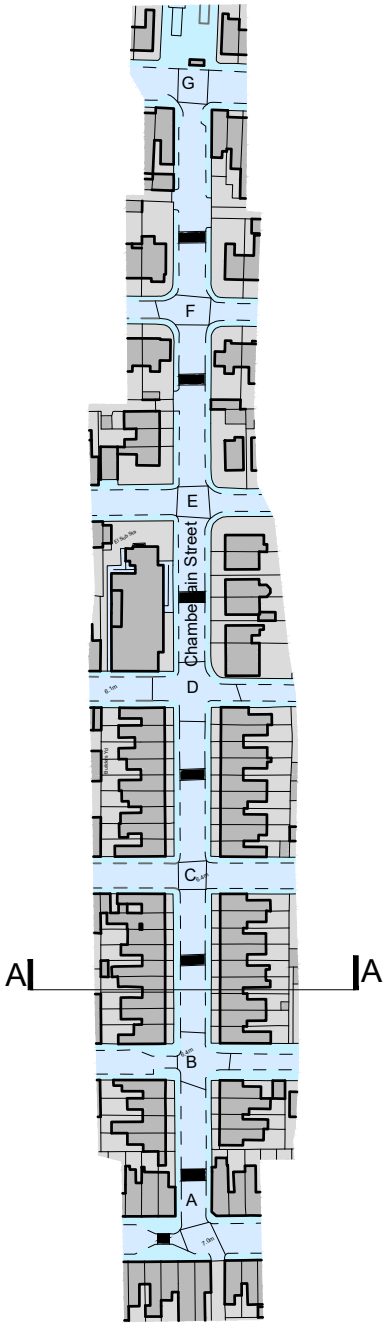
Chamberlain Street

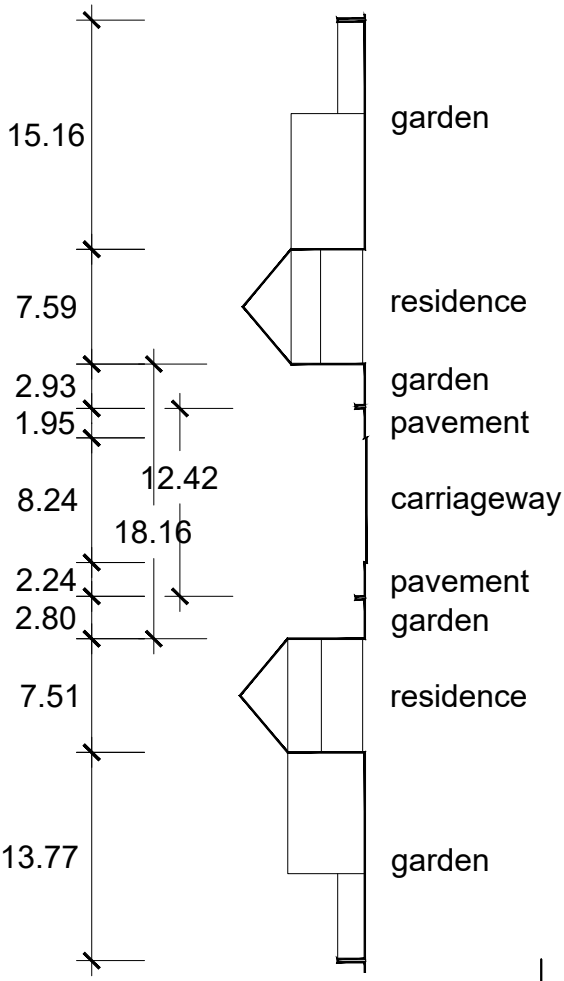
Chamberlain Street

REV F 11-08-2024

Sketch – En Plein Air

50m
40m
30m
20m
10m





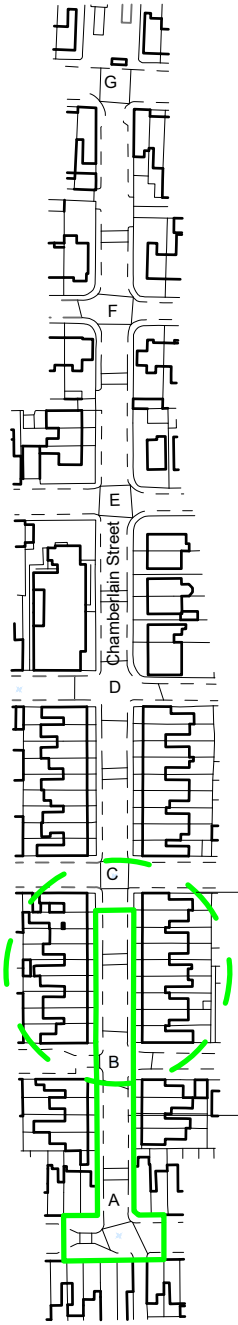
Street Plan 1:2,500 @ A4

Street Section A-A 1:500 @ A4

Chamberlain Street

Materiality & Texture

Chamberlain Street



Mabon
"40 yards"

Mabon
1,731msq

My Street | Participant Street Territory

Chamberlain Street

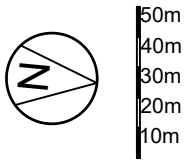
Street Photograph

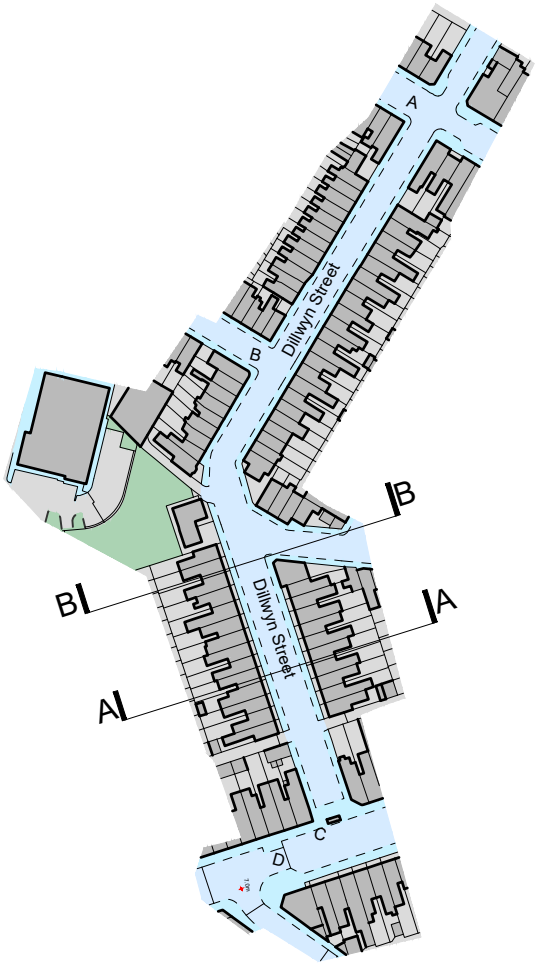
Dillwyn Street

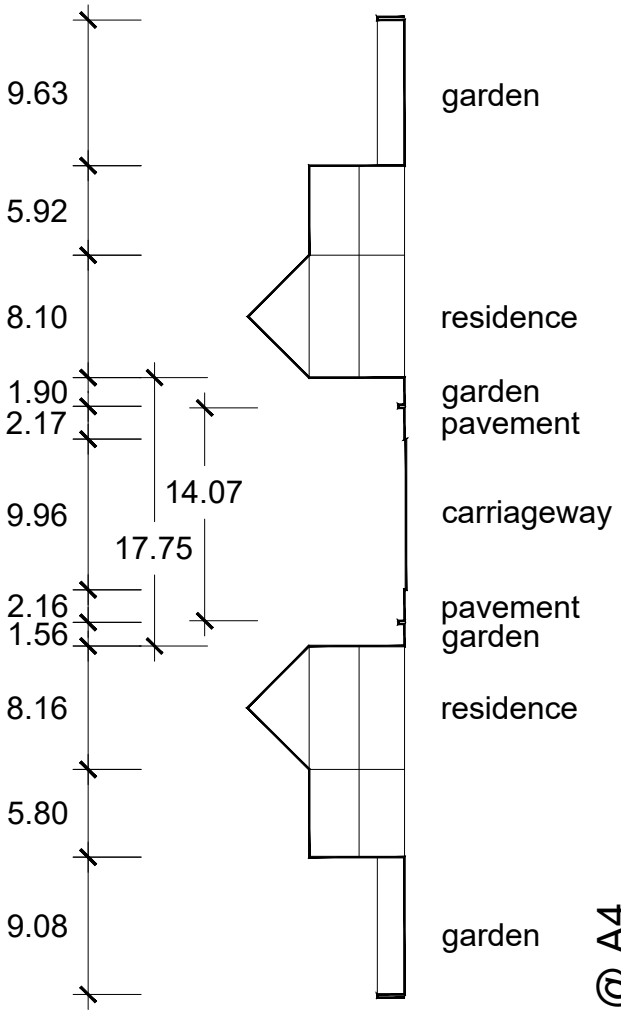
Dillwyn Street

REV F 11-08-2024

Sketch – En Plein Air



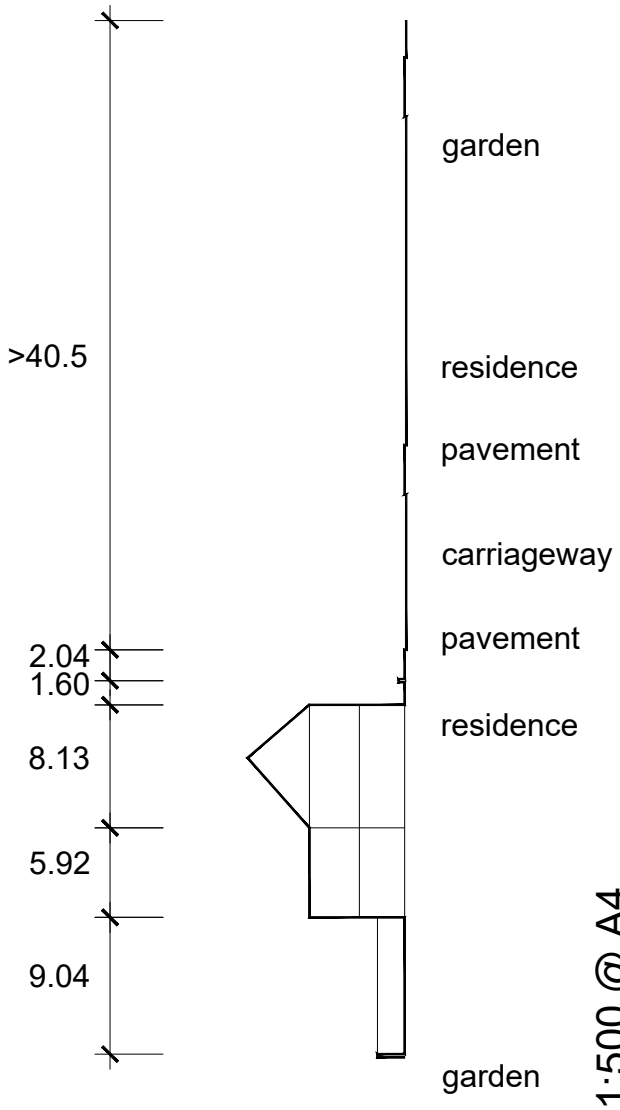




Street Plan 1:2,500 @ A4

Street Section A-A 1:500 @ A4

Dillwyn Street

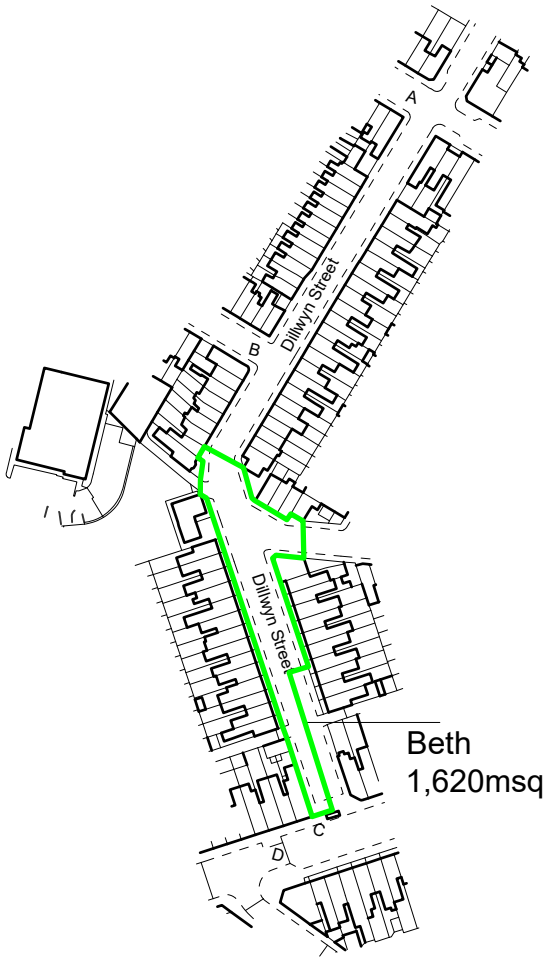


Street Section B-B 1:500 @ A4

Dillwyn Street

Materiality & Texture

Dillwyn Street



My Street | Participant Street Territory

Dillwyn Street

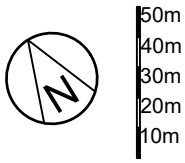
Street Photograph

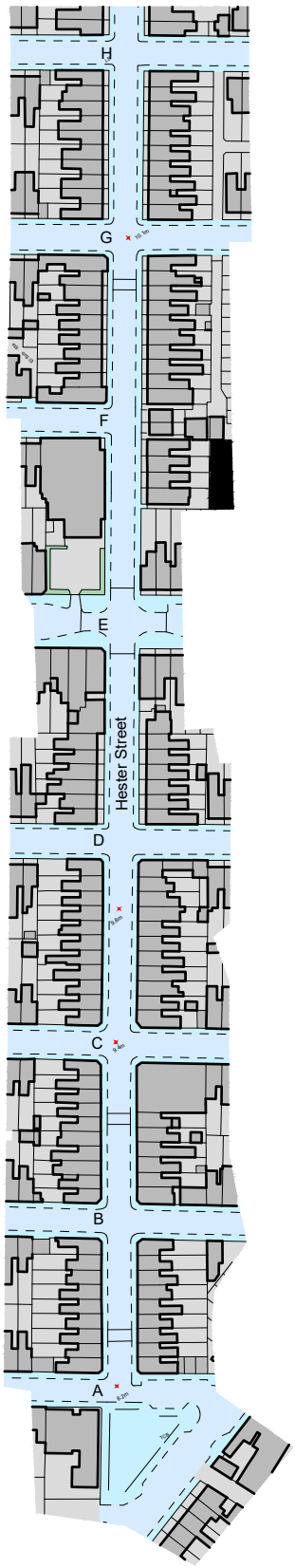
Hester Street

Hester Street

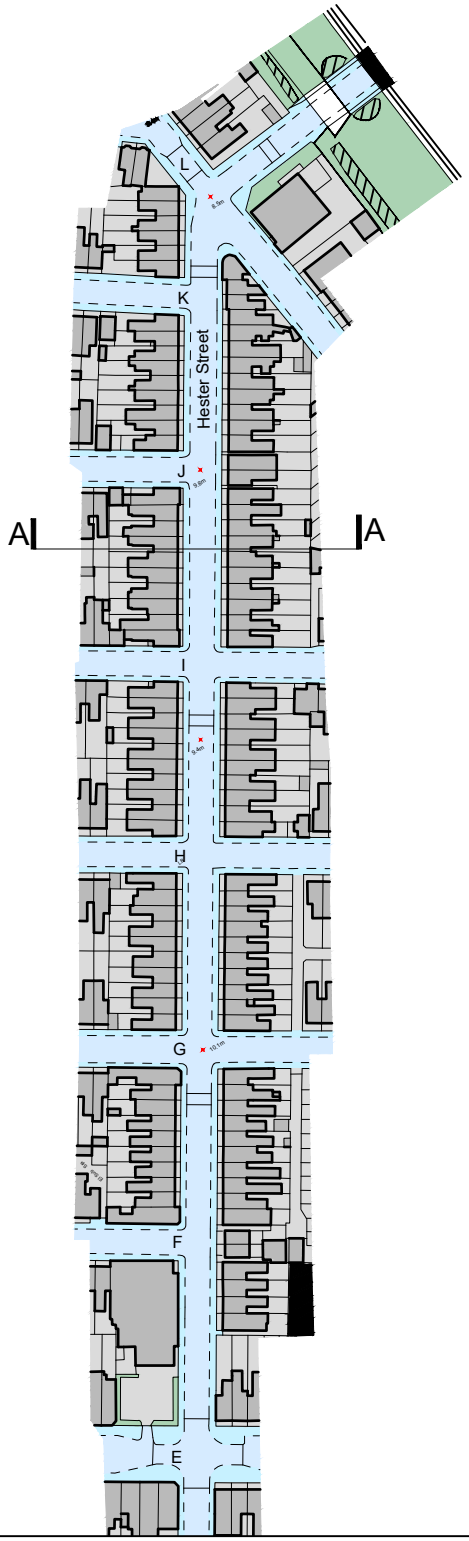
REV F 11-08-2024

Sketch – En Plein Air



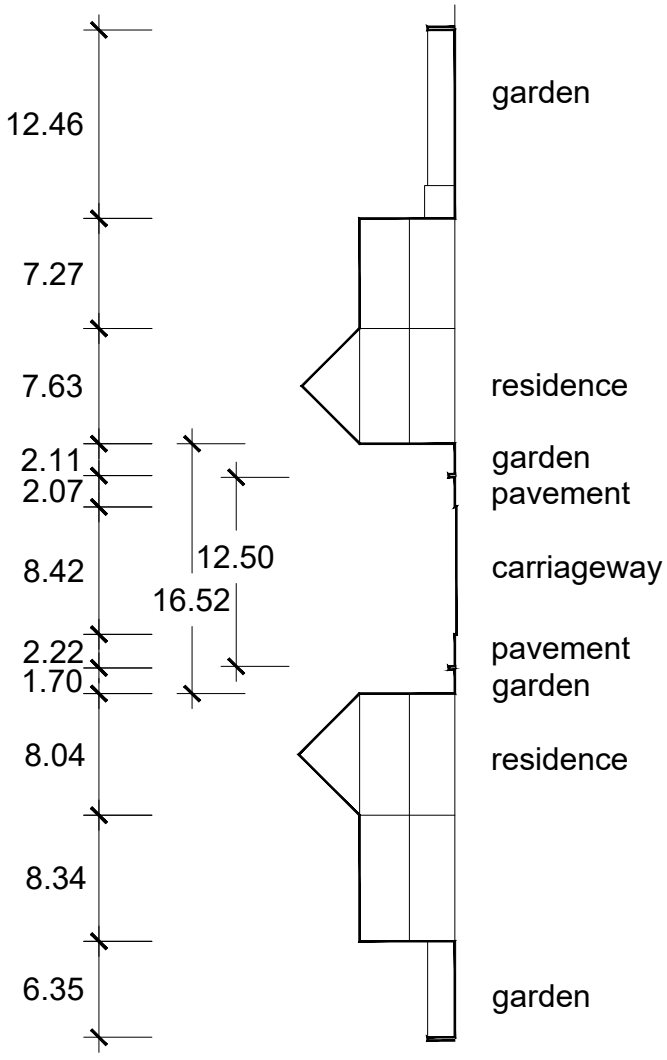


Street Plan (West) 1:2,500 @ A4



Street Section (East) A-A 1:500 @ A4

Hester Street



Street Section A-A 1:500 @ A4

Hester Street

Materiality & Texture

Hester Street

Hester Street

Street Photograph

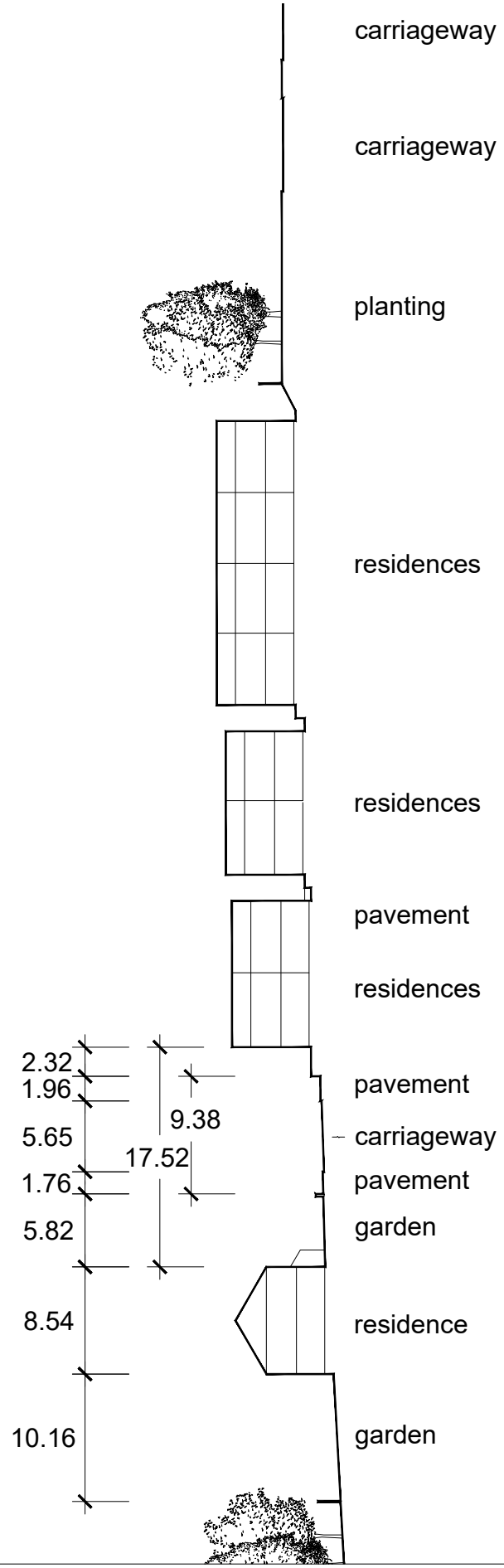
Hoggan Street

Sketch – En Plein Air

Hoggan Street

Street Plan 1:2,500 @ A4

Hoggan Street



Street Section A-A 1:500 @ A4

Hoggan Street

Materiality & Texture

Hoggan Street

My Street | Participant Street Territory

Hoggan Street

Street Photograph

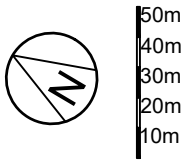
Holford Street

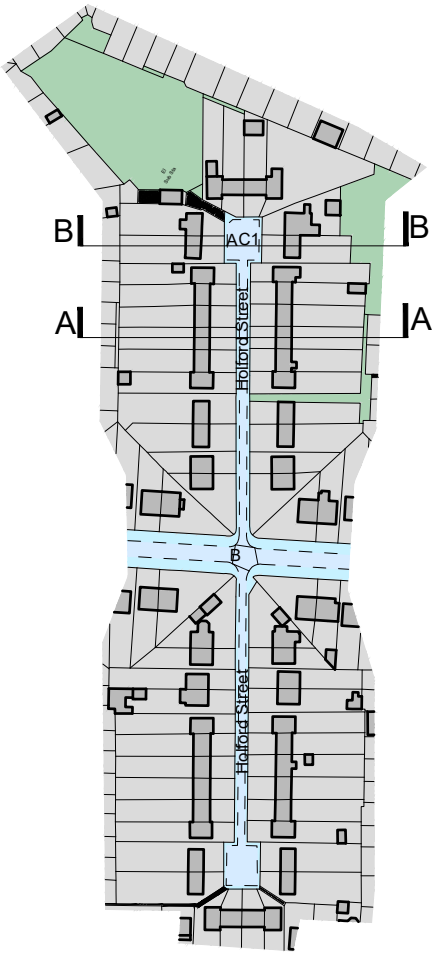
Sketch – En Plein Air

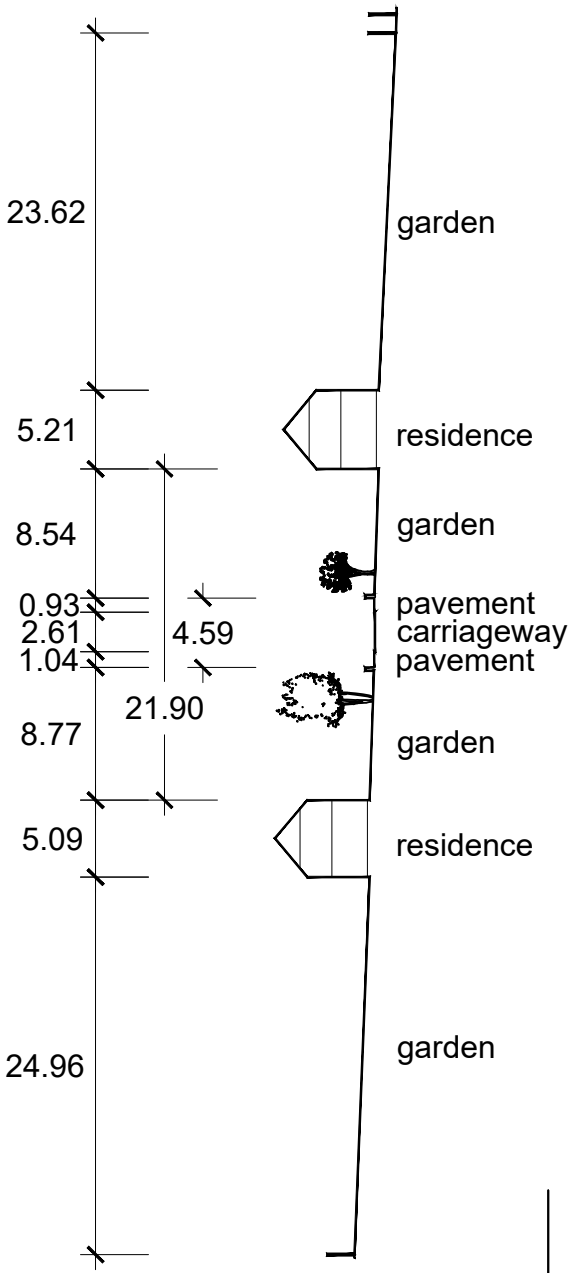
Holford Street

Sketch – En Plein Air

Holford Street | Cul de Sac



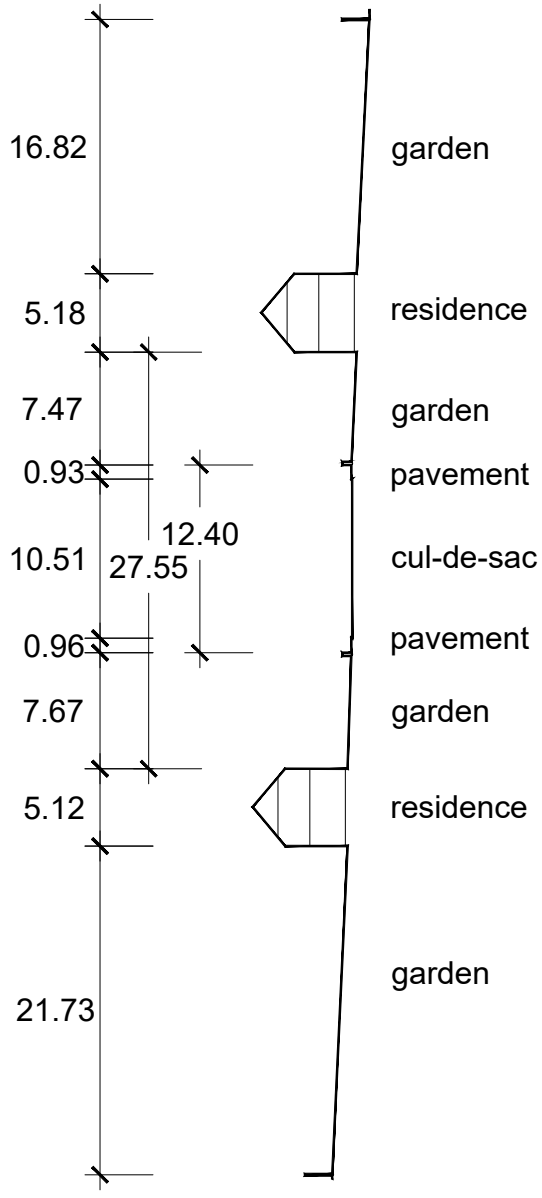




Street Plan 1:2,500 @ A4

Street Section A-A 1:500 @ A4

Holford Street



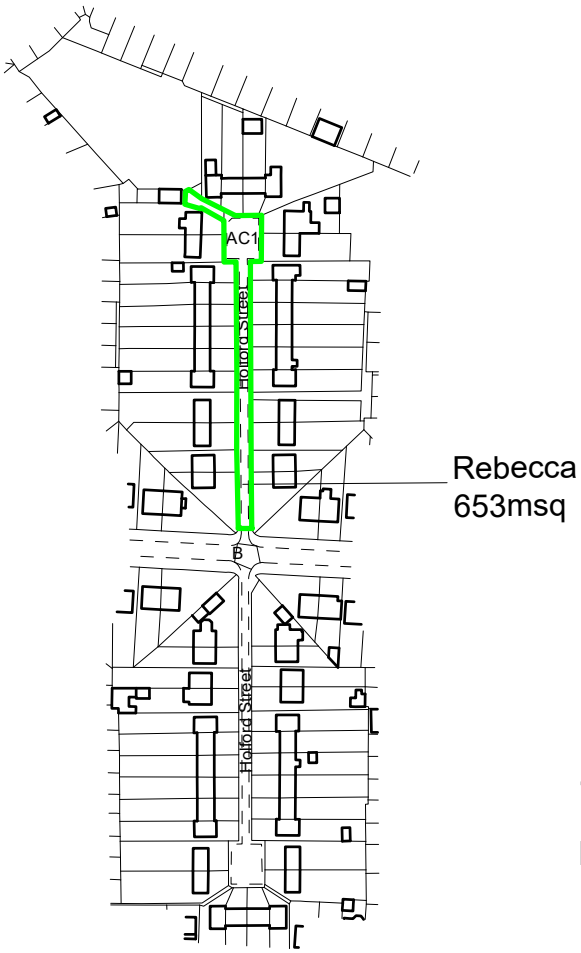
Street Section B-B 1:500 @ A4

Holford Street

Materiality & Texture

Holford Street

"Oh mine is definitely the right side of Holford Street where the [community gardens] are. The other side I'd feel like an imposter. I think I've only ever been down there once actually and that was when I had a birthday card delivered to my house that I couldn't understand and it wasn't for me at all." (Rebecca)

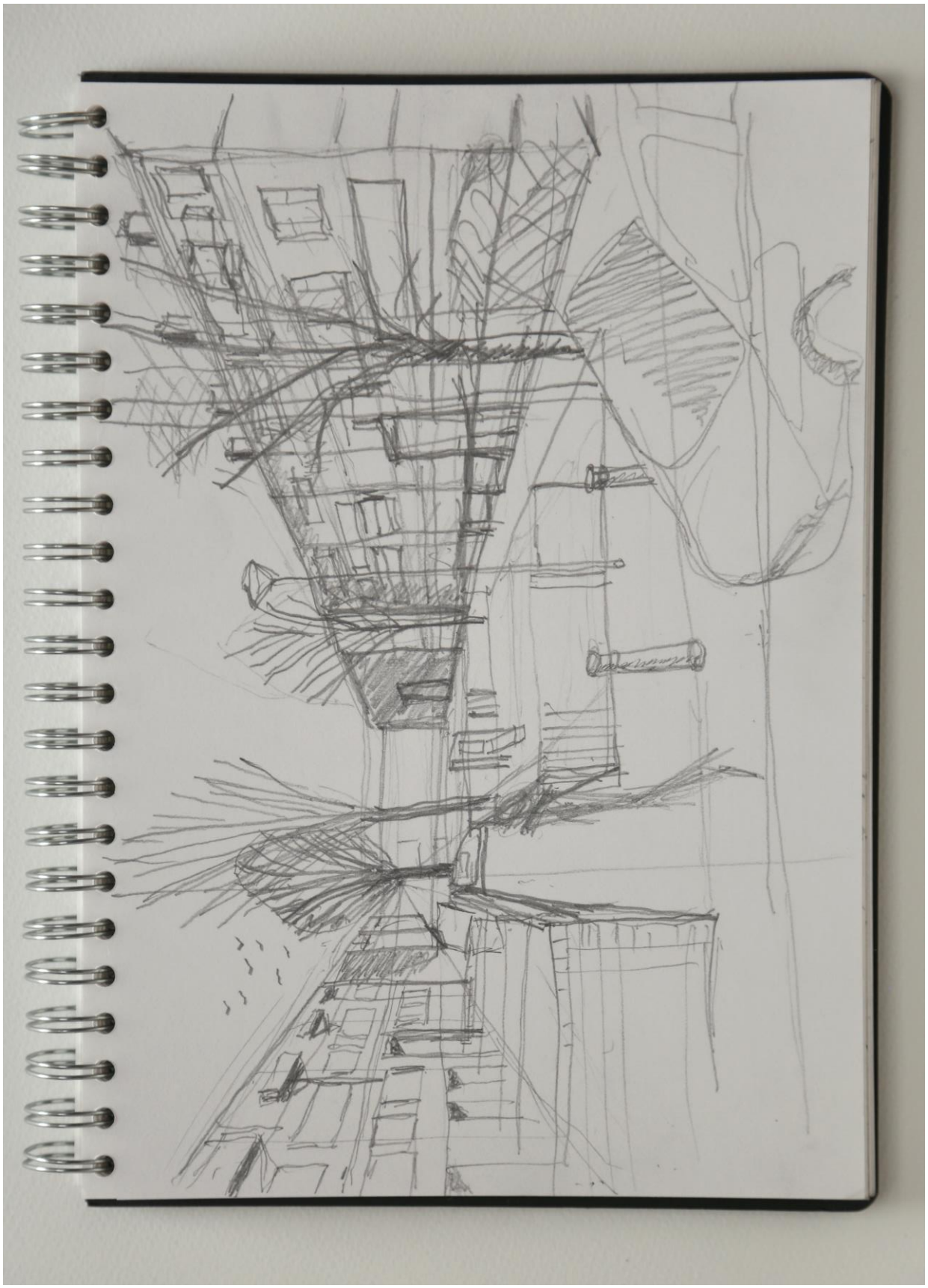


My Street | Participant Street Territory

Holford Street

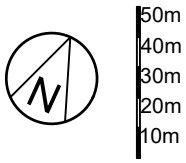
Street Photograph

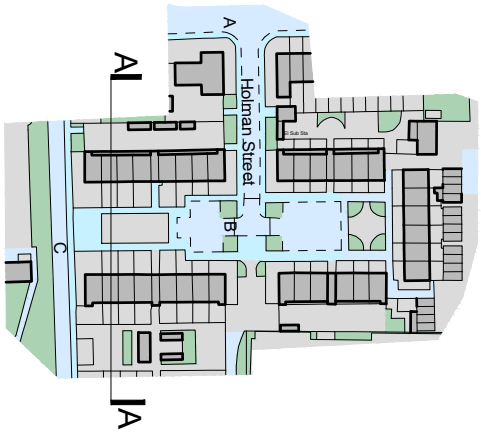
Holman Street

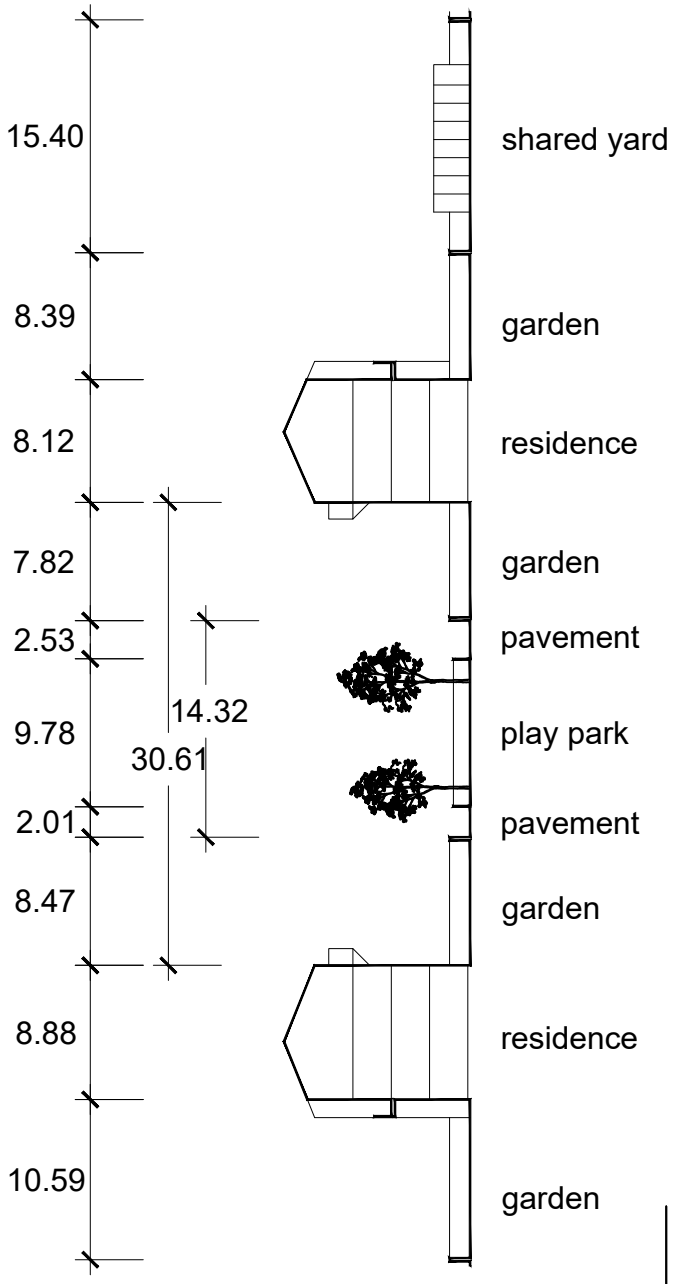


Sketch – En Plein Air

Holman Street







Street Plan 1:2,500 @ A4

Street Section A-A 1:500 @ A4

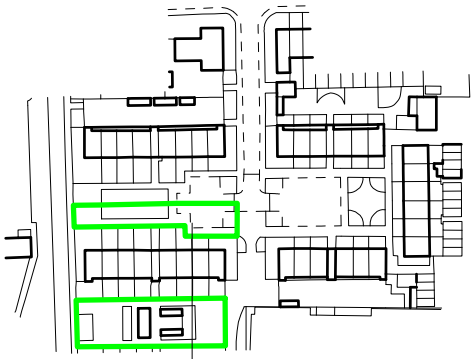
Holman Street

Materiality & Texture

Holman Street

"I think probably not so much now because the car park has taken half of that away and I don't live in that side of Holman Street, I live on the other side now so that side definitely is now more homely and more my street and the people that I'm comfortable with, I'm not saying that I'm not comfortable with the other people but I mean because I'm seeing these people more often and I'm having more interactions with them on a daily basis...

That side of Holman Street is like, I don't even, I can't relate to that any more anymore at all, the car park side. It's shocking, I've only started getting over that [a park area] now. The conversations we were having when that was put in, we were actually quite traumatised about reliving our childhood and that was just taken away." (Aisha)



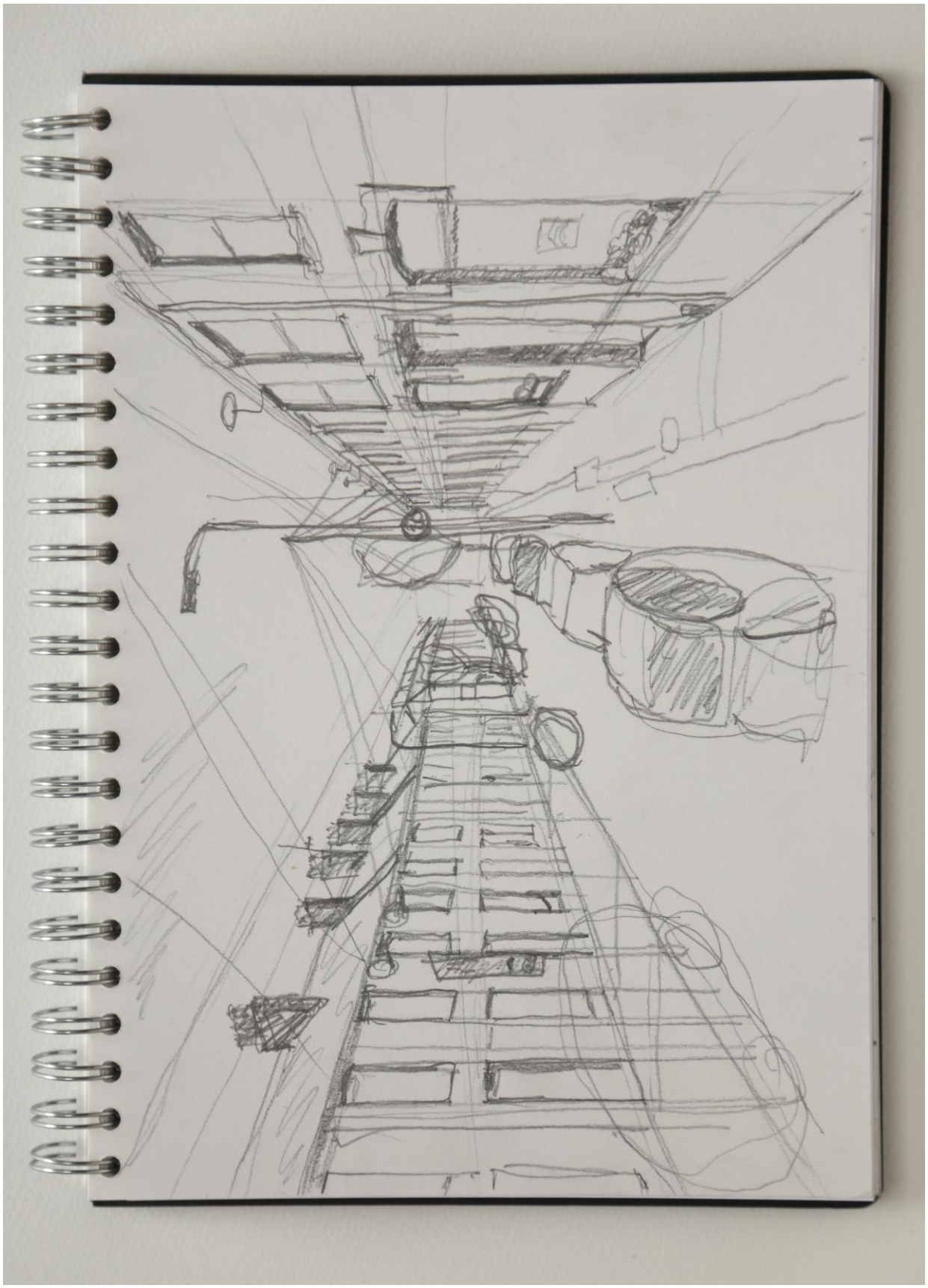
Aisha
454msq +
766msq

My Street | Participant Street Territory

Holman Street

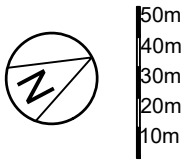
Street Photograph

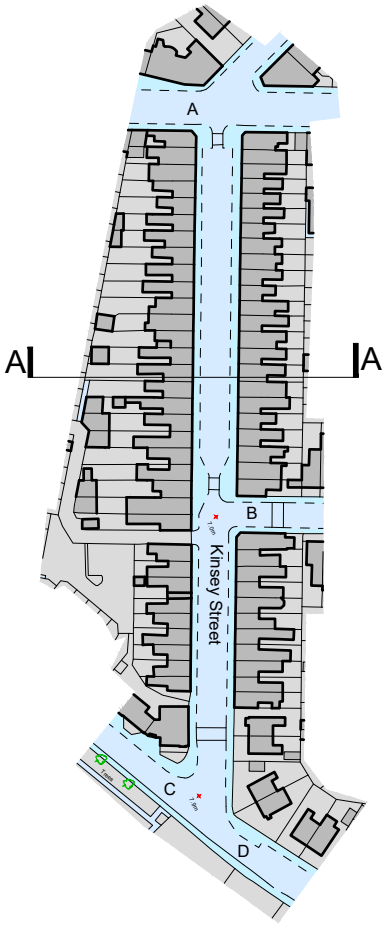
Kinsey Street

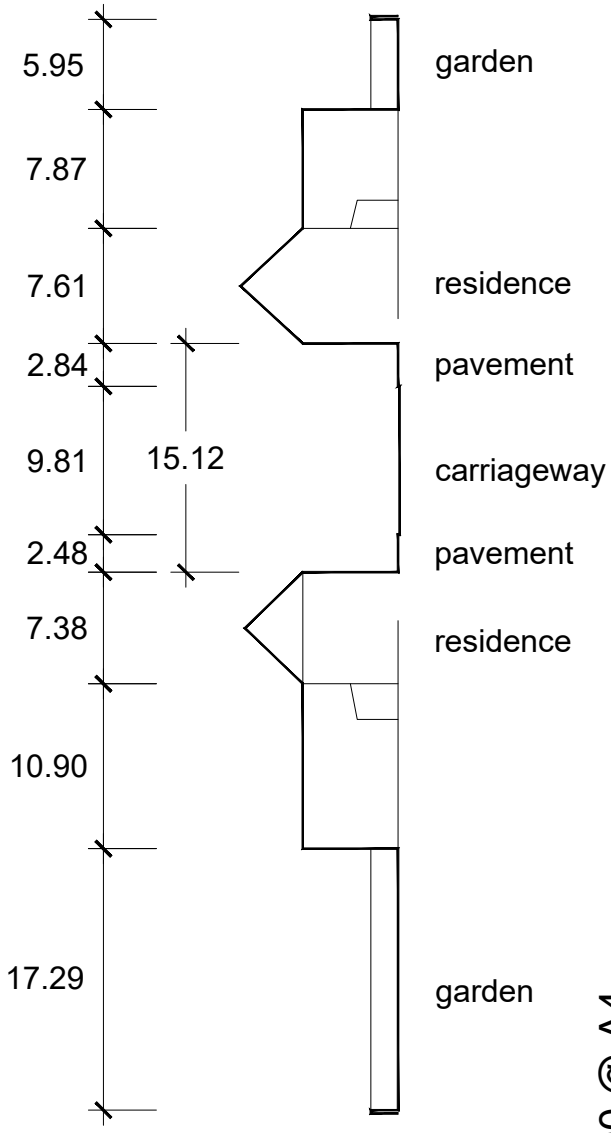


Sketch – En Plein Air

Kinsey Street







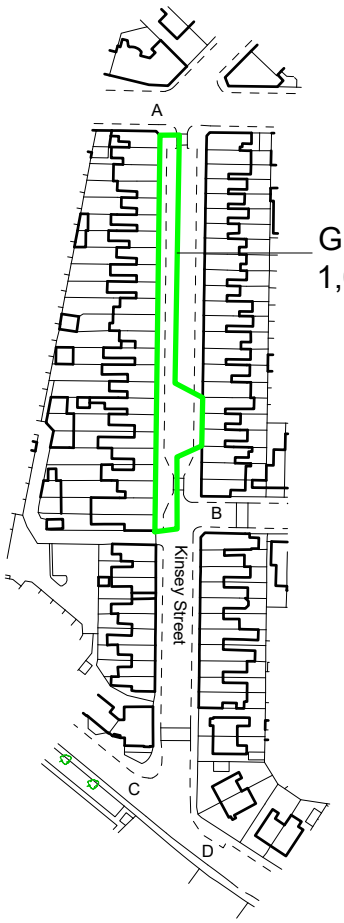
Street Plan 1:2,500 @ A4

Street Section A-A 1:500 @ A4

Kinsey Street

Materiality & Texture

Kinsey Street



Gus
1,019msq

My Street | Participant Street Territory

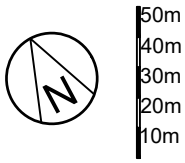
Kinsey Street

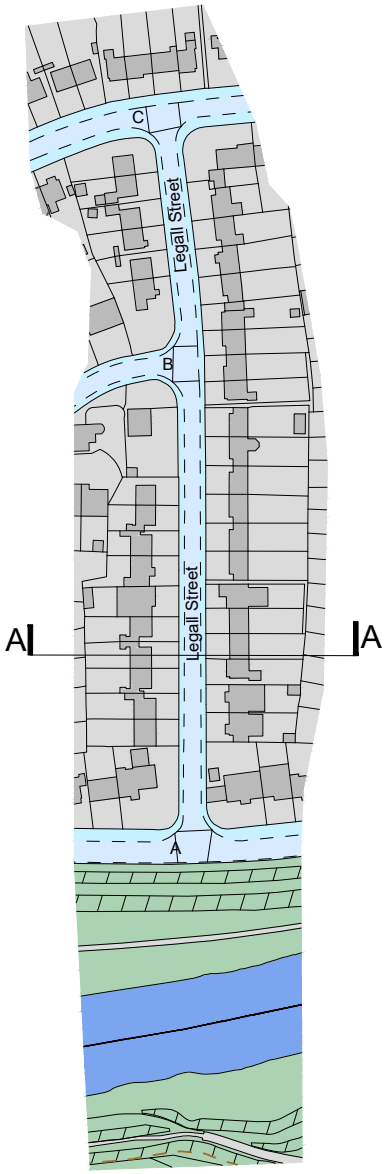
Street Photograph

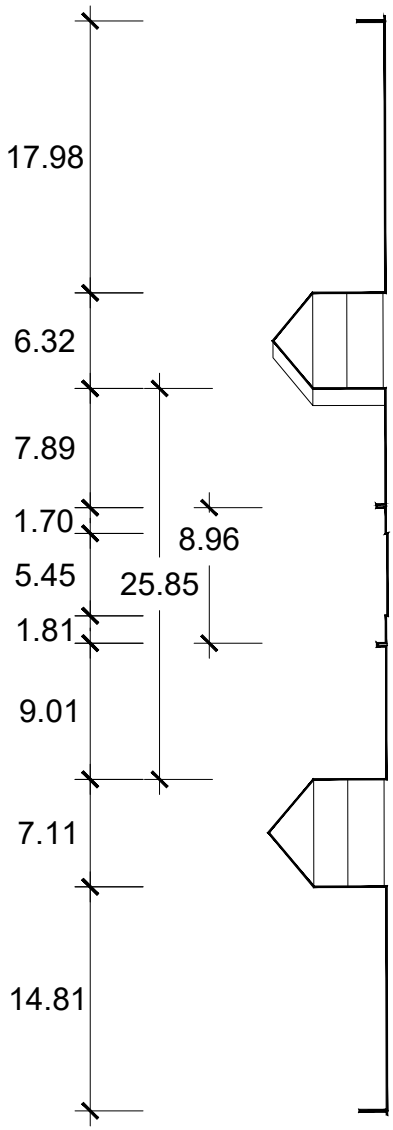
Legall Street

Sketch – En Plein Air

Legall Street







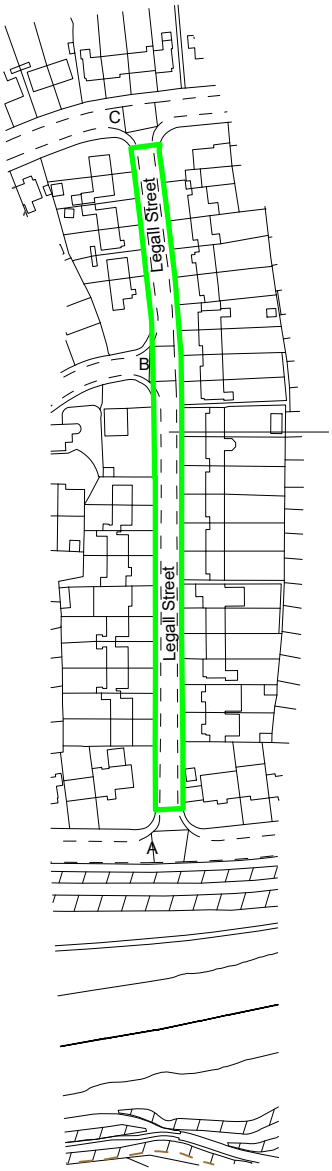
Street Plan 1:2,500 @ A4

Street Section A-A 1:500 @ A4

Legall Street

Materiality & Texture

Legall Street



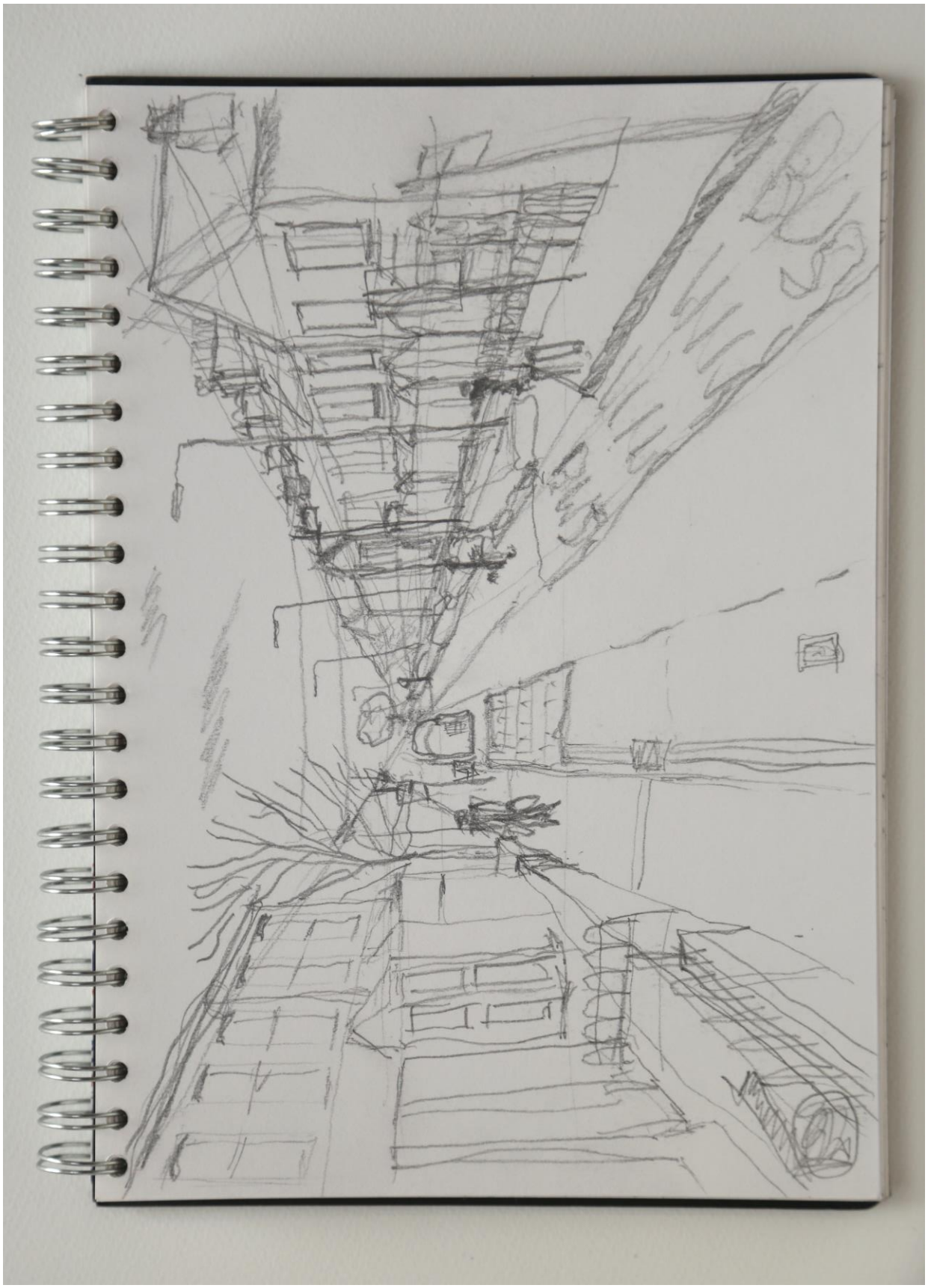
Shiva
1975msq

My Street | Participant Street Territory

Legall Street

Street Photograph

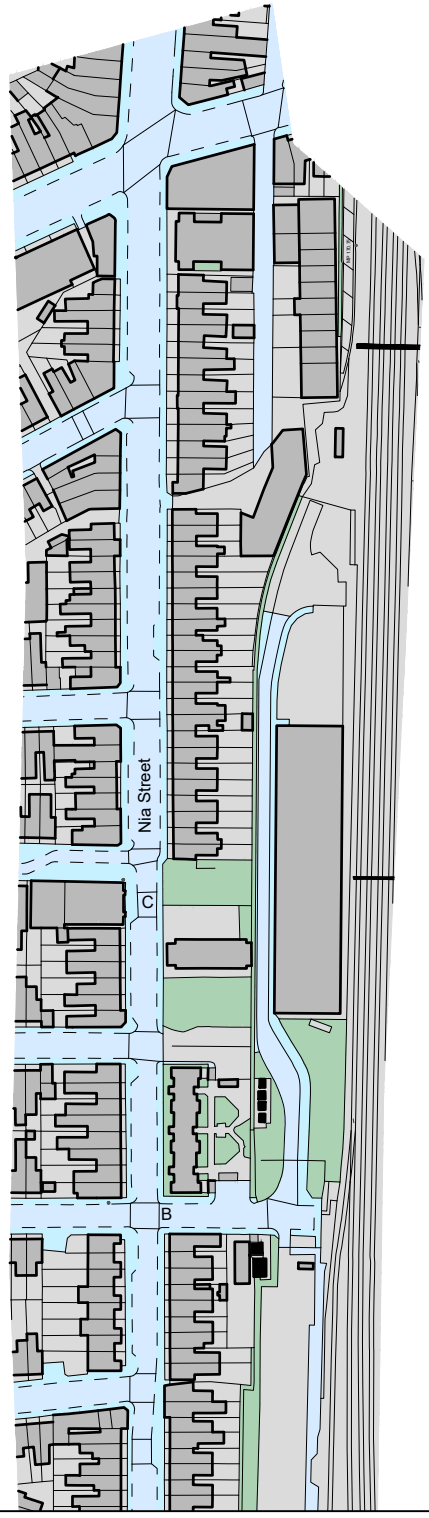
Nia Street



Sketch – En Plein Air

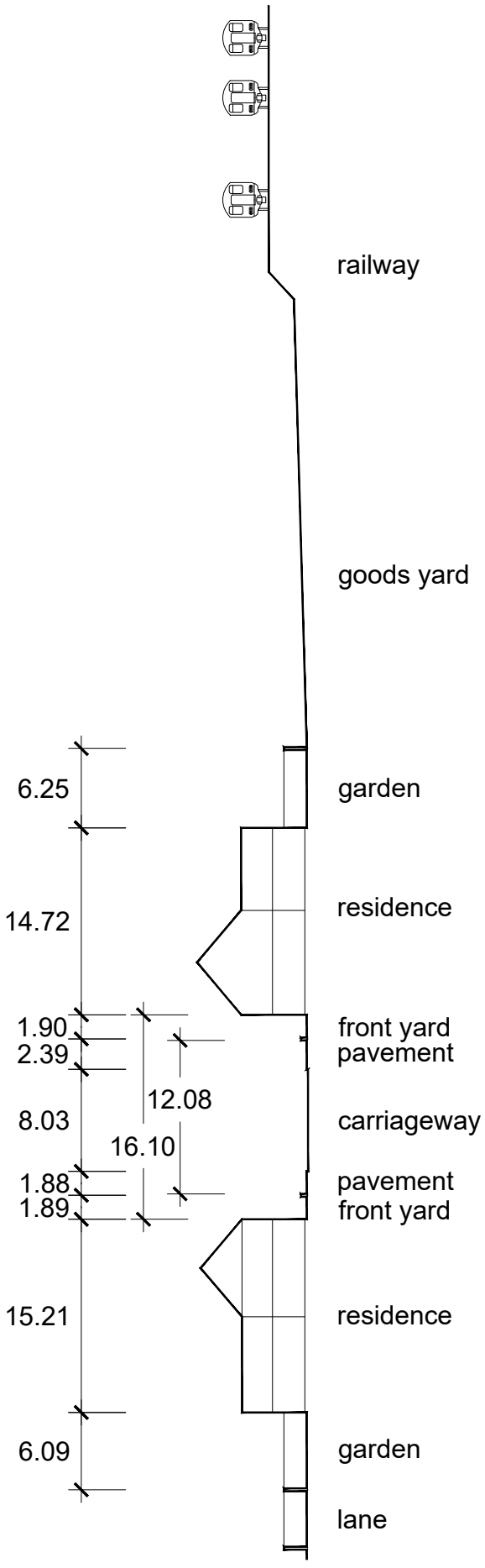
Nia Street

Street Plan (West) 1:2,500 @ A4



Street Plan (East) 1:2,500 @ A4

Nia Street

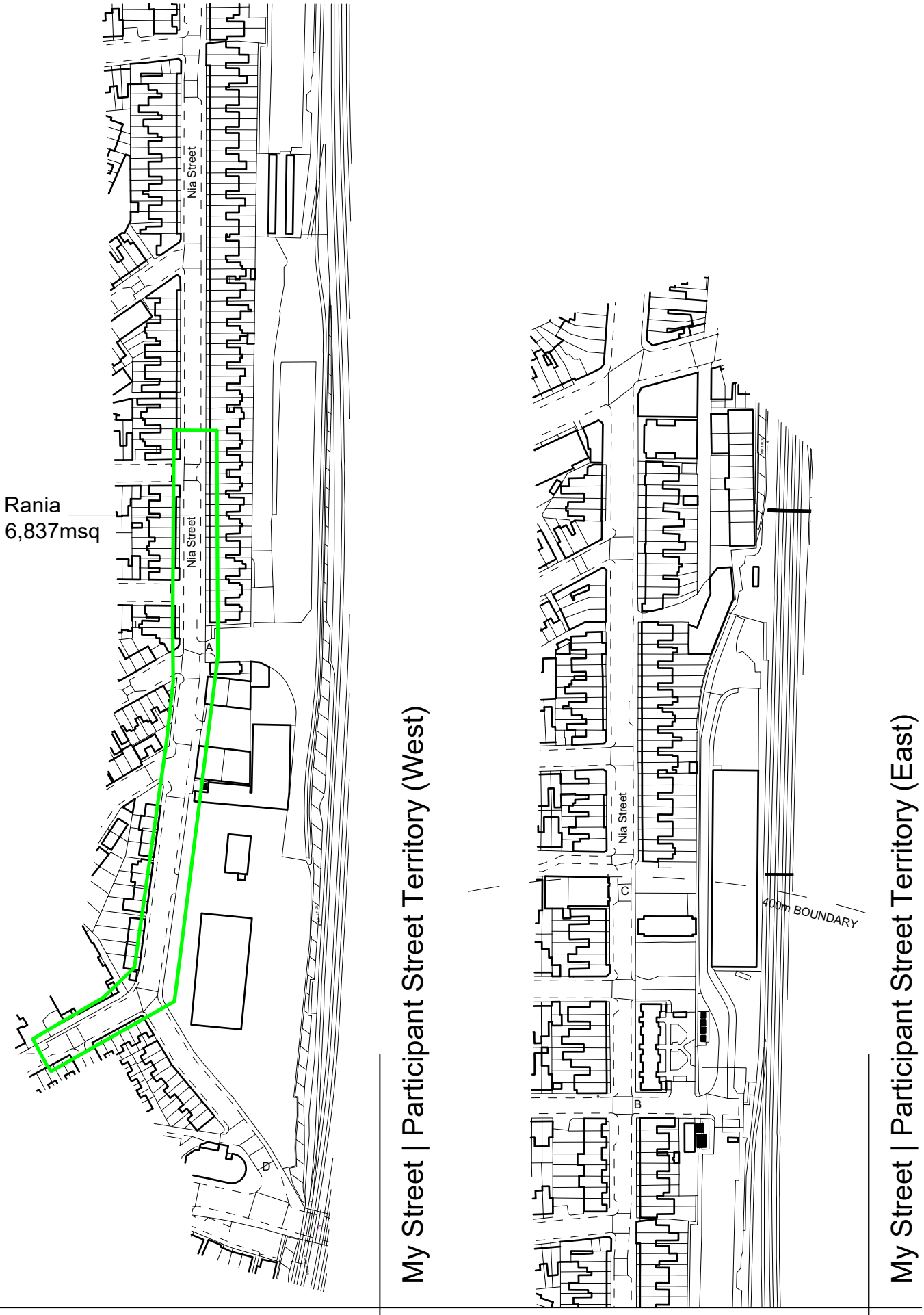


Street Section A-A 1:500 @ A4

Nia Street

Materiality & Texture

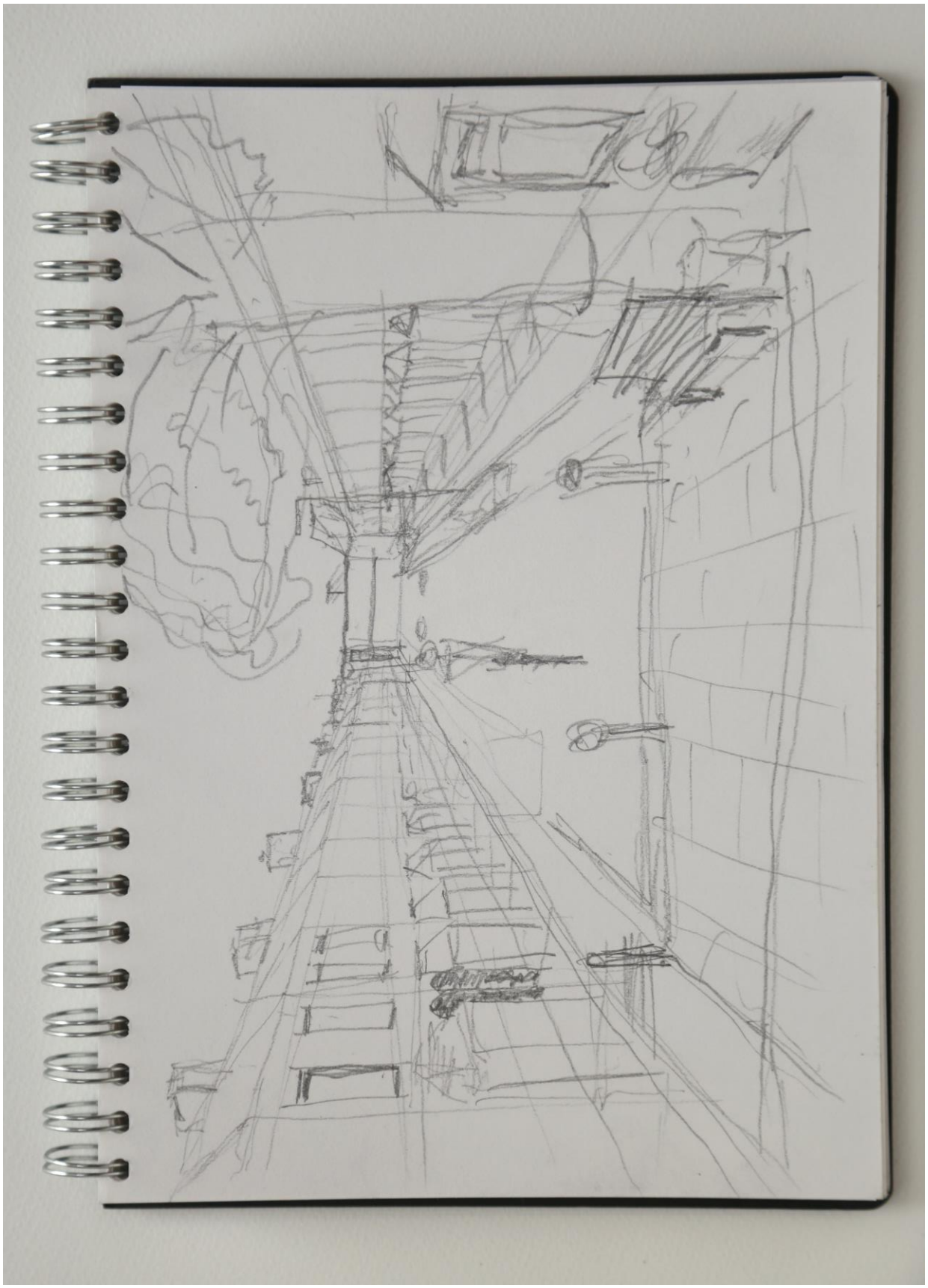
Nia Street



Nia Street

Street Photograph

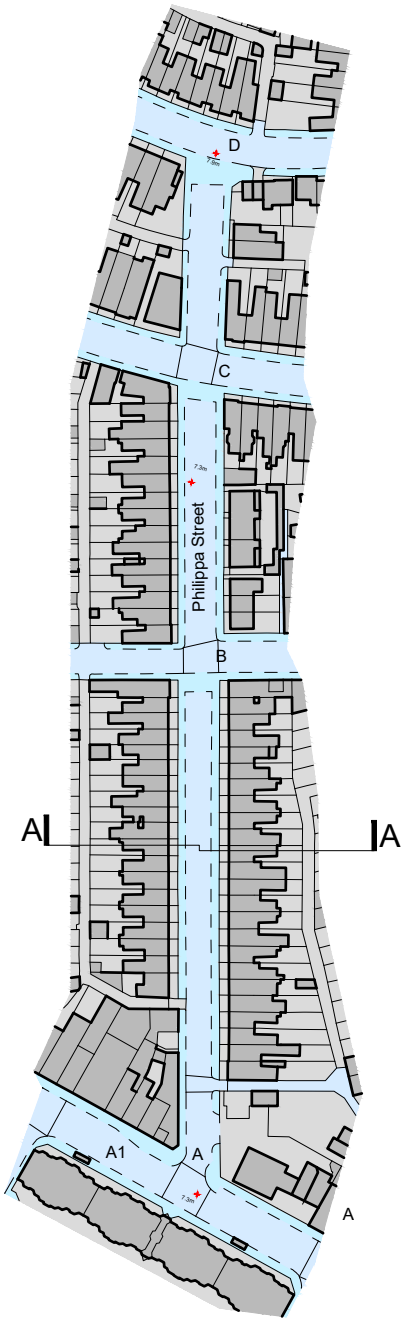
Philippa Street



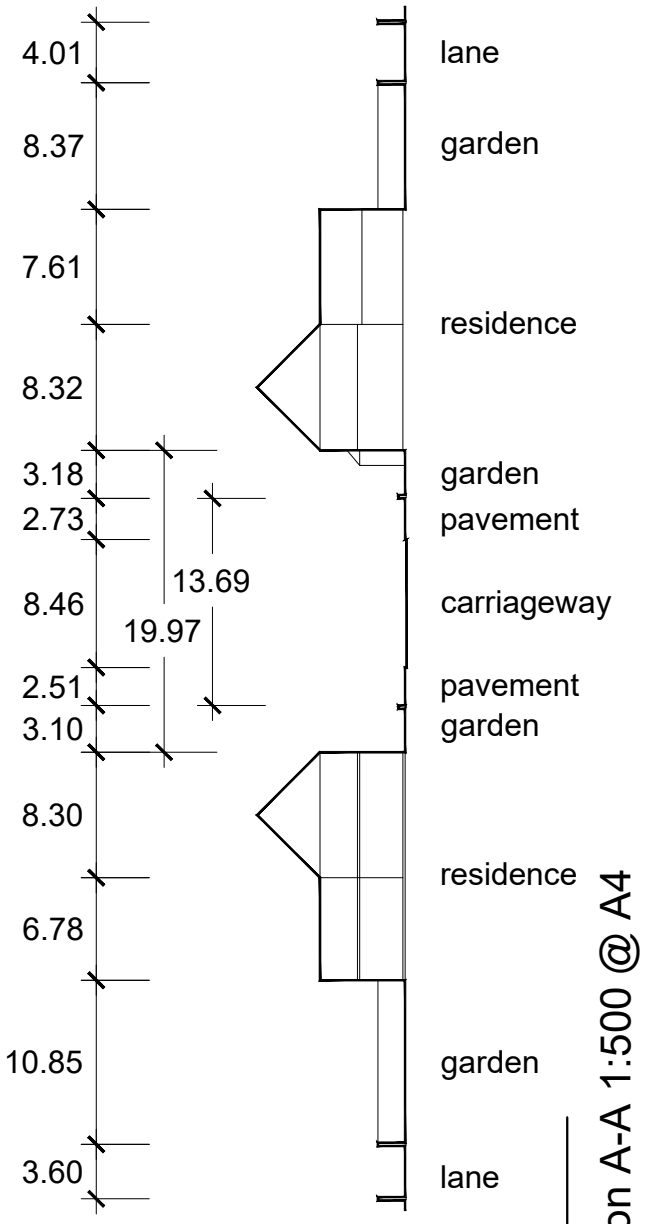
Sketch – En Plein Air

Philippa Street

50m
40m
30m
20m
10m



Street Plan 1:2,500 @ A4

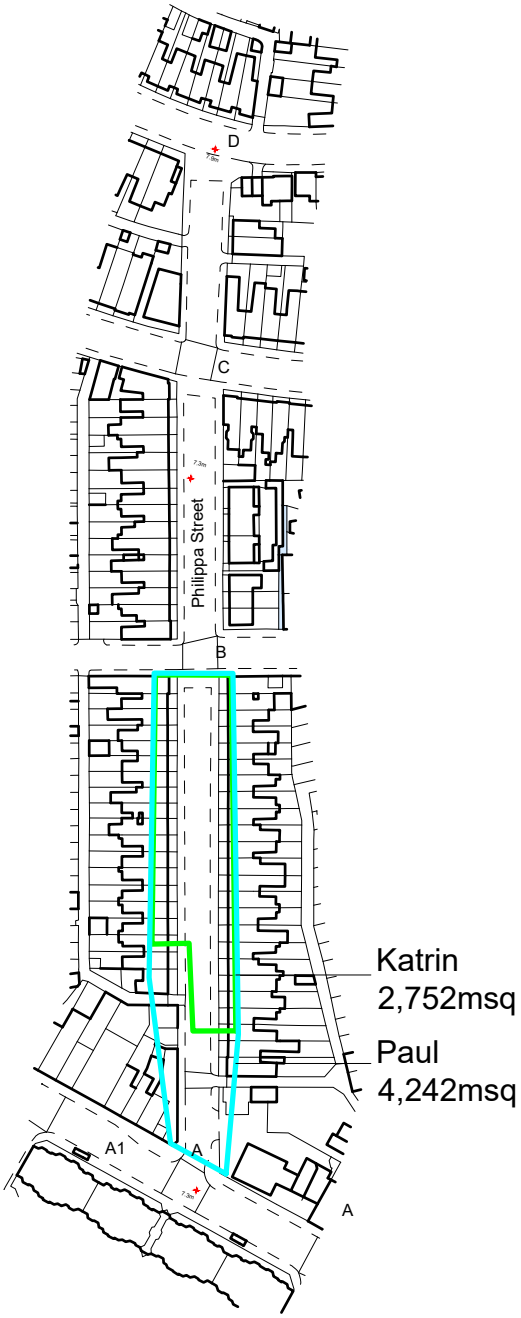


Street Section A-A 1:500 @ A4

Philippa Street

Materiality & Texture

Philippa Street



My Street | Participant Street Territory

Philippa Street

Painting – Acrylic on Paper

Philippa Street

Street Photograph

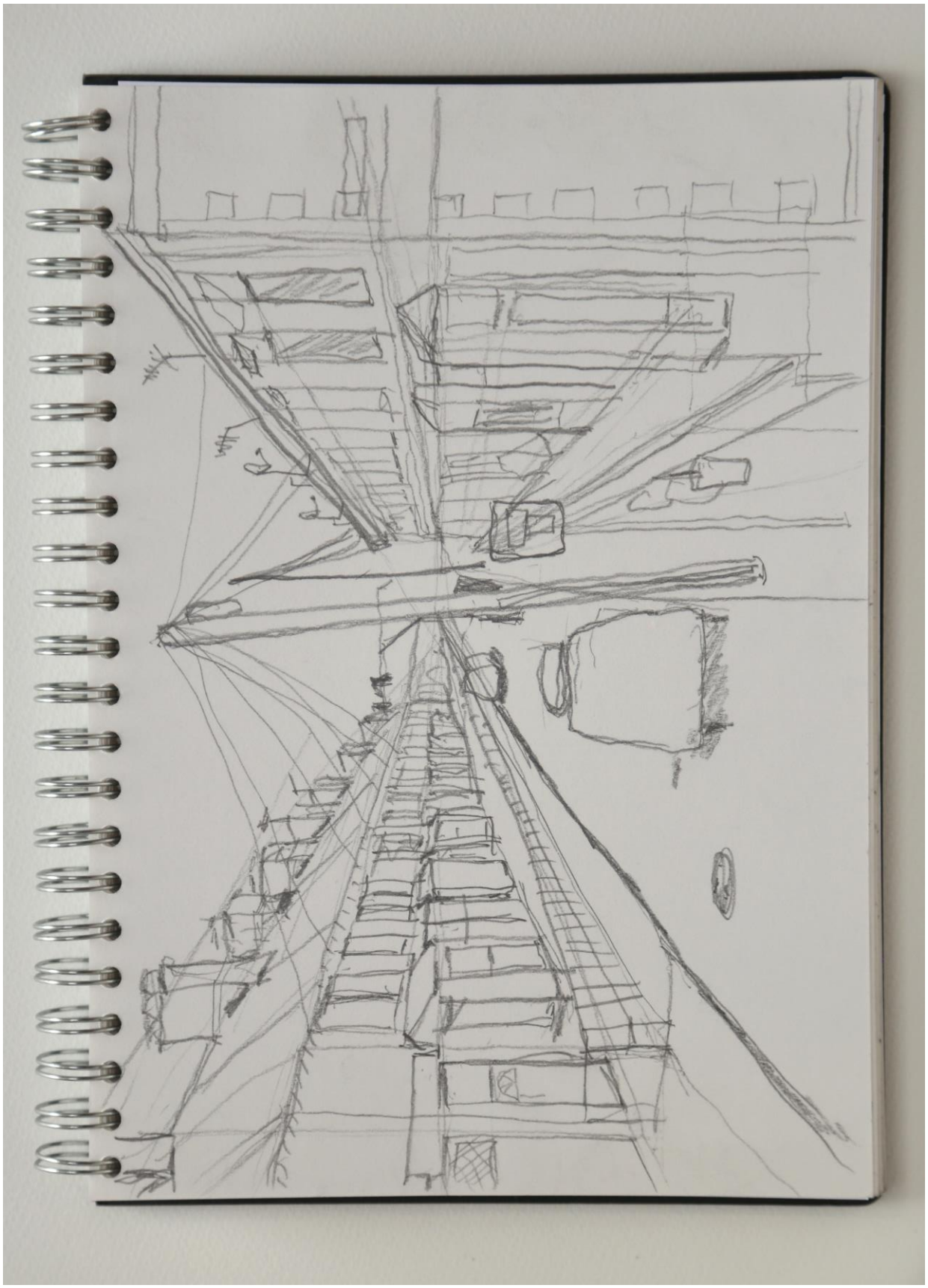
Simpson Street | South

Street Photograph

Simpson Street | North

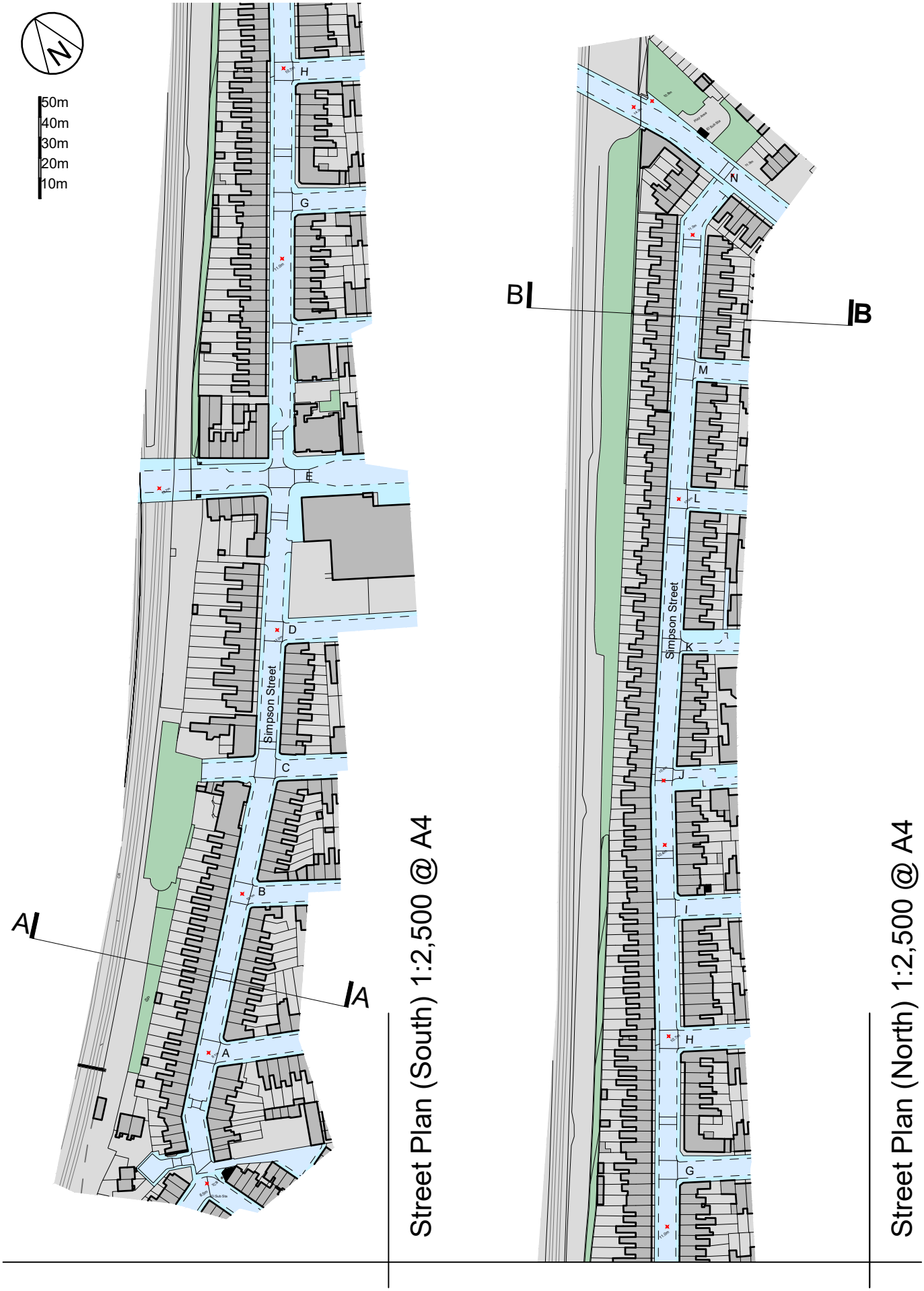
Sketch – En Plein Air

Simpson Street | South

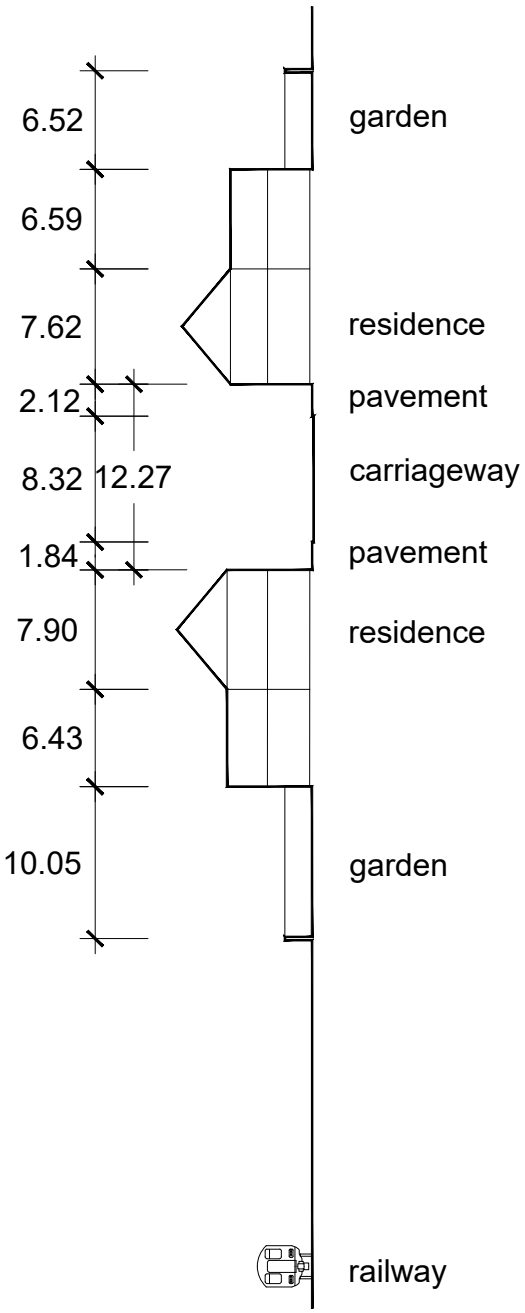


Sketch – En Plein Air

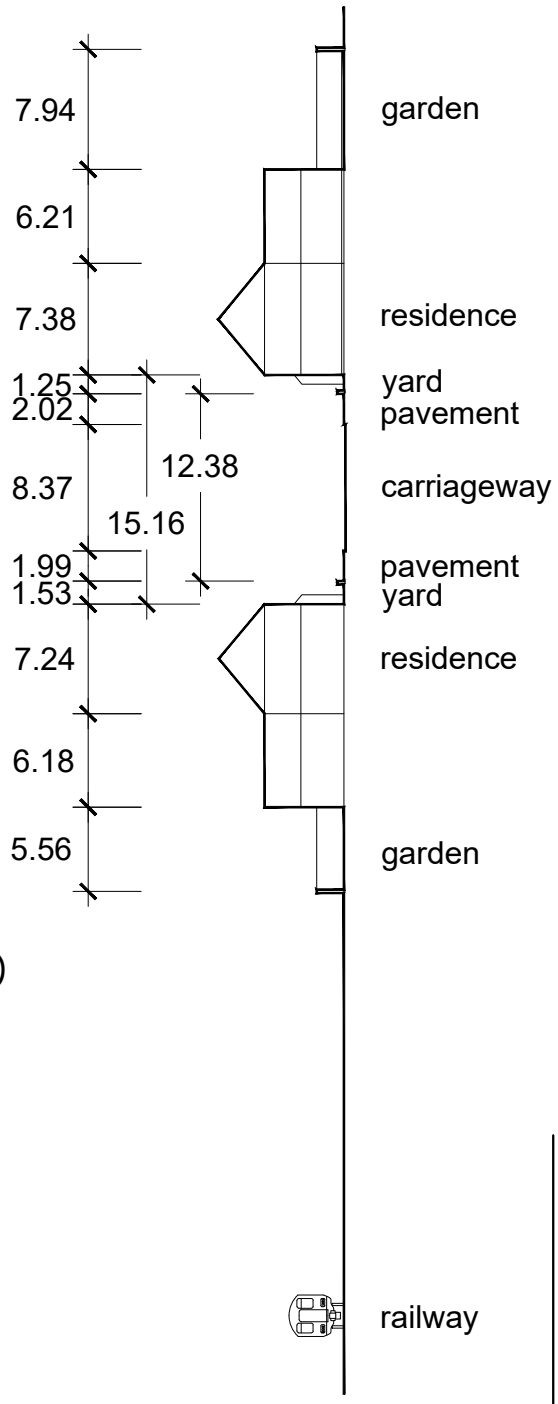
Simpson Street | North



Simpson Street



Street Section A-A 1:500 @ A4



Street Section B-B 1:500 @ A4

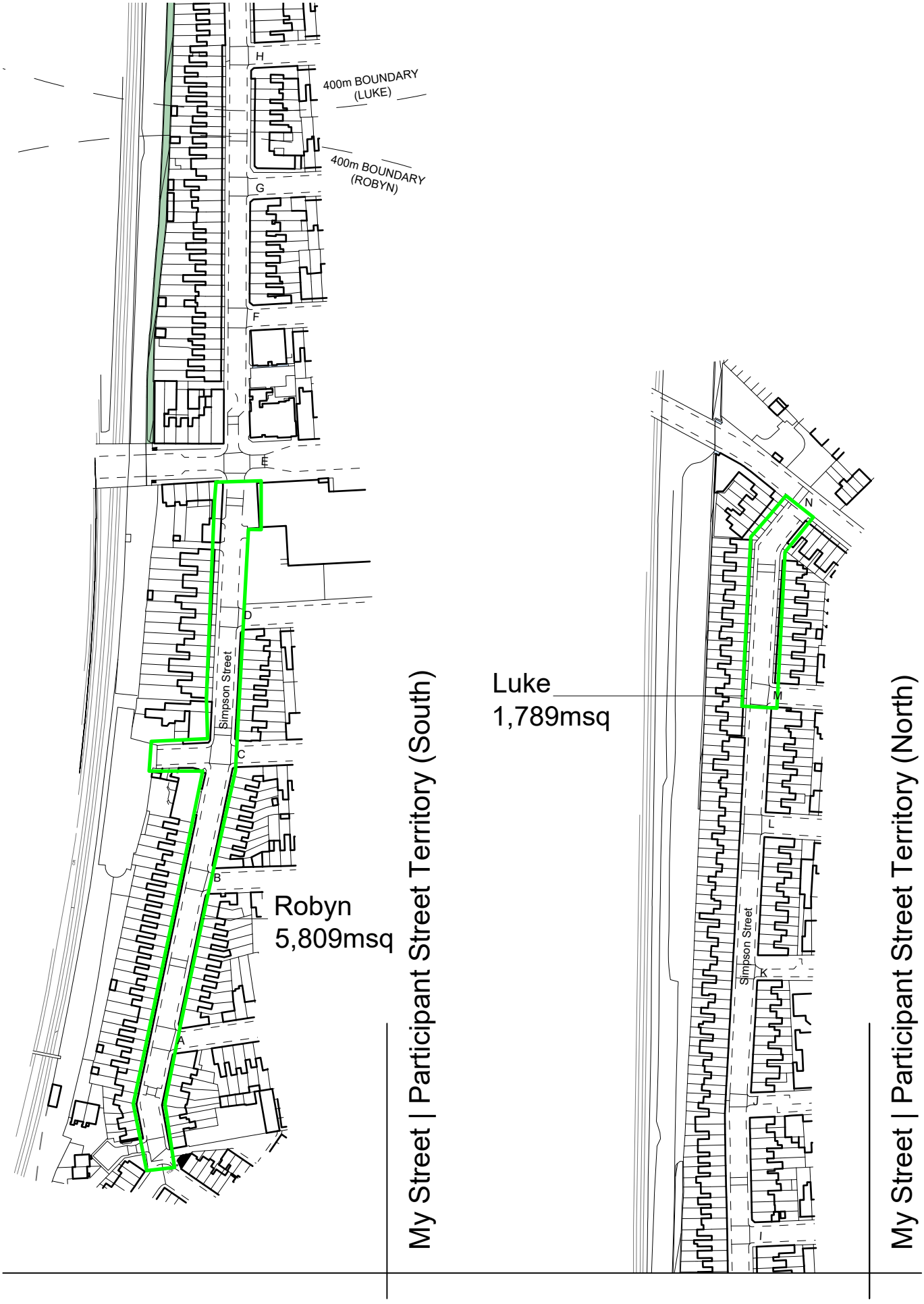
Simpson Street

Materiality & Texture

Simpson Street | South

Materiality & Texture

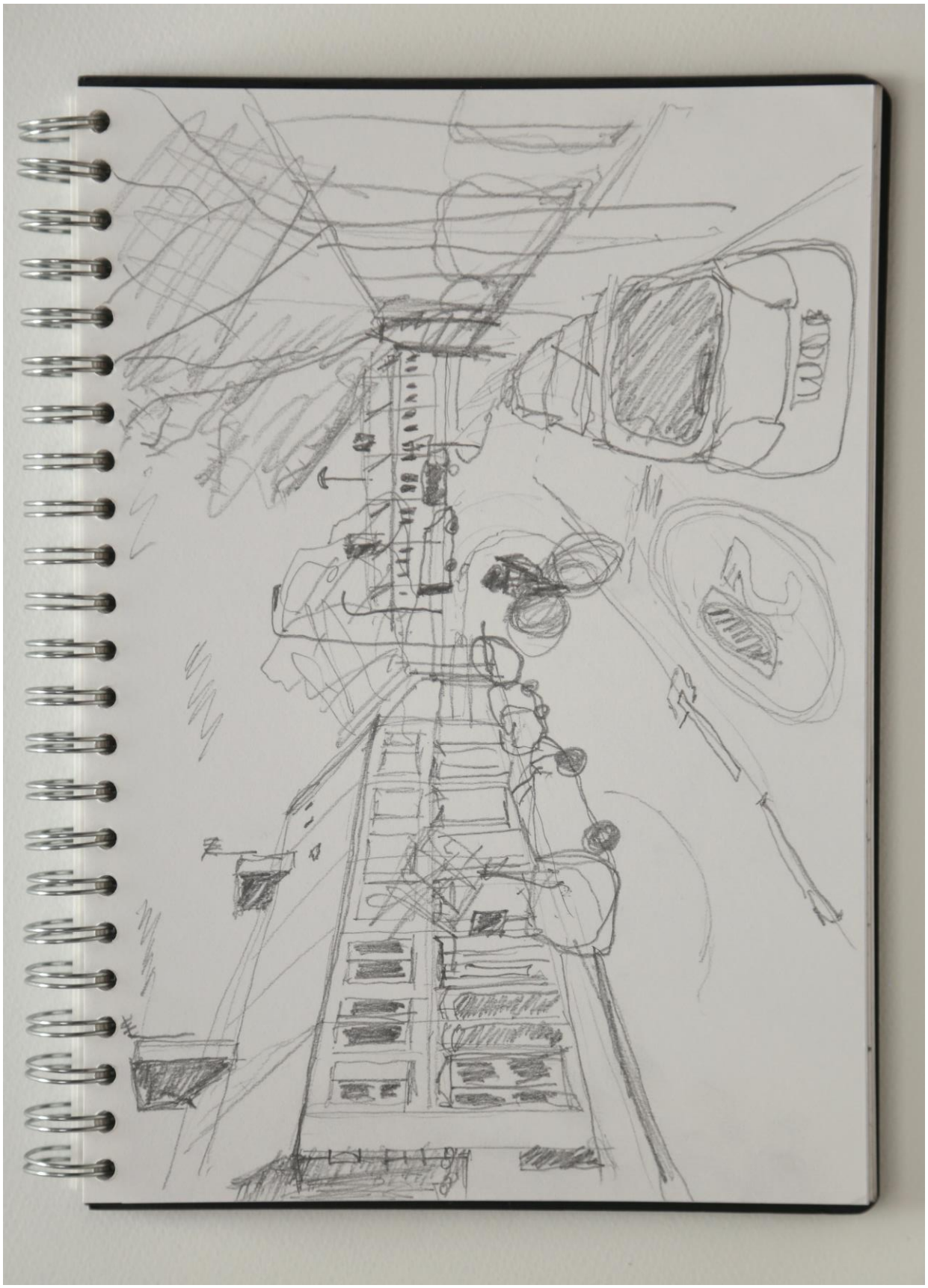
Simpson Street | North



Simpson Street

Street Photograph

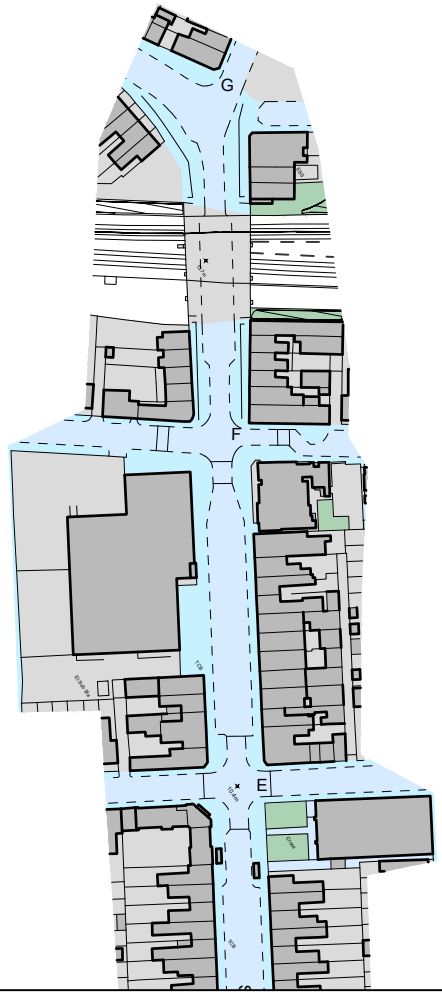
Steer Street



Sketch – En Plein Air

Steer Street

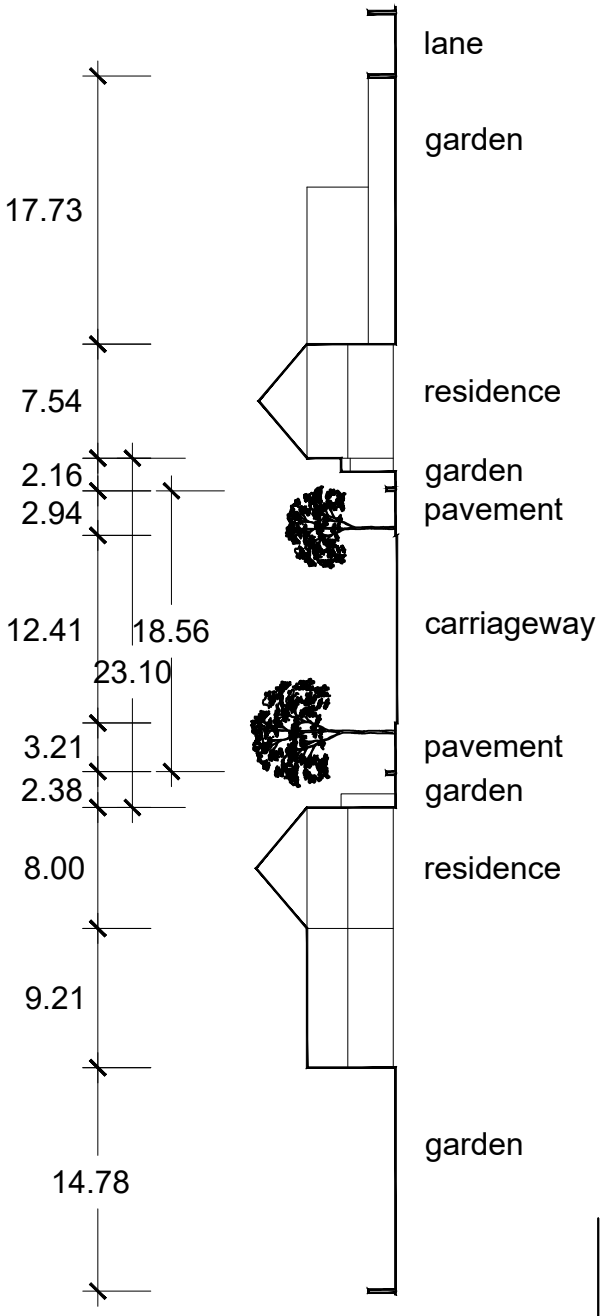
Street Plan (South) 1:2,500 @ A4



Street Plan (North) 1:2,500 @ A4

50m
40m
30m
20m
10m

Steer Street



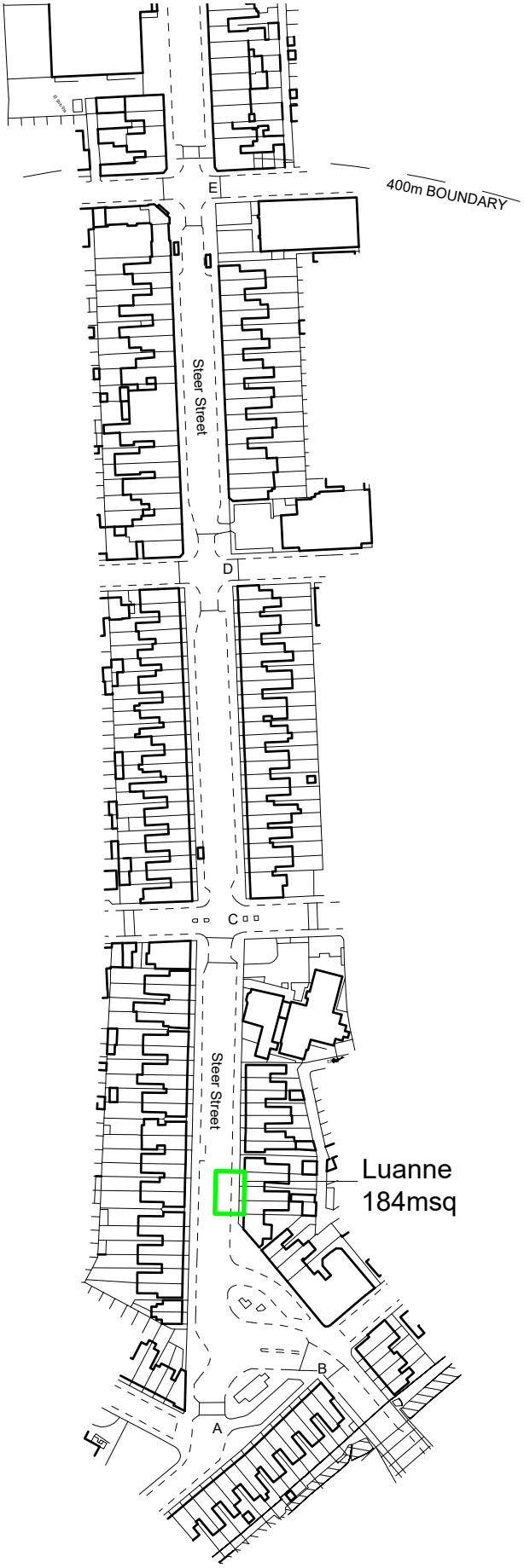
Street Section A-A 1:500 @ A4

Steer Street

Steer Street

REV F 11-08-2024

Materiality & Texture



My Street | Participant Street Territory

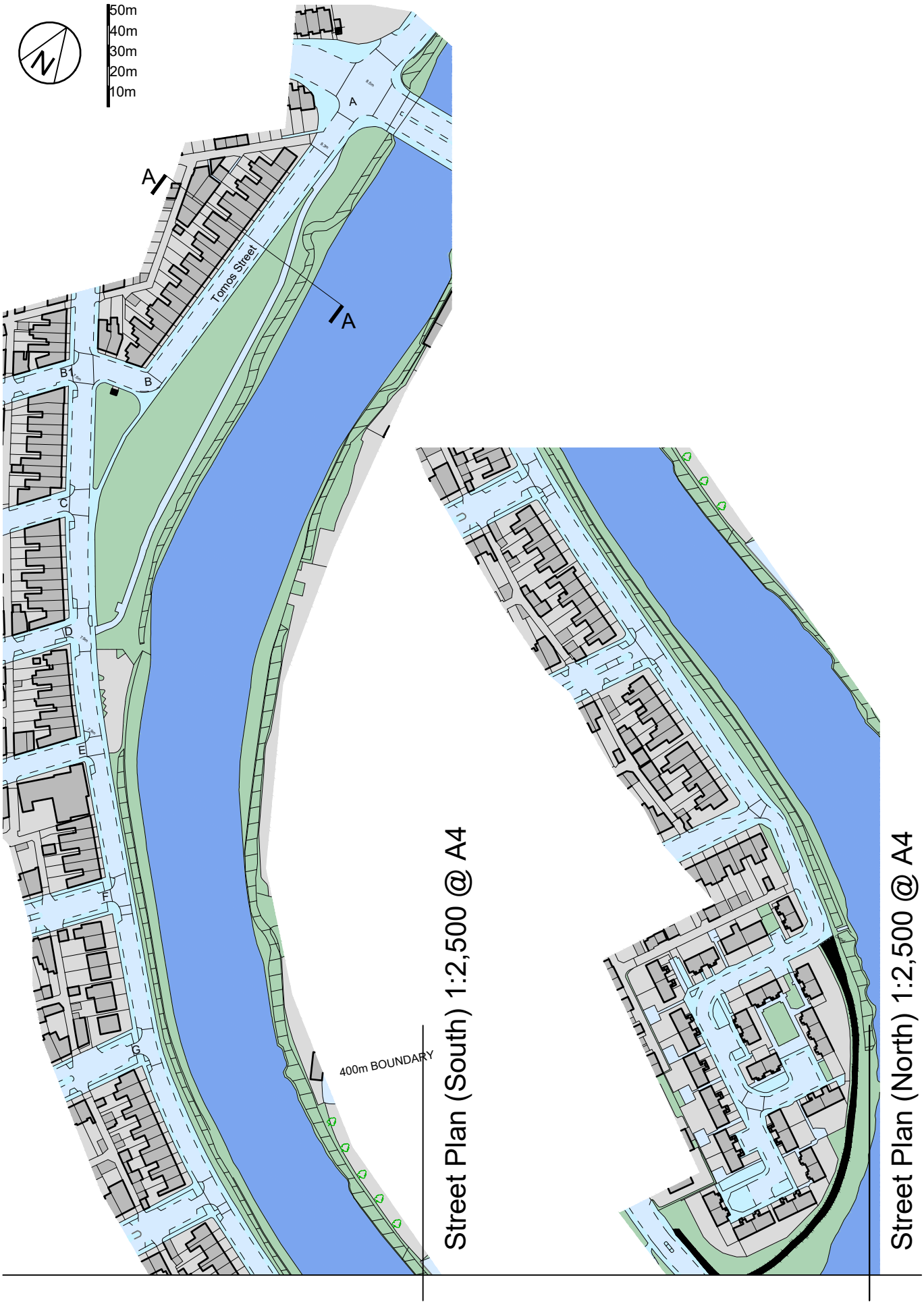
Steer Street

Street Photograph

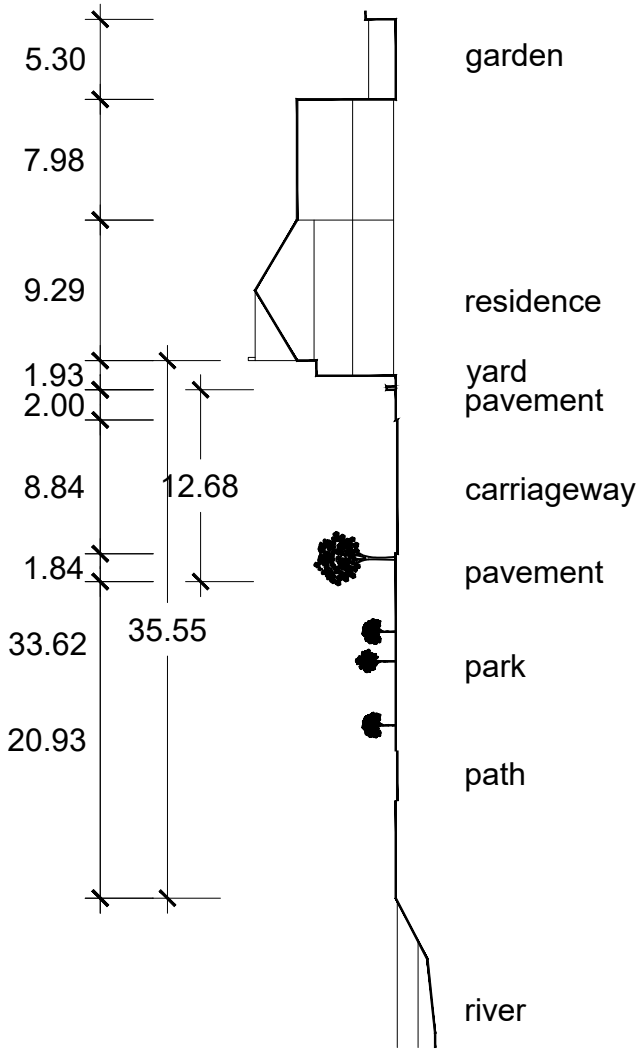
Tomos Street

Sketch – En Plein Air

Tomos Street



Tomos Street



Street Section A-A 1:500 @ A4

Tomos Street

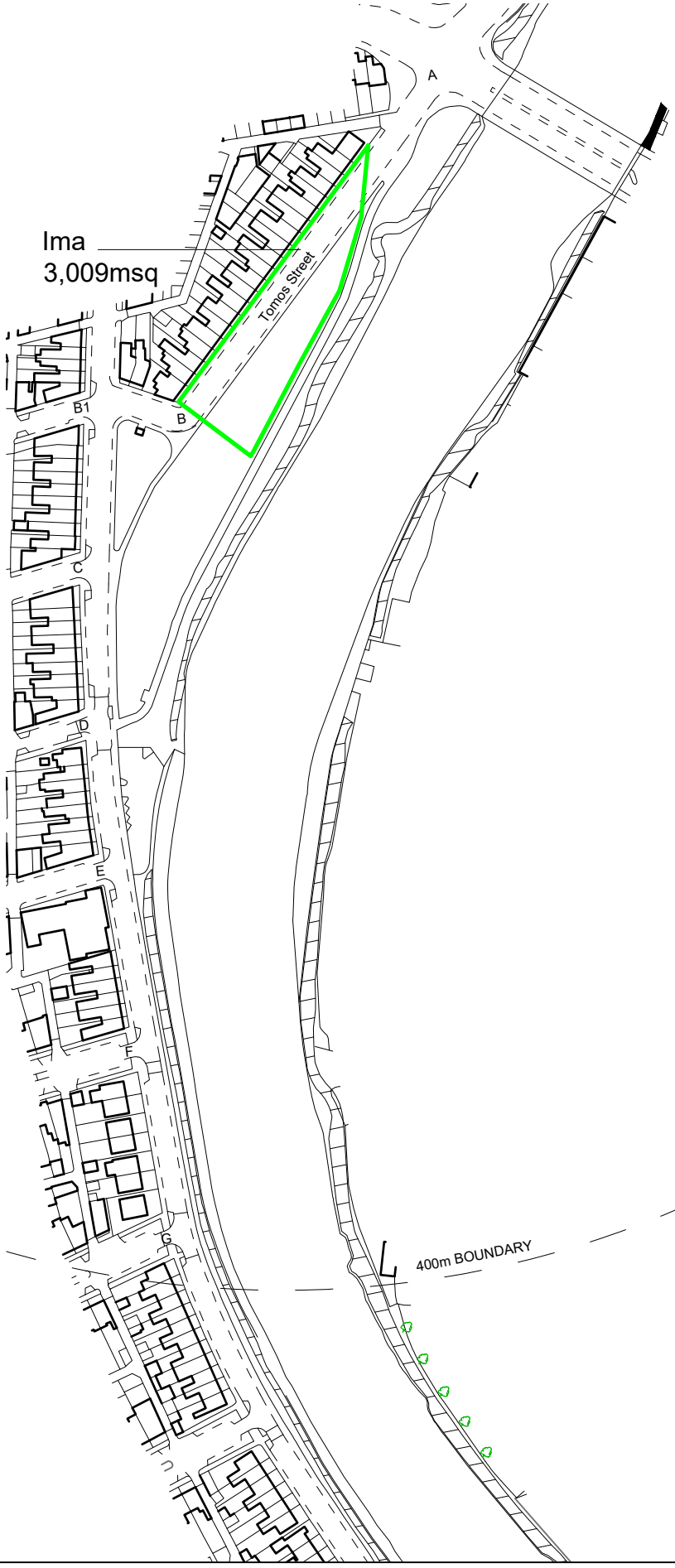
Materiality & Texture

Tomos Street

"That's why I answered this question from my door to the end of the building that's the safest place for me to leave my children and play outside. For myself up to the crossing and have a walk. But for them not to cross on the pavement by the end of the building. " (Ima)

"You live opposite this green space and the park, does that feel as if it's part of the street...?" (Interviewer)

"It is part of the street." (Ima)



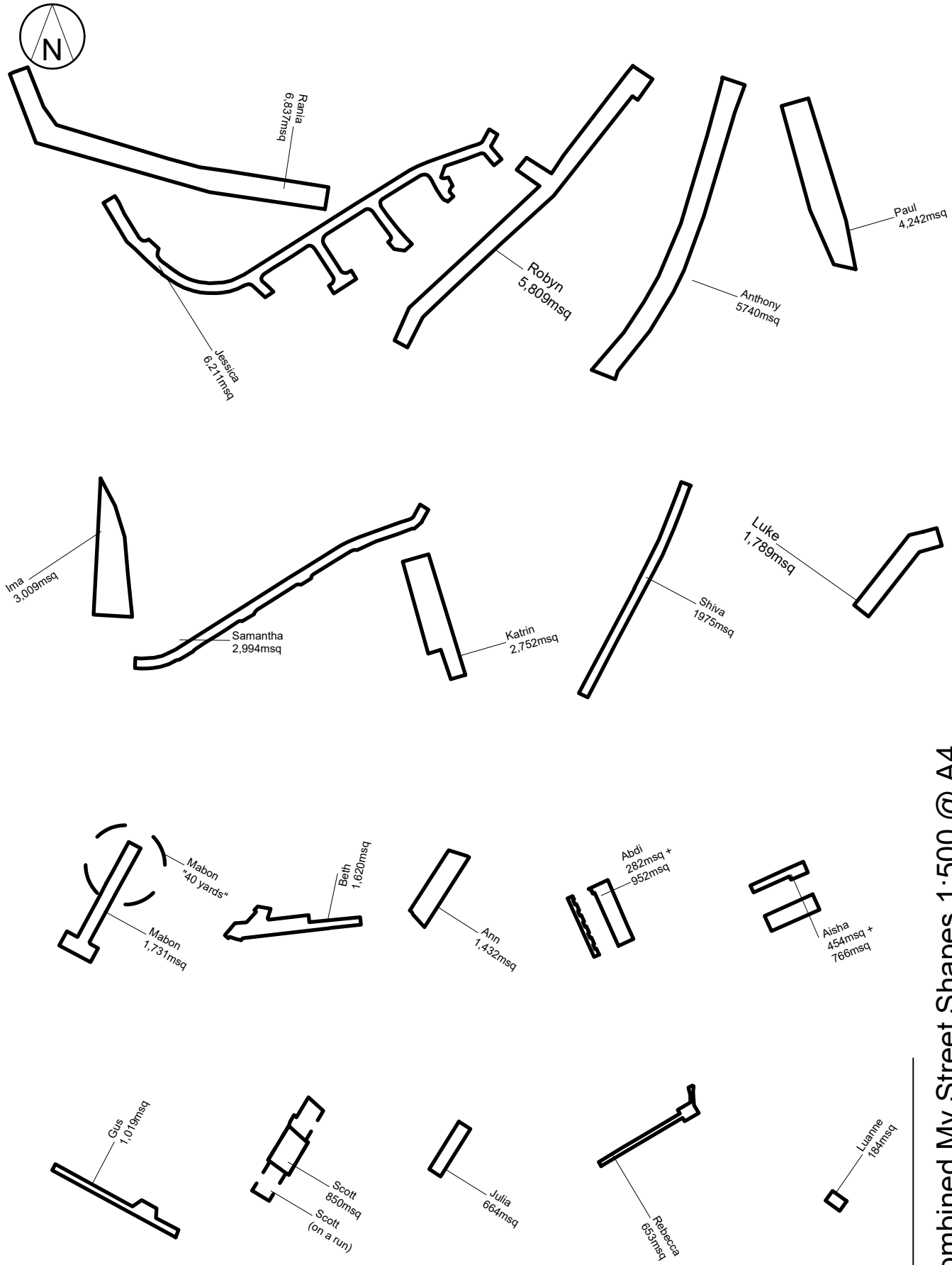
My Street | Participant Street Territory

Tomos Street

combined my street comparison

This visual drawn output shows the drawn shapes of My Street with mapping underlay removed.

They are arranged from largest to smallest My Street Area.



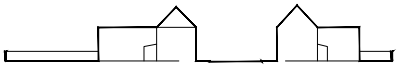
Combined My Street Shapes 1:500 @ A4

All Streets

combined street sections comparison

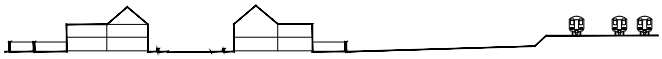
This visual drawn output shows the variety of street morphometrics in section arranged from narrowest to widest street.

simpson street (south)



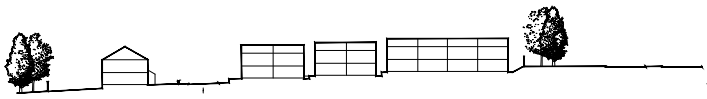
kinsey street

simpson street (north)

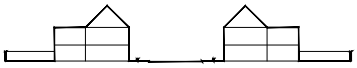


nia street

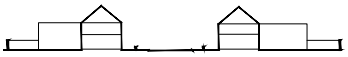
hester street



hoggan street

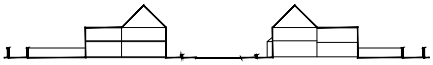


dillwyn street



chamberlain street

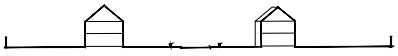
cadwaladr street



philippa street

holford street

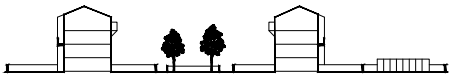
ashley street



legall street

arfon & campbell streets

beddoe street



holman street

tomos street

Comparative Sections.1:500 @ A1 Not to Scale @ A4

All Streets

references

Forrest, C. (2018) What's in a name? A feminist reflection on street name changes in Durban. *Agenda* [online]. 32 (2), pp. 53–61. Available from: https://doi.org/10.1080/10130950.2018.1445338 [Accessed 24 November 2021].

Ordnance Survey (2023) *OS MasterMap (Terrain 5, Topography Layer, and Building Height Attribute)* [online]. Available from: digimap.edina.ac.uk [Accessed various dates from 13 May 2020 - 15 May 2022].

WEN Wales (2018) *100+ Welsh Women*. 2018 [online]. Available from: https://www.100welshwomen.wales/ [Accessed 10 August 2023].

Rear cover image: detail of wall painting from fieldwork photo from street observation at Holford Street.

Appendix 2 | Supplementary Material to Systematic Review (Chapter 2.2)

S1 Supplementary Material: Search strategy

Population:

Not restricted. Whole population.

Intervention / exposure:

"residential street" OR "residential design" OR (resident* adj3 character) OR "urban design" OR "street design" OR "hous* design" OR "shared space" OR "neighb*rhood design" OR "neighb*rhood character" OR "road layout" OR "street layout" OR "street design" OR "shared surface" OR "home zone" OR "residential zone" OR "shared zone" OR "bike boulevard" OR "residential environment" OR "neighbo*rhood environment" OR "housing regeneration"

Comparison:

Not restricted. Default: no intervention / exposure.

Outcome:

- General: "non communicable disease" OR ncd OR "chronic condition" OR "chronic disease".
- Specific list of NCDs: Developed from the list of GHE cause codes and ICD-10 codes (World Health Organization, 2017). All items under Table A Section II searched, each item as OR syntax:

- neoplasm
- cancer
- leukaemia
- leukemia
- diabetes
- "endocrine disorder"
- "blood disorder"
- "immune disorder"
- "mental disorder"
- "depressive disorder"
- depression
- bipolar
- schizophrenia
- "alcohol use"
- "alcoholism"
- "fetal alcohol"
- "drug use"
- "drug addiction"
- anxiety
- "eating disorder"
- "anorexia nervosa"
- "developmental disorder"
- "developmental condition"
- "behavi*ral disorder"
- "behavi*ral condition"
- "intellectual disability"
- "learning disability"
- "mental health"
- "mental wellbeing"
- "mental illness"
- "neurological condition"
- "neurological disease"
- alzheimer
- dementia
- "parkinson* disease"
- epilepsy
- "multiple sclerosis"
- migraine
- headache
- "neurological condition"
- "sense organ disease"
- glaucoma
- cataract
- "refractive error"
- "macular degeneration"
- "vision loss"
- "sight loss"
- "hearing loss"
- "hearing impair*"
- "sense organ disorder"
- "cardiovascular disease"
- cvd
- "heart disease"
- "heart attack"
- stroke
- cardiomyopathy
- myocarditis
- endocarditis
- "respiratory disease"
- "chronic obstructive pulmonary disease"
- copd
- asthma
- "digestive disease"
- "peptic ulcer disease"
- cirrhosis
- appendicitis
- "genitourinary diseases"
- "kidney disease"
- hyperplasia
- urolithiasis
- "genitourinary disorders"
- infertility
- "gynecological diseases"
- "skin diseases"
- "musculoskeletal diseases"
- arthritis
- gout
- "back pain"
- "neck pain"
- "musculoskeletal disorder"
- "msk disorder"
- "congenital anomalies"
- "neural tube defect"
- "cleft lip"
- "cleft palate"
- "down syndrome"
- "congenital heart"
- "chromosomal anomal*"
- "oral condition"
- "oral disease"
- "dental caries"
- "periodontal disease"
- "periodontal condition"
- edentulism.

- Plus key risk factors: "alcohol consumption" OR "high blood pressure" OR "high cholesterol" OR "irritable bowel syndrome" OR "physical activity" OR "physical inactivity" OR "raised blood pressure" OR arteriosclerosis OR hyperglycemia OR hyperlimidemia OR hypertension OR malnutrition OR obesit* OR overweight OR stress OR smoking OR "tobacco use".
- Plus terms from (Bird *et al.*, 2017): disability OR MVPA OR sedent* OR "weight status".

Generic* search syntax:

Population	**Intervention**	**Comparison**	**Outcome**
And	**And**	**And**	**And**
[any]	Residential street design	[any]	Non-communicable disease

Generic* search filters:

Study design	[any]	**Date range**	01/01/2003 – present**
Language	English	**Publication type**	Peer reviewed journals

* Specific syntax and filters vary by database. For example, Medline (Ovid interface) only allows full year search;

** Searches conducted 05 December 2017.

S2 Supplementary Material: eligibility criteria

Review of Titles and Abstracts. Only studies after 31/12/2002 will be included in search results.

Participant, comparator, and study design are not used as eligibility criteria.

Item	**Response Options**
Publication Details	
Intervention: Is a street design intervention?	□ Yes (included) □ >2 design factors (included) □ GIS + 1 No. qualitative factor (included) □ GIS measured factors only (excluded) □ No (excluded)
Intervention: Physical environment intervention?	□ Yes (included) □ No (excluded)
Intervention: Internal environment or external environment?	□ Internal (excluded) □ External (included) □ Internal + External (included)
Intervention: At a street scale?	□ Yes (included) □ No (excluded)
Intervention: Type of streets	□ Residential (included) □ Mixed Use including Residential (included) □ Non-residential (excluded)
Outcome: is a non-communicable disease?	□ Yes (included) □ No (excluded)
Method:	□ Quantitative (exclude) □ Mixed methods (included) □ Qualitative (excluded)
Eligibility Outcome	□ Included □ Excluded

Additional guidance for reviewers:

Design intervention: requires to consider the street design in a holistic sense and not just a single design factor. Studies considering multiple design factors (>2) are included in screening. Studies solely measuring quantitative GIS based measures are excluded. Studies of Air Quality excluded unless air quality is measured in situ at the location study is considering design factors related to air quality.

Pre-assessment of a number of commonly used tools reported elsewhere has been made.

Neighbourhood Environment Walkability Scale (NEWS) (Excluded)

Systematic Pedestrian and Cycling Environmental Scan (SPACES) (Included if other conditions are met).

Irvine Minnesota Inventory (IMI) (Included if other conditions are met).

Environment in Asia Scan Tool—Hong Kong – (Included if other conditions are met).

International Physical Activity Prevalence Study (IPS) Environmental Module (PANES or IPAP-SEM) (Excluded).

Street scale: focus is the streetscape. Neighbourhood infrastructure 'beyond' the street excluded: neighbourhood parks, neighbourhood green space, major transport infrastructure not associated with the residential street. The street however can be defined by the study and no limit is set on distance.

Non-communicable disease: refer to list of diseases and selected risk factors within search criteria developed from WHO GHE cause categories and ICD-10 code.

Appendix 3 | Critical Appraisal

This appendix is a reflective critical appraisal of the thesis and responds to the doctoral descriptor of “critically reflect on their work and evaluate its strengths and weaknesses including understanding validation procedures” (UWE Bristol, 2023).

This assessment first uses a critical appraisal checklist for qualitative studies (Critical Appraisal Skills Programme, 2018) which is a preferred tool of the UK National Institute for Health and Care Excellence (2023, app.H).

Second, Braun and Clarke’s 15 point checklist for good reflexive thematic analysis (2022) with a specific focus on findings in Chapters 4.2 – 4.4 which use this analytical method.

Third, reflections on transdisciplinary quality appraisal are presented based on one checklist (Jahn and Keil, 2015), the full checklist is not presented as it was found to have many items that were out of scope or not applicable to this study, which itself is useful to demonstrate the limitations within a PhD study with a single researcher, for transdisciplinary research.

CASP Qualitative Checklist (Critical Appraisal Skills Programme, 2018)**:**

Question	**Response** (yes / can't tell / no)	**Comments**
Section A: Are the results valid?		
1. Was there a clear statement of the aims of the research?	Yes	Goals have been described including the importance of the research, why it was important. The relevance of the study for research, practice, and policy have also been made clear. (Chapter 1.0)
2. Is a qualitative methodology appropriate?	Yes	The topic could have been approached in various ways but the focus on health practices, and the evidenced gaps in existing literature, mean that a qualitative approach seeking to illuminate the issues and provide a deep understanding is the right method. The evolution of thinking over the course of the research has also been explained. The focus on health practices and resident perceptions of the street environment meant qualitative research was best placed to respond to the research question that has been developed. (Chapter 1.0, 3.0)

3. Was the research design appropriate to address the aims of the research?	Yes	The research design is justified within the thesis (Chapter 3.0) and selection of methods at both data collection and analysis stages made explicit including comparison with other potential designs (e.g., critical realist). The health questions / focus was initially cast extremely wide and arguably this has created additional work and complexity in synthesis which are acknowledged in the text and can inform future research designs.
4. Was the recruitment strategy appropriate to the aims of the research?	Yes	The recruitment methods both in terms of participants and also street environment has been described including what the sample aimed to achieve – access to the phenomenon of health practices. Limitations of the sample (Chapter 3.3) and recruitment methods have been discussed (Chapter 5.3) including the withdrawal of one participant and how more broadly recruitment may have been affected including due to Covid-19 restrictions.

5. Was the data collected in a way that addressed the research issue?	Yes	The data collection setting has been justified (Chapter 3.2). Data collection methods are explicit (Chapter 3.2) including an interview protocol (Appendix 6). The methods have been justified including how these responded to the circumstances of Covid-19 creating both opportunities and limitations (Chapter 5.3). A pilot was used to validate the approach (Chapter 3.2). The concept of saturation has been critically addressed and justified with a focus in the research on “theoretical sufficiency” and “sampling adequacy” (Braun and Clarke, 2021, p.202) based on the cited methodological approach. More data were collected than perhaps necessary to address the research question however this is reasonable, even sensible, given the unique opportunity for data collection during the Covid-19 restrictions which provides a rich series of datasets for future potential research / secondary analysis.

		The amount of data has created more work to analyse and synthesise the findings and the thesis has to manage a balance between clear headline findings and the large number of individual findings.
6. Has the relationship between researcher and participants been adequately considered?	Yes	Researcher positionality has been addressed reflexively throughout including making motivations explicit (Chapter 1.0) and later discussed within findings (Chapter 4.8). The researcher has demonstrated a significant effort to go beyond themselves and their own experiences to address in a rigorous way their own positionality in relation to their participants and the research topic. Changes to the research design as the study progressed have been addressed, particularly in relation to Covid-19 and a responsive approach has been demonstrated.

Section B: What are the results?		
7. Have ethical issues been taken into consideration?	Yes	Institutional ethical approval was obtained and clearly explained. The response to Covid-19 is described and how this addressed both participant and researcher health and wellbeing. Ethics have been described as formative to the research, particularly an aim to reduce health inequalities, and are discussed throughout. (Chapter 3.2)
8. Was the data analysis sufficiently rigorous?	Yes	The analysis methods are clearly described (Chapter 3.2) and for reflexive thematic analysis are based on the cited methodology. Development of thematic findings are discussed. Presentation of data extracts are quite restricted due to space constraints and also the further analysis to create high level findings (Chapters 4.5, 4.6, 4.7). Examples of contradictory cases are included and the data extracts draw from across the dataset and are not overly reliant on a few cases. The researcher's positionality is made clear through a reflexive approach.

		The research uses facet methodology to integrate and validate across the data (not for example triangulation). Analysis draws on the experiences that affect most participants whilst making clear the limitations and that this is not a “logic of inference” (Maxwell, 2010, p. 477). Themes affecting fewer participants are noted for their potential importance (e.g., violence, injury) whilst at the same time noting the limitations of the data.
9. Is there a clear statement of findings?	Yes	The findings are explicit. Findings are linked back to the research questions. As above there are a lot of findings and the thesis aims to balance the disaggregated and aggregated levels of these. The headline however is clear which is to evidence the street as a health setting and the other findings support this being developed through a systematic and rigorous analysis.

		The limitations and generalisability are made explicit. While the findings are context-specific, a strength of the study for future is the contribution to methods which can be applied to different setting.
Section C: Will the results help locally?		
10. How valuable is the research?	-	Contribution to knowledge is explicit across various domains (Chapter 5.2) and limitations are clearly stated (Chapter 5.3). Recommendations for practice, policy, and research are made (Chapter 5.6). The practice-oriented nature of the research is a strength of the study as are the recommendations for future. Local authorities in particular may find the study of value to address population health.

15 Point Checklist for Good Reflexive Thematic Analysis (Braun and Clarke, 2022)**:**

Criteria	**Response** (yes / partial / no / out of scope)	**Comments**
Process: transcription		
The data have been transcribed to an appropriate level of detail; all transcripts have been checked against the original recordings for 'accuracy'.	Yes	Transcription was undertaken manually by the researcher to a protocol.
Process: coding and theme development		
Each data item has been given thorough and repeated attention in the coding process.	Yes / with limitation noted	Coding has been a rigorous and systematic process. A limitation is noted due to practical resource constraints that one pass of coding was undertaken with additional validation steps: *At the point of having coded 60% (n=12) of data items 94% (n=48) of finally included code labels had been identified. In other words, only*

		three code labels were created in the remaining (n=8) coding of participant observations (data items).
The coding process has been thorough, inclusive and comprehensive; themes have not been developed from a few vivid examples (an anecdotal approach).	Yes	As above item – a rigorous and systematic process. Themes develop first from a consideration of what affected most participants whilst also reporting differences by gender and identifying codes with a potentially intense health impact for a few people whilst noting limitations where based on only a few participants or participant observations in other people (e.g., suicide, autism codes).
All relevant extracts for each theme have been collated.	Yes	Using NVivo software all data extracts for a theme were extracted and printed out for analysis (not included in thesis).
Candidate themes have been checked against coded data and back to the original dataset.	Yes	This process was undertaken as part of the analytical method.
Themes are internally coherent, consistent, and distinctive; each theme contains a well-defined	Yes	Themes have been clearly defined whilst also maintaining participant language and terms as much as possible.

central organising concept; any subthemes share the central organising concept of the theme.		
Process: Analysis and interpretation – in the written report.		
Data have been *analysed* – interpreted, made sense of – rather than just summarised, described or paraphrased.	Yes	A development of the cited method is the three levels of analysis and refining this to apply to health-related outcomes. The inclusion of coding in findings is a deviation from the published method with reasons noted: that these represent in themselves new data and also the health-related outcomes at a code level are important to note as well as at a thematic level.
Analysis and data match each other – the extracts evidence the analytic claims.	Yes	There is consistency between the claims and extracts used to support these. A limitation is noted due to space constraints and also the need to report the high-level aggregated synthesis and findings that go beyond reflexive thematic analysis.

Analysis tells a convincing and well-organised story about the data and topic; analysis addresses the research question.	Yes / adjustments stated	Yes in relation to Chapters 4.2, 4.3, 4.4 with adjustments noted such as the use of three levels of analysis. Analysis clearly addresses and is linked to the research questions – the overall response to these including additional analytical methods beyond reflexive thematic analysis (Chapters 4.5, 4.6, 4.7).
An appropriate balance between analytic narrative and data extracts is provided.	Yes / adjustments stated	In the context of the PhD thesis stated, the methodology, and integrated system of analysis, which includes more than just reflexive thematic analysis. This is different to a 'normal' reflexive thematic analysis report which may seek to include more data extracts.
Process: Overall		
Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase, or giving it a once-over-lightly (including returning to earlier phases or redoing the analysis if need be).	Yes	Including in response to Covid-19 each phase of work has been planned to a project programme with sufficient time allowed and adjustments made as required to ensure a rigorous process.

Process: Written report		
The specific approach to thematic analysis, and the particulars of the approach, including theoretical positions and assumptions, are clearly explicated.	Yes	There is an overall coherent methodological approach which is aligned to reflexive thematic analysis both as method and methodology.
There is a good fit between what was claimed, and what was done – i.e., the described method and reported analysis are consistent.	Yes	Yes and refinements are noted including differences noted in the relative *themey-ness* of street physical environment characteristics compared to street social environment / health practices.
The language and concepts used in the report are consistent with the ontological and epistemological positions of the analysis.	Yes	Yes, the epistemology is an interpretivist-constructivist one and findings are reported as the co-produced interpretation of researcher and participants.
The researcher is positioned as *active* in the research process; themes do not just 'emerge'.	Yes	Researcher positionality is addressed directly at the outset and throughout to findings. Also the epistemology is an interpretivist-constructivist one.

Transdisciplinary Requirements Profile for Researchers

This critical reflection is based on Jahn and Keil's (2015) quality criteria for transdisciplinary sustainability research, here substituting health for sustainability, which is the focus of these criteria. The general dimensions have been used as a framework as the published researcher checklist was found to be difficult to relate to a PhD research by a sole researcher, an important point in its own right.

Quality dimensions (Jahn and Keil, 2015, p.198)	**Response** (yes / partial / no / out of PhD scope)	**Comments**
Quality of the research problems		
"Systemic: understanding of social-ecological systems, including feedback effects and temporal inertia"	Yes	Central to the research question, design, and overall aim of the research of the street as a health setting (Chapter 1.0).
"Scale spanning: consideration of different spatial, temporal, and social scales and of transition effects"	Partial	Spatial: The focus is on street scale and relates this to smaller and larger scales.

		Temporal: yes both being open to lifecourse interpretations as well as temporal changes in the street setting, and finally the time period of Covid-19 pandemic. Social: partial, focus is on the social environment of the street and links this to other scales. Transition: partial – arguably unintended health impact is more relevant to health research which is included.
"Prospective: consideration of alternative development paths, critical thresholds and surprises"	Out of PhD scope	Research focus is not to propose interventions or evaluate these. The research potentially can underpin this in future.
Quality of the research process		
"Context specific: relation to concrete problems and their respective action and behavioral contexts"	Yes / Partial	Research addresses real-world problems relevant to context. Research critiques behavioural focus and aims to shift focus to wider social and physical environment.

"Integrative: Integration at epistemic, social-organizational, and communicative levels"	Partial / Out of PhD scope	The research overall integrates many aspects: research question, data collection methods. However, does not integrate epistemology, this is discussed as part of integration of research at different levels (Chapter 4.7). Communication is limited by the scope of being a PhD.
"Method-based: Accountable, transparent production and evaluation of knowledge"	Yes	The research is based on coherent methodology with established analytical methods. The methods of production are transparent.
Quality of the research results		
"Critical-reflective: Uncertainty, ignorance, cognitive boundaries, impact assessment, role understanding"	Yes	Reflexivity is incorporated throughout the thesis. The research aims to move beyond existing disciplinary understanding and boundaries and the findings reflect having done this successfully within the scope of the research design. Health impact assessment is one approach taken to understanding the findings including mapping pathways to impact (Chapter 4.5).
"Normative: Maintaining the viability of societies, attention to current and future issues of justice"	Yes	The normative argued for is the socio-ecologic paradigm. This is reflected in public health practice values (Chapter 5.6) whilst noting that

		these are not normative across all disciplines involved in the topic area therefore part of the argument and recommendation is to address this.
“Impact oriented: Usability of results, increased capabilities for action, safeguarding knowledge”	Partially / Out of PhD scope	Intervention design and evaluation is out of scope. The research sets out recommendations for practice, policy, and research (Chapter 5.6) which have the potential to lead to impact on the problems.

Appendix 4 | Fieldwork and Analysis Methods Tables

Table 27: Fieldwork Methods Summary Table

Template developed from Mason (2018) *(best printed at A3 size)*

Research question	Data sources and methods	What could they yield	How realistic and feasible was it be to use these methods / sources?	Did I have, or could I gain, access to these sources?	Was I be able to marshal the appropriate resources, including skills, budget?	What were the costs / benefits of different methods (practically, ontologically and epistemologically)?	What ethical issues arose or could have arose in using these methods / sources?
Research Question							
What are people's everyday health practices in their residential street environment; which street environment characteristics impact those practices; and how are these both to be understood within a socio-ecologic paradigm of population health?	For the purposes of data collection this question was broken down into four sub-questions that were the brought back together at the analysis stage to address the overarching question.	*See sub-questions.*	*See sub-questions.* A practical limitation of the research was imposed by Covid-19 particularly not meeting participants face-to-face.	*See sub-questions.*	*See sub-questions.*	*See sub-questions.* As above the combination of methods was a dialogic one using different methods to respond to different aspects of the research question within the practical limitations of the research.	*See sub-questions.* Ethics approval was received dated 30/01/2020. Adjustments due to Covid-19 were incorporated subsequently within the boundaries of that approval which facilitated the timely progress of the research.
Prerequisite questions							
What are residents' everyday practices in the residential street environment?	Observations (interviews) of participants in a diverse range of streets in Cardiff's Southern Arc. In depth observations that aimed to: • Generate insights into the question in a way that methods such as survey forms may not; • Provide insights into the wider ecology of the street and people living there; • Driven by theory creation and inductive analysis from the data generated; • Allowed existing orthodoxy / theories to be compared to the theory that may emerge from the data. • Made the everyday the centre of the research. Core methods:	""telling" examples" and "flashes of insight" (Mason, 2018, p.71) Data consisting: Interviews with participants. Units of practices. Other types of units may emerge.	Realistic to use these methods. These methods fitted with Covid-19 restrictions by avoiding face-to-face interactions with participants whilst allowing access to the street as fieldsite albeit by researcher alone. This was driven by Covid-19 and the implications in terms of data produced and what it represented or who was interpreting it only became fully	Sampling was snowballed from key actors (Fetterman, 1998). Key actors also came from gatekeepers within pilot and using existing networks of researcher. Gatekeepers turned out to be of greater importance in participant recruitment during Covid-19 due to the difficulties in meeting people in other public settings.	Yes, this was possible including during Covid-19 which has meant a slower rate of progress. Costs were minimised such as travel by basing study in Cardiff. Leveraged researcher time as resource and existing skills and networks within Cardiff. Other physical resources: • Digital audio recorder • Dedicated mobile phone Reciprocation: Due to Covid-19 were offered as a £10- donation to a local charity or community group to each participant.	Participant observation: Valued residents' lived experience in their own words. Supported participants to think outside of their normal frames and consider the street in potentially new ways. Sought to gain insight into residents lived experience. Was an ideal method for inductive theory building. Is not participatory but involves the researcher directly with participants and gives priority to their lived experiences, and as	Ontology / values in practice: method speaks to improving population health; through the life course; focused on wider determinants; and reducing inequalities. Also, to including people in decisions about their own health and recognise this right. Epistemology: Knowledge has not been purely developed from the knowledge of professional designers, experts, or researchers. Methodology: Aligned with production of street environment by participants through their everyday practices.

Research question	Data sources and methods	What could they yield	How realistic and feasible was it be to use these methods / sources?	Did I have, or could I gain, access to these sources?	Was I be able to marshal the appropriate resources, including skills, budget?	What were the costs / benefits of different methods (practically, ontologically and epistemologically)?	What ethical issues arose or could have arose in using these methods / sources?
	Participant observation: • Semi-structured participant interviews (Brinkmann, 2018) conducted via telephone / online. • Field notes (Fetterman, 1998) of both participant observations and street observations. Key question: • Please can you imagine you are showing me around your street and tell me about the day-to-day things you do there?		clear later – i.e., fieldsite observations were by the researcher alone not with participant. Fieldsites were within cycling distance of researcher base allowing access during Covid-19 by cycle. The approach was relatively flexible. Skills developed during research: Participant observation Fieldnotes	It was recognised that the researcher as a white, middle-class, man in his 40s would need to work hard to connect with and gain access with some participants.		far as possible in their own words. The focus on semi-structured interviews allowed the research to proceed during Covid-19 pandemic. A potential cost was that this method did not allow participants to be observed in the street setting itself.	Methods: Risk management was addressed in relation to personal data; protection of researcher and participants; Covid-19. Broadly these were minimised through avoiding face-to-face contact. Risks both during and after including publication of identity, in part addressed through changing name of street and participant pseudonyms. Participants given option to choose pseudonym.
Do these practices relate to residents' health and if so how?	Participant observation (as previous item), including specific questions: • You mentioned activities of … which of these do you think support your health and wellbeing in the broadest sense? • You mentioned activities of … which of these do you think have a negative effect on your health and wellbeing in the broadest sense?	Participant interpretation of how everyday practices link to health-related outcomes. Gaps between participant interpretations and existing literature.	As above and as part of the participant observation method. Pilot indicated a more difficult concept for participants to engage with, potentially requiring greater researcher interpretation.	*As above.*	*As above.*	*As above.*	*As above.*
Do street physical environment characteristics impact on health practices and if so, which ones and how?	Participant observation (as previous item), including specific questions: • Are there specific elements of the street environment that you think help support your health or if changed could help support your health more? • Are there specific elements of the street environment that you think help support your health or if changed could help support your health more?	The participant's interpretation and view of links between street environment and health practices.	As above and as part of the participant observation method. Pilot indicated a more difficult concept for participants to engage with, potentially requiring greater researcher interpretation.	*As above.*	*As above.*	*As above.*	*As above.*
How can any pathways to health impact linking health practices and street environment be understood within the socio-ecologic	Data for this question is the output of analysis from the preceding three questions.	Identifying underlying processes and mechanisms within a complex system.	*As above, within participant observations.*	*As above.*	*As above.*	As above. And, specifically to investigate pathways to health impact centres the participant interpretation of this.	*As above.*

Research question	Data sources and methods	What could they yield	How realistic and feasible was it be to use these methods / sources?	Did I have, or could I gain, access to these sources?	Was I be able to marshal the appropriate resources, including skills, budget?	What were the costs / benefits of different methods (practically, ontologically and epistemologically)?	What ethical issues arose or could have arose in using these methods / sources?
paradigm of population health?							
Corequisite questions							
How do residents define 'My Street', their perceived boundaries of the street where they live?	Participant observation (as above item), including specific questions: • Where do you feel that your "street" extends to; in other words, what do you see as your territory or home patch? (developed from: Barton, Grant and Guise, 2010; Appleyard, 1981)	A verbal description of the participant's interpretation of 'My Street'	As above and as part of the participant observation method.	*As above.*	*As above.*	As above. It was identified prior to fieldwork that this was a crucial factor to ensure that the key concept of the street is understood from the participant's interpretation.	*As above.*
Describe sampled participants from a range of perspectives including demographics and current health status.	Participant observation (as above item), including survey questions: • How long have you lived on your street? • Year Born • Age • How do you describe your ethnic group / identity • Sex • Preferred pronouns • Health status: ONS well-being (Tinkler and Hicks, 2011)	Data that could be anonymised and categorised in various ways. This could be used in analysis for comparative analysis.	As above and as part of the participant observation method.	*As above.*	*As above.*	As above. Self-described ethnic identity fitted with the research values and prioritised the participant's experience. This did make it somewhat harder to categorise participants by standardised groupings. Demographic type data could be wide ranging and there was a need to balance the items that were thought to be important with the time available and intrusiveness of collecting more data items.	As above. For data minimisation only collect what is needed – e.g. date of birth is not required so year of birth and current age was used to subsequently categorise participants by decade.
Describe the physical characteristics of sampled streets from a range of perspectives including a range of visual and design practice approaches.	Street observations and desktop data collection was carried out by researcher using a diverse range of tools to provide a series of different perspectives or facets into the street environment. Due to Covid-19 methods done with participants were rejected for reasons of complying with the law and safety of both participants and researcher. Pilots showed it wasn't practical to get participants to do tasks separately to the interview observation. Tools used: • Fieldwork observation including fieldnotes (Fetterman, 1998). • Survey tool: Microscale Audit of Pedestrian Streetscapes (MAPS) (Sallis, 2010) in streets.	A detailed, rigorous, and varied understanding of the street environment. Data to contrast participant knowledge and interpretation with how the researcher interprets the street environment.	These methods fitted with Covid-19 restrictions including on face-to-face interactions with participants whilst allowing access to the street as fieldsite. Fieldsites were within cycling distance of researcher base allowing access during Covid-19 by cycle. The approach was relatively flexible.	Access: yes, the streets were all public spaces that anyone can go into. And in fact treating separately from participant helped to further anonymise participant. Covid-19: both from a legal and health risk perspective this was assessed and kept under constant review due to changing regulations relating to	Survey tools for MAPS survey: tape measure, inclinometer. Field equipment: personal protective equipment; drawing equipment; a dedicated mobile phone camera (focal length 26mm); other equipment detailed in methods. Transport: a bicycle and lock. Covid-19: personal protective equipment; safety protocols; and a letter from South Wales Police in case of being questioned about legality of being in the street.	Practically: a significant time commitment to undertake and complex due to Covid-19. Epistemologically coherent: must recognise this is largely the researcher's interpretation and not the participant's due to implications of Covid-19. This required consideration in analysis. Methodology: consistent as embellishing methods (Mason, 2018)	Anonymisation of data was undertaken in line with the participant information and ethics approval. Ethics related to this mainly related to safety considerations in the field including during Covid-19. A fieldwork safety risk assessment incorporated guidance from the Code of Practice for the Safety of Social Researchers to be followed (Social Research Association, 2019).

Research question	Data sources and methods	What could they yield	How realistic and feasible was it be to use these methods / sources?	Did I have, or could I gain, access to these sources?	Was I be able to marshal the appropriate resources, including skills, budget?	What were the costs / benefits of different methods (practically, ontologically and epistemologically)?	What ethical issues arose or could have arose in using these methods / sources?
	• Photography using a mobile phone camera of streets with photos selected for general context; street overview; materiality; and examples related to MAPS survey. • Hand drawn sketches of the streetscape in open air settings (Chilvers, 1996). Desktop tools: • Architectural drawings (plan, section) of street (source: Digimap). • Historic maps (source: Digimap). • Health related public data sources: Welsh Index of Multiple Deprivation (Welsh Government, 2019).	Data allowing identification of street typologies and characteristics supporting subsequent comparative analysis. Data in different formats including visual data that provided different facets into the research questions and ways to investigate and think about the questions.	Maximised use of MD existing skills. Skills developed during research: use of MAPS tool.	the pandemic in Wales.			

Table 28: Analysis Methods Summary Table

Template developed from Mason (2018) *(best printed at A3 size)*

Research question	Data type	Data sources	Data extraction required (Stage 1 analysis)	Data analysis (Stage 2 analysis)	Data synthesis (Stage 3 analysis)	What could they yield	What were the costs / benefits of different methods (practically, ontologically and epistemologically)?
Research Question							
What are people's everyday health practices in their residential street environment; which street environment characteristics impact those practices; and how are these both to be understood within a socio-ecologic paradigm of population health?	Data contained within prerequisite and corequisite questions.	See below. For this question the inputs are the outputs of the analyses below which are then synthesised here.	*See below.*	*See below.*	Reflexive synthesis of prerequisite and corequisite questions analysis toward the central research question.	This analysis is mainly about synthesising the overall research question.	The combination of methods of analysis was a dialogical approach. This was unlikely to produce singular integrated explanations or multiple parallel explanations, rather it was likely to produce "intersecting explanations… based on the dynamic relation of more than one way of seeing, of asking questions and of researching." (Mason, 2018, p.42) Practically this analytic combination made effective use of existing researcher skills and time resource.
Prerequisite questions							
What are residents' everyday practices in the residential street environment?	Data about everyday practices.	Audio recordings of interviews. Participant observation fieldnotes. Street observation fieldnotes.	Clean verbatim transcription using NVivo tool. Fieldnotes: associated with participant case in NVivo.	Open coding using NVivo of practices. Development of thematic coding both within NVivo and in hard copy.	Synthesis of health practices.	List and description of everyday practices. Themes of everyday practices.	Epistemological: Instead of establishing causality on the basis of connections and relationships between variables such as street environment and health, I was attempting to develop explanations (whether or not these are causal) through close appreciation of how processes work in particular contexts, through the use of "telling" examples, and / or through flashes of insight that illuminate my intellectual puzzle. (Developed from Mason, 2018, p71) An open, reflexive, inductive approach allowing theory to

Research question	Data type	Data sources	Data extraction required (Stage 1 analysis)	Data analysis (Stage 2 analysis)	Data synthesis (Stage 3 analysis)	What could they yield	What were the costs / benefits of different methods (practically, ontologically and epistemologically)?
							be developed from the participants situated and contextual knowledge and experiences as observed.
Do these practices relate to residents' health and if so how?	Data about health – practices links.	Audio recordings of interviews. Participant observation fieldnotes. Street observation fieldnotes.	Clean verbatim transcription using NVivo tool. Fieldnotes: associate with participant case in NVivo.	Open coding using NVivo of health-related codes. Development of thematic coding both within NVivo and in hard copy.	Synthesis with practices to identify health practices.	Informs which practices are health practices. Description of perceived health links Insight into health-related practices absent from the street or undertaken in other settings.	An open, reflexive, inductive approach allowing theory to be developed from the participants situated and contextual knowledge and experiences as observed. Did not exclude the researcher interpretation of these issues within analysis and synthesis.
Do street physical environment characteristics impact on health practices and if so, which ones and how?	Data about street environment – health practices.	Audio recordings of interviews. Participant observation fieldnotes. Street observation fieldnotes.	Clean verbatim transcription using NVivo tool. Fieldnotes: associate with participant case in NVivo.	Open coding using NVivo of health-related codes. Development of thematic coding both within NVivo and in hard copy.	Synthesis with practices to identify relationships and processes.	List and description of street environment characteristics. Themes of street environment characteristics. Identify which characteristics of the street residents' feel inhibit, support, or otherwise influence health related practices in the street.	An open, reflexive, inductive approach allowing theory to be developed from the participants situated and contextual knowledge and experiences as observed. Did not exclude the researcher interpretation of these issues within analysis and synthesis.
How can any pathways to health impact linking health practices and street environment be understood within the socio-ecologic paradigm of population health?	Uses outputs from preceding three questions to address pathways.	Outputs from preceding three questions.	Is the analysis in preceding three questions.	Is the analysis in preceding three questions.	Is synthesis of the outputs from preceding three questions specifically in relation to pathways to health impact with socio-ecologic understanding of the problem.	Description of pathways and processual chains. Conceptual mapping / diagrams. Impact framework / diagrams.	Inductive and recursive mapping of pathways. Links closely to Health Impact Assessment methods for practice. Potential to evidence domains of impact and conceptual links / processual chains within these.
Corequisite questions							
How do residents define 'My Street', their perceived boundaries of the street where they live?	Definitions of My Street	Audio recording of participant description of street.	Audio recording was interpreted onto a plan of the street. Plan area of My Street per participant was calculated.	Comparative analysis of My Street across participants.	Synthesis into overall research question.	Synthesis of different definitions of the street based on residents' experience and interpretation.	Fits with constructivist-interpretivist epistemology and ensures street definition is coherent with health practices in terms of being developed from participant interpretation.

Research question	Data type	Data sources	Data extraction required (Stage 1 analysis)	Data analysis (Stage 2 analysis)	Data synthesis (Stage 3 analysis)	What could they yield	What were the costs / benefits of different methods (practically, ontologically and epistemologically)?
Describe sampled participants from a range of perspectives including demographics and current health status.	Participant characteristics data.	Survey responses from participant observations.	Compile data and calculate fields e.g. age bracket by decade: • Participant pseudonym • Participant street pseudonym • Pronouns • Sex • Age (Decade) • Ethnic identity • Years on Street • ONS Satisfied • ONS Worthwhile • ONS Happy • ONS Anxious • Presence of front garden / yard • Carriageway Width (m) • Public Street Width (m) • House to House Width (m) • My Street Area (m^2)	Data participant cases (using NVivo) linked and applied to each participant case as a case classification.	Analysis by classification used to identify further common themes: e.g., by gender / ethnic identity / wellbeing responses.	This combined with street characteristics and health practices to provide cross-cutting analysis by classification.	Ethnic identity: self-described allows for deeper qualitative consideration of issues of identity however heterogenous responses limited ability to group by this characteristic. Essential data to analyse data in a way that responds to practice values in public health: reducing health inequalities, equality, inclusion, diversity.
Describe the physical characteristics of sampled streets from a range of perspectives including a range of visual and design practice approaches.	Street physical environment characteristics data	Street observation tool outputs: • Hand drawn sketches of streets • Street observation fieldnotes • Photographic data • MAPS survey data Desktop data: • Historic mapping of street location • Street plan data in electronic format	Calculate and compile street data: • Street Era • Street Predominant House Type • WIMD Overall • WIMD Income • WIMD Employment • WIMD Health • WIMD Education • WIMD Access to Services • WIMD Community Safety • WIMD Physical Environment • WIMD Housing Calculated participant data and compiled under participant data. Created architectural plans and sections: in line with protocol and calculate street dimensions including: • Carriageway width • Public highway width • House to house width Visual material: compiled data pack for all streets comprising:	Linked data participant cases (using NVivo) and applied to each street case as a case classification. Comparative analysis across participants and streets within and across mixed data. Painting as a reflexive practice within analysis and recorded within reflexive notes.	Analysis by classification to identify further common themes: e.g., by housing typology / width / WIMD criteria. Further reflexive analysis of visual material.	This combined with participant characteristics and health practices to provide cross-cutting analysis by classification.	Practical cost that this was a time intensive element. Practical limitations of analysis of this data which comprised (at least) a second set of data to be analysed and therefore the focus within this research was on descriptive and illustrative analysis with a 'light touch' level of interpretation. Methodological benefit of exploring combinations of methods in creative and new ways. Deepened the understanding of the fieldsite. Related this research to concepts in varied disciplinary fields supporting future research and translation into practice. Epistemologically consistent, simply required recognising that this is the researcher interpretation and requires a reflexive approach to this. Practically required due to Covid-19.

Research question	Data type	Data sources	Data extraction required (Stage 1 analysis)	Data analysis (Stage 2 analysis)	Data synthesis (Stage 3 analysis)	What could they yield	What were the costs / benefits of different methods (practically, ontologically and epistemologically)?
			• Plan • Section • My Street representation • Materiality collage • Hand drawn sketch				
Other data related to methodology and quality							
-	Methodological data about street location	Street observation fieldnotes and records. MAPS Mini data (pilot).	Extract and compile data. • Day of Week • Covid Lockdown Status • School Term Status • Covid retail restrictions status	-	Reflexive synthesis within findings and discussion of methodological implications. Synthesis of data into findings contextualised and situated findings in relation to the data items collected (day of week / lockdown status / school term status).	Reflexive learning from alternative methods tested. Gaps for future investigation.	Epistemology: these items were considered as constructing the situated and contextual knowledge (as opposed to confounding or bias).
-	Methodological data about participants	Data from participant recruitment. Data from participant observations. Participant observation fieldnotes and records.	Calculated and compiled data into Excel: • Time taken for recruitment • Time between recruitment and participation • Route of procurement including gatekeeper if associated • Pseudonym selection • Observation tools during pandemic • Consent form format during pandemic • Reciprocation during pandemic • Qualitative responses to validation questions • Participant photography exercise (n=1) • Participant mapping exercise protocol (n=0) • Social media recruitment protocol (n=0) Transcription of validation responses.	-	Reflexive synthesis within findings and discussion of methodological implications. Synthesis of responses to validation questions in relation to substantiation and quality.	What worked and what was difficult methodologically. Validation: relatability / ease of engagement of topic to participants. Benefits of observation method with participants was to provide participant with a different frame to think about the subject. Methods for future development. Gaps for future investigation. MAPS: synthesis of what works and where there are potential gaps for investigation.	Epistemology: recruitment and sampling were considered as constructing the situated and contextual knowledge (as opposed to confounding or bias).

Appendix 5 | Fieldwork Risk Assessment

Describe the activity being assessed:	Assessed by:	Endorsed by:
Fieldwork, ethnographic observation in one street in Cardiff.	Mark Drane	Supervisory team
Who might be harmed: Researcher / Participant **How many exposed to risk:** 2	**Date of Assessment:** 10.10.2019	**Review date(s):** See revision notes.

Revision Ref	Revision Date	Revision Notes
-	10/10/2019	Ethics Application Initial
A	23/12/2019	Ethics Application Revised
B	29/04/2020	Pre-fieldwork commencement review including for Covid-19 physical distancing.
C	18/06/2020	Risks reviewed at Supervisory Meeting on 12/06/2020. All observations currently via online meetings so no face-to-face participant contact. No hard copy materials have needed to be sent to participants currently and all communication has been electronic. Mitigation to reduce risk of spreading Covid 19 during site visits: check for symptoms before leaving home (NHS Direct Wales, link), ADD: "A loss of smell or taste (anosmia)" ADD clarifying text: "Additionally The Health Protection (Coronavirus Restrictions) (Wales) (Amendment) Regulations 2020, which clarifies: "6A.—(1) "A person responsible for work being carried out at premises where a person is working must, when such work is being carried out during the emergency period, take all reasonable measures to ensure that a distance of 2 metres is maintained between any persons on the premises...", 7(2)(da) ""premises" includes any building or structure and any land…""

Hazards Identified *(state the potential harm)*	Existing Control Measures	S	L	Risk Level	Additional Control Measures	S	L	Risk Level	By whom and by when	Date completed
This assessment excludes everyday risks that the research does not elevate.										
Risk to researcher of psychological trauma, as a result of actual or threatened violence or the nature of what is	Research question does not overtly engage with issues of a traumatic nature. However it is likely a participant may have negative experiences and share these and these may be traumatic.	2	3	6	Regular supervision meetings during field work to include agenda item and time for debrief over any traumatic experiences. Such supervision meetings to be held via web call as required.	1	3	3	MD ongoing	12/06/20 and Ongoing through fieldwork

disclosed during the interaction. (non-physical harm risk)										
Risk of being in a comprising situation, in which there might be accusations of improper behaviour. (non-physical harm risk)	Observations are primarily being undertaken in the public street or other public space. Reduced likelihood resulting from reduced face to face contact. Reduced potential severity due to not being physically present.	3	1	3	All participants to be taken through same consent process including right to withdraw, data protection, and privacy. All first meetings / interviews to be undertaken in a public space. It is part of the research method that over time the researcher will gain the trust of participants. Only once participants are better known and understood should meetings inside houses be undertaken. Researcher to follow the Social Research Association Code of Practice (2019).	3	½	1.5	MD ongoing	Ongoing through fieldwork
Risk of causing psychological harm to others	Research question does not overtly engage with issues of a traumatic nature. However, it is likely a participant may have negative experiences and share these and these may be traumatic.	4	3	12	• Researcher to be mindful that additional stress may have resulted from Covid 19. • All observations to include Participant Wellbeing Debrief for participant to allow them to reflect on the experience. • If distressed researcher to us Having a Difficult conversation approach (Samaritans, no date). • If participant is in extreme distress, observation / interview to be ended. • Try to ensure a family member or neighbour is available to be with them after, or alternatively offer to telephone a friend or family member and wait with the person until they arrive.If researcher is concerned for someone's immediate safety call an ambulance on 999.Any such participant to be removed from the study and the supervisory team alerted to any such incident. • These guidelines to be followed for web / telephone based interviews also.	4	1	4	MD ongoing	Ongoing through fieldwork

					Follow Samaritans guidance: Look for signs someone may not be ok: • Feeling restless and agitated • Feeling tearful • Not wanting to talk to or be with people • Not wanting to do things you usually enjoy • Using alcohol or drugs to cope with feelings • Finding it hard to cope with everyday things • Not replying to messages or being distant Situations to look out for: • relationship and family problems • loss, including loss of a friend or a family member through bereavement • financial worries • job-related stress • college or study-related stress • loneliness and isolation • depression • painful and/or disabling physical illness • heavy use of or dependency on alcohol or other drugs • thoughts of suicide Actions for researcher to take: • Talk to them about their feelings using Samaritans. • Encourage them to contact Samaritans on 116 123, email jo@samaritans.org. • Provide a list of specialist organisations on Samaritans website. • Offer to contact Samaritans on their behalf.					

					• If researcher thinks they are in immediate danger, can call an ambulance on 999.					
Risk of causing physical harm to others	Research observes participants in their normal, everyday activities except for the presence of the researcher. During Covid 19 face to face observations will not be undertaken, participants may be asked to undertake limited observations themselves. This risk substantially reduced.	2	3	6	Written guidance to be provided alongside any observations undertaken by participants. Awareness of road safety whilst conducting interviews and observations. Researcher to have routine of prompting self and participant to check for traffic when crossing road in particular. MD to attend (as part of separate volunteering work for Walking Friends Wales) Living Streets Walk Leader 1 day Training on 21/01/20 prior to any walking interviews being undertaken. Training includes appropriate walking routes and how to manage risk and ensure a safe and enjoyable walk for all. Living Streets is a charity that specialises in street level engagement with communities including undertaking street audits with communities and therefore has relevant expertise to provide this training.	2	2	4	MD ongoing MD	Ongoing during research Done 21/01/20
Risk of physical harm to Mark Drane during site visits	Separate field visits planned not face-to-face with participants. Risks generally not elevated by this research.				In line with Queercare protocol, Leaving Home Whilst Doing Support Work (link): • Identify a buddy • Check in with buddy before leaving home • Check in with buddy when returning home					
Risk of researcher contracting or spreading Covid 19.	Risk of contracting or spreading Covid 19 both in the field and through optional printed material exercises shared with participants.	3	3	9	Measures form part of overall action to reduce risk of spreading Covid 19 including other measures reducing amount of fieldwork. MD to complete volunteer training with Riverside Covid 19 Mutual Aid Group including on avoiding spreading Coivd 19 protocols.	2	2	6	MD	28/03/20

					Mitigation to reduce risk of contracting Coivd 19 during site visits: Researcher does not fall into higher risk category (NHS Direct Wales, link). **Mitigation to reduce risk of spreading Covid 19 during site visits:** Check for symptoms before leaving home (NHS Direct Wales, link): • A high temperature (fever) • A new continuous cough • A loss of smell or taste (anosmia) **Mitigation to reduce risk of both contracting and spreading Covid 19 during site visits:** In accordance with The Health Protection (Coronavirus Restrictions) (Wales) Regulations 2020, 6A(1): obligation to take reasonable measures to maintain physical distance of 2.0 at work in 'premises' defined as "any building or structure and any land" but not vehicles. Additionally The Health Protection (Coronavirus Restrictions) (Wales) (Amendment) Regulations 2020, which clarifies: 6A.—(1) "A person responsible for work being carried out at premises where a person is working must, when such work is being carried out during the emergency period, take all reasonable measures to ensure that a distance of 2 metres is maintained between any persons on the premises..." 7(2)(da) ""premises" includes any building or structure and any land…"					

					• Site visits to be conducted in general accordance with Welsh Government Guidance. • Travel to site to be on foot or by researcher's own bicycle. • No contact with participants in field during current restrictions. • Take hand sanitiser. • Avoid touching surfaces if possible in field. • Limit the time spent in the field to the minimum necessary. • On returning home follow any hygiene routines in hour household. This mitigation includes relevant items from Queercare protocol, Leaving Home Whilst Doing Support Work (link). **Mitigation to reduce risk of both spreading Covid 19 through any hard copy materials sent to participants:** • Avoid sending materials in hard copy, send electronically where possible. • Check with participant if any person in their household is shielding or is an high risk (as per NHS Direct Wales list). If yes, do not send materials. • Queercare Leafleting Protocol for production and delivery of any printed materials.					
Risk of Mark Drane and dependents being traced to home address.	As a registered architect MD address is currently on the public register of the Architects Registration Board.	3	2	6	MD emailed ARB to have home address removed from register or changed to UWE Bristol 12/10/19.	3	1	3	MD Prior to fieldwork	Done 23/12/19

RISK MATRIX: (To generate the risk level).

Very likely 5	5	10	15	20	25
Likely 4	4	8	12	16	20
Possible 3	3	6	9	12	15
Unlikely 2	2	4	6	8	10
Extremely unlikely 1	1	2	3	4	5
Likelihood (L) ↑ / Severity (S) →	Minor injury – No first aid treatment required 1	Minor injury – Requires First Aid Treatment 2	Injury - requires GP treatment or Hospital attendance 3	Major Injury 4	Fatality 5

ACTION LEVEL: (To identify what action needs to be taken).

POINTS:	RISK LEVEL:	ACTION:
1 – 2	NEGLIGIBLE	No further action is necessary.
3 – 5	TOLERABLE	Where possible, reduce the risk further
6 - 12	MODERATE	Additional control measures are required
15 – 16	HIGH	Immediate action is necessary
20 - 25	INTOLERABLE	Stop the activity/ do not start the activity

Appendix 6 | Fieldwork Protocol

Fieldwork Protocol – Street Site Visits & Observations

Describe the activity being assessed: Fieldwork, ethnographic observation in one street in Cardiff.	**Prepared by:** Mark Drane	**Endorsed by:** Supervisory team
Who might be harmed: Researcher **How many exposed to risk: 1**	**Date of Protocol:** 29.04.2020	**Review date(s):** -

Item	Description	

1.0	**Compliance with government restrictions:** The Health Protection (Coronavirus Restrictions) (Wales) Regulations 2020, Regulation 8 provides that:
	
	"(1) During the emergency period, no person may leave the place where they are living without reasonable excuse. (2) For the purposes of paragraph (1), a reasonable excuse includes the need... (f) to travel for the purposes of work or to provide voluntary or charitable services, where it is not reasonably practicable for that person to work, or to provide those services, from the place where they are living..." (National Assembly for Wales, 2020, link)
	
	The fieldwork is interpreted to fall within this definition as:
	
	• The regulations do not define 'work' therefore reference is made to a dictionary definition: "Activity involving mental or physical effort done in order to achieve a purpose or result." (https://www.lexico.com/definition/work) The PhD involves fieldwork and other activity with the purpose being to pursue the research question.
	• Elements of the work that can be practicably done from home are being done so (i.e. participant observations).
	• Elements of the work that cannot reasonably practicably be done from home are being progressed with appropriate risk assessment.
	• In broader terms considering the spirit of the regulations this work is considered important as it contributes to a wider understanding of the impact of the street environment on the health of the population. This includes impacts from Covid-19 including:
	  ○ Urban design and the planning of cities in particular has an influence on the spread of infectious disease.
	  ○ There is a potentially large impact on the health of the population resulting from government restrictions.
	  ○ This research can support investigating both the negative health impacts of those restrictions as well as the potentially beneficial impacts the street may have in mitigating some of these impacts, for example, physical activity, maintaining social distancing in public space, access to green space and nature.
	  ○ Whilst evidence is not currently available it is arguable that the impacts of the lock down on health (physical, mental, and social) will be significant and require investigation.	

	○ Regarding timing, if this research is not conducted now then an opportunity to gather data on these potential health impacts may be lost. Also gathering research data at this time may allow additional longitudinal analysis.	
2.0	**Relevant Persons Enforcing Covid 19:** • Should a relevant person (a constable, police community support officer, or person designated by Welsh Ministers) request me as researcher to leave the field site then, to avoid unnecessary confrontation, the researcher will leave the field site and consult with the supervisory team. • The researcher will not impede the work generally of relevant persons and key workers, for example, not getting in the way of refuse collectors being able to maintain a physical distance.	
3.0	**Before leaving home:** • Confirm no symptoms of Covid 19 (temperature, persistent new cough, and in line with guidelines). • Researcher to wear a visible UWE Bristol identity card on a lanyard. • Researcher to take the minimum materials required to site. • Wash hands in line with guidance before leaving home. •	
4.0	**At the site:** • Do not enter any premises or residence including of participants. • Carry hand sanitising gel and use in the field every hour or after any surfaces touched.	

Appendix 7 | Participant Observation Interview Protocol

Initial observation prompt card (pilot)

Amend: 25/05/2020: highlight adjusted for essential prompts
Amend: 05/06/2020: mainly adding completion checklist with details of redactions
Amend: 01/07/2020: added notes on eye contact and reducing background noise.
Amend: 16/07/2020: pre-interview checklist amended.
Amend: 10/08/2020: re-ordered 'is your street unique' into preceding section.
Amend: 25/09/2020: removing pilot tech questions etc. bring base information to front.

Rev I 10-08-2020

Except for the overall health question and initial question, this prompt is not a verbatim survey but rather a series of prompts to guide conversation.

Preparation (day or days before interview):

- Receive and securely file Participant Consent Form (electronic version, in password protected format).
- Participant Breaker spreadsheet (password protected file): move from Potentials list to Participants list and allocate participant a reference number [Amend: 05/06/2020, 16/07/2020].
- Street Breaker (password protected file): allocate street a pseudonym within street breaker [Amend: 05/06/2020].
- Participant Personal Data spreadsheet (password protected file): move participant data from Possibles list to Participants list, add details including mobile, email to sheet. [Amend: 16/07/2020].
- Participant Research Data (pseudonymised file): move participant data from Possibles list to Participants list, add details including date consent form received, and other known information. [Amend: 16/07/2020].
- Agree time & format for web call.
- Street information:
    - Download CAD data from Digimap.
    - Prepare street drawings: plan, section, using template.
    - Visit street in person or view on Google street view.
- Snowballing: current prepare list of types of participant / street needed.

Prior to commencement (30 minutes):

- Re-read this protocol.
- Read Samaritans, Having a Difficult Conversation guidance (link):
- [Amend: 25/09/2020]: Audio settings: computer volume = 50; TASCAM DR-05 input level = 65.
- Mute other apps / email notifications on computer. [Amend: 05/06/2020].
- Focus on interview, avoid other activities and unintentional sound whilst recording including typing on keyboard or clicking pen! [Amend: 01/07/2020].
- Look at camera frequently to provide eye contact with participant [Amend: 01/07/2020].
- Make a conscious effort to smile [Amend: 01/07/2020].
- Items denoted thus – essential to cover.
- Items denoted thus – consider inclusion if time and suitable.

Online call:

- Thank for participating in the research. [Amend: 22/05/2020]
- *Take a few minutes to say hello and have some introductory chat.*
- *Check participant comfortable with tech.*
- *Cover any questions and check the participant is ok to proceed and that they are ok for time.*
- *Say it's fine to take a break if they need or want just to say.*
- *Explain that conversation will be recorded.*
- *Start audio recorder.*

Reminder of consent:

- What do people use their streets for and are there links to wellbeing & health?
- Participant has given their consent.
- Participation is voluntary.
- Anything you feel uncomfortable sharing just say I'd rather not talk about that for now.
- Participant has the right to withdraw.

Outline of observation:

- Was planned as a walk & talk in the street so replaces part of that.
- Ask them to tell me about their street and how they use it – this is the key focus – the things they use the street for.
- Questions about overall wellbeing.
- Pilot validation questions.
- Debrief at end with recorder stopped.

Background information collection:

Address:

Contact telephone number:

How long have you lived on your street?

[25/09/2020 brought forward] **Pseudonym:**

Same gender and starting letter as your name. Or I can suggest one for you later.

[Amend: 22/05/2020, 26/05/2020] **Year Born:**

[Amend: 16/07/2020] **Age:**

[Amend: 22/05/2020] **How do you describe your ethnic group / identity:**

Sex:

Preferred pronouns: (e.g. he / him; she / her; they / them):

Initial question:

"Please can you imagine you are showing me around your street and tell me about the day to day things you do there?"

"Perhaps start with day to day activities as they are now during the lockdown and then we can talk about what might have changed."

Extensions:

Describe where you are doing this in the street?

Describe what you are doing at this point in the street?

Can you describe what the street is like at this point?

Why do it here not elsewhere?

What makes this a good spot for that to happen?

Tell me more about… [Amend: 05/06/2020]

Potential follow on prompts:

So how have things changed since Covid-19 lockdown - what activities would you typically doing in the street on a day to day basis?

What activities are you not doing now that Covid-19 lockdown?

What new activities are you doing due to Covid-19 lockdown?

Are there any activities you would like to do in or on your street but can't?

Do you face any particular challenges using the street, such as related to how accessible you find it?

Practices:

What is the purpose of … activity?

How often are you doing this activity?

Do you do this activity with anyone usually?

And what do you do in the street during the activity you describe?

Is your activity mostly in this part / end / side of the street?

Home patch:

Where do you feel that your "street" extends to; in other words, what do you see as your territory or home patch? *(developed from Appleyard and also Grant)*

Do you think this street is different from surrounding streets, is it special or unique in anyway?

We not in the street now but how would you normally get around in the street?

Do you walk much in the street or is this unusual for you? If so how…?

Wellbeing assessment:

Now I would like to ask you four questions about your feelings on aspects of your life. There are no right or wrong answers.

For each of these questions I'd like you to give an answer on a scale of nought to 10, where nought is 'not at all' and 10 is 'completely'.

1. **Overall, how satisfied are you with your life nowadays?**

   where nought is 'not at all satisfied' and 10 is 'completely satisfied'

2. **Overall, to what extent do you feel that the things you do in your life are worthwhile?**

   where nought is 'not at all worthwhile' and 10 is 'completely worthwhile'

3. **Overall, how happy did you feel yesterday?**

   where nought is 'not at all happy' and 10 is 'completely happy'

4. **On a scale where nought is 'not at all anxious' and 10 is 'completely**

   anxious', overall, how anxious did you feel yesterday?

You mentioned activities of … which of these do you think support your health and wellbeing in the broadest sense?

Are there specific elements of the street environment that you think help support your health or if changed could help support your health more?

You mentioned activities of … which of these do you think have a negative effect on your health and wellbeing in the broadest sense?

Are there specific elements of the street environment that you think help support your health or if changed could help support your health more?

[25/09/2020 reordered] Are there any other aspects of your identity or life that you feel might be important to consider in relation to the street, your activities there, and how they relate to health? Have I missed something glaringly obvious?

Validity:

How did you find this conversation: what did you find easy to relate to and think about?

What was difficult to relate to or think about?

[25/09/2020] How did you feel about doing the interview online rather than face to face?

Snowballing:

Age *(sampling grid)*:

Streets needed:

- Major environmental character (+ve / -ve park / industrial / topology).
- After 2016.
- Home zone

Additional activity:

1. Repeat post-lockdown?
2. Draw a map of your street.
3. Take up to 10 photos of your activities in the street.

Participant wellbeing debrief:

Stop audio recording making it clear this is being done to participant.

How was that for you?

How are you feeling now?

Depending on the response the researcher will use the Having a Difficult Conversation approach (Samaritans, no date). *Not recorded but may be written up in fieldnotes after including a record of any signposting provided to other sources of help if provided.*

SHUSH - active listening tips:

- **Show you care:** Focus on the other person, make eye contact, put away your phone.
- **Have patience:** It may take time and several attempts before a person is ready to open up.
- **Use open questions:** Use open questions that need more than a yes/no answer, and follow up with questions like 'Tell me more'.
- **Say it back:** Check you've understood, but don't interrupt or offer a solution.
- **Have courage:** Don't be put off by a negative response and, most importantly, don't feel you have to fill a silence.

If you're worried someone is suicidal, it's okay to ask them directly. Research shows that this helps - because it gives them permission to tell you how they feel, and shows that they are not a burden.

Post observation checklist:

[Amend: 05/06/2020]

- Transfer file from TASCAM audio recorder to UWE OneDrive secure storage.
- Participant Personal Data spreadsheet (password protected file): update with data. [Amend: 16/07/2020].
- Participant Research Data (pseudonymised file): update with data. [Amend: 16/07/2020].
- Add participant personal data to secure spreadsheet.
- Add participant research data including pseudonym to anonymised spreadsheet.
- Redact audio using Audacity (v2.4.1) software including all:
    - People's names
    - Street names
    - Ward names
    - Adjacent street names
    - Adjacent ward names
    - Locations which are used in the generic sense of places in the city and unrelated to the participants personal data need not be redacted (e.g. the city centre; the train station; generic reference to specific wards / areas as perceived wealthy areas or deprived areas).

  Redaction involves inserting a tone (the optimum tone found to be waveform: sine; frequency 600Hz; amplitude 0.05 which is audible on playback and not so loud as to be overly disruptive to the flow / listener).
  A label track is created within Audacity software. Where data is redacted a label is added giving a description of what has been omitted, including:
    - Street name (the sampled street)
    - Adjacent street (a street connected to the adjacent street)
    - Nearby street (a street in the same ward or close proximity)
    - Nearby trunk road (a significant distributor trunk road in the city)
    - Child name (participant's child – no reference to gender)
    - Partner name (participant's life partner, or husband, or wife – no reference to gender or marital status).

  Labels are also used to identify key points in the conversation and bookmark these.
  On completion of redaction the audio track is exported to MP3 format at 320KBps. A separate label track file is exported as a text file. Files names are in the form starting with the date of the observation: YYYY-MM-DD Participant Pseudonym; for example, 2020-06-05 Rania.

Appendix 8 | Participant Information Booklet

Getting involved in a research project. Participant Information.

Healthy Street Life.

Revised with Covid-19 Distancing Measures

University of the West of England, Bristol

May 2020

Overview

- This is an invitation: **joining in is your decision, you can say no.**
- **You are in control** – during observations you are in control of how long this lasts, & what information you want to share or not.
- **You can change your mind:** you can pull out up to 12 months after joining.
- We hope this research will be enjoyable to join in.
- **What about Coronavirus / Covid-19?** In line with government advice additional measures are being taken to protect both you and our researcher. This means observations will be online (e.g. Skype / Zoom / WhatsApp / telephone).
  Only if you are able to, we will also ask you to make some observations in your own street such as taking photos during daily exercise or make a drawing of your street from home.

What is the research?

- Our research is interested in: **What do people use their streets for & are there any links to wellbeing and health?**
- Streets are an important part of the environment around us & it is important to know more about how people feel about them & use them.
- Our observations involve a 'walk and talk' in your street, led by you. …Or as close to this as we can manage within the limitations of Covid-19 restrictions. So for example we may ask you to describe your street via telephone or web call.
- **We will record this observation using a hand-held voice recorder, & record the route taken.**
- Online / phone calls will be recorded in the same way.
- We will take photos or draw pictures of your street but not of you or any people. Our researcher will do this separately and does not need to meet you face to face.
- For this part of the study you only agree to 1 observation of 1 hour plus taking some photos / making a drawing of your street during your daily exercise or from home.

Who is doing the research?

- **Mark Drane**, the researcher, is a doctoral (PhD) researcher at the University of the West of England (UWE Bristol).

- **UWE Bristol** is one of the UK's largest universities & undertakes research in many topics including built environment & public health.
- **Professor James Longhurst** is Mark's Supervisor & Director of Studies at UWE Bristol.
- This research complies with UWE Bristol's strict policies including ethics, personal data, safety, & safeguarding.
- **The research has been reviewed and approved by the Faculty Research Ethics Committee on 30th January 2020, reference FET.19.10.015.**

Why is this research important?

- It is important in our research to understand if the street environment is helping people to live a good quality of life & stay healthy.
- By understanding what is important to people in their daily lives we hope to better understand how streets should be designed.

Who is paying for the research?

- Mark Drane is a PhD student at UWE Bristol.
- No money is received from industry, public bodies, or healthcare organisations for this research.

How will the research findings be presented?

Results will be made anonymous by changing your name & the street name & presented in:

- PhD thesis
- Journal publications
- Conference papers
- Publications will be shared online & on social media.
- **Your name & street will not be identified by name in any publication.**
- Audio recordings and images may be used in presentation of findings.

Your wellbeing & safety:

- Our methods have been reviewed and adjusted in light of Covid-19 restrictions and distancing measures.
- Your wellbeing is important.
- The research only involves everyday activities in your street.
- If you have access needs, let our researcher know.
- **You can stop an observation at any point.**
- **You do not have to share any information you do not want to.**

How will you use my personal data?

- Your participation will involve sharing some personal data with us.
- We will comply with laws & relating to personal data.
- We will store all data securely and contact details will be stored separately from observation details such as audio recordings.
- Personal data for the research project will be destroyed 5 years after completion.
- Observation data with your name & street name removed will be transferred to a UK based academic research data repository at the end of the research.
- Your name and your street name will be changed in written data. Audio recordings and images will also have your name and the street name changed.
- Any telephone calls or web based calls will be recorded using the same methods and are equally protected and securely stored.

Complaints:

- Please speak to the researcher directly or see the contacts page for other contact details.

Researcher:

This is your main contact during the research and first point of contact.

Mark Drane, UWE Bristol

Telephone:

07342-145761

Email:
mark2.drane@live.uwe.ac.uk

CONTENTS

This booklet contains the detailed information about participating in the research.

This content has all been reviewed by the research Supervisory Team and also the UWE Bristol Faculty Research Ethics Committee.

1 CONTACT DETAILS

Researcher:

This is your main contact during the research and first point of contact.

Mark Drane, UWE Bristol

Telephone:

07342-145761

Email:
mark2.drane@live.uwe.ac.uk

Director of Studies:

The researcher's supervisor.

**Prof. James Longhurst,
UWE Bristol**

Telephone:

0117-328-2892

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James.Longhurst@uwe.ac.uk

UWE Bristol:

Postal address:

Coldharbour Lane, Bristol
BS16 1QY

2 PARTICIPANT INFORMATION SHEET

Invitation

You are invited to take part in research taking place at the University of the West of England, Bristol. Before you decide whether to take part, it is important for you to understand why the study is being done and what it will involve. Please read the following information carefully and if you have any queries or would like more information please contact Mark Drane, UWE Bristol using the contact details above.

Who is organising and funding the research?

The lead researcher is Mark Drane, a doctoral (PhD) researcher whose Director of Studies is Prof. James Longhurst. Further details of their experience and biography are available at the UWE website.

This research is not connected in any way to public bodies, authorities, or health organisations so whether you chose to participate or not will not affect how you receive existing services from these organisations. To ensure the safety of the researcher we have notified Cardiff Council and South Wales Police that the study is happening.

What is the aim of the research?

The built and natural environment plays an important part in supporting day to day life and health, this study aims to understand the residential street scale and to do this from the perspective of residents. This is a pilot to inform a longer-term and in-depth study at the street scale using face-to-face (ethnographic) methods to collect information through talking to residents about their experiences of the street space. You have been invited to participate as a resident of a street type that falls within our sampling criteria for this pilot.

Our main interest is to find out what people use their streets for; for what purposes; and how they feel about that. Streets are an important part of the environment around us and it would be valuable to know more about how people feel about them and use them.

We will use this information to then think about what links there may be between the street and people's wellbeing.

The anonymised (by use of a pseudonym) results of our study will be analysed and outcomes from the research will be published in a PhD thesis; journal publications; and presented at conferences – these publications will also be shared online and via social media. You will not be identified in any publication.

Why have I been invited to take part?

You have been invited to participate as a resident of a street type that falls within our sampling criteria for this pilot. We will ask you questions about your day to day life and how you use the street space as part of these activities. The purpose of the questions will be to gain an understanding of your experiences and views about the street.

Do I have to take part?

No, your participation is entirely voluntary and if you decide to take part you are still free to withdraw at any time within 12 months of the date of your signed consent form by emailing Mark Drane. You do not need to give any reason if you decide to withdraw later. Deciding not to take part or to withdrawal from the study does not have any penalty.

What will happen to me if I take part and what do I have to do?

Simply put we would like to ask you to take our researcher on a tour of your street for about 20-30 minutes, talking about some of your everyday activities in the street. For this pilot we would also like to ask you some questions about this approach to make sure that it is a convenient and effective method to use on our longer-term future study.

During Covid-19: these observations will be conducted online via your preferred method: telephone, Zoom, Skype, WhatsApp call.

For observations (photos / drawings) of the street:

Our researcher will visit the street separately and does not need to meet you face-to-face.

If you are able you will be asked to draw or photograph your street including noting

some of your day to day activities. You can do this during your permitted daily exercise outside your home or from home if you wish or are isolating or shielding.

Changes to Covid-19 restrictions: our methods will be kept under review should restrictions change.

What are the benefits of taking part?

We aim for all our work to be fun and engaging, we hope this will be enjoyable.

This research is based on the idea of prevention: to help people, if possible, stay healthy in the first place than to treat them once they become ill. Preventing ill health and keeping people healthy where they live this could benefit with greater quality of life and help to free up capacity in the NHS and care services for when we really need it. This research will support future work to make this happen.

Many public bodies and organisations think they already know what is important for people's health but sometimes this isn't really based on speaking to the residents who actually live in an area. This research aims to avoid this and is entirely based on speaking directly to residents: your voice is important! Your participation will support this research which aims to ensure that people's experiences are better reflected in proposals by public bodies and people designing streets.

What are the possible risks of taking part?

We do not foresee or anticipate any significant risk to you in taking part in this study which is based around your normal day to day activities. If, however, you feel uncomfortable at any time you can ask for the observation to stop. If you need any support during or after the observation, then the researchers will be able to put you in touch with suitable support agencies. The research team are experienced in conducting observations and are sensitive to the subject area. The research methods have been designed with these considerations in mind.

What will happen to your information?

Your information will be treated in accordance with the terms and conditions of the General Data Protection Regulations (GDPR): this means that personal data, and recordings or transcripts of your answers will be stored securely in password protected computers. A privacy notice is provided at the end of this sheet. The research method is an observational approach that means you are in control of what information you share with the researcher. We expect to collect your name and contact details so we can stay in touch during the research. We are mainly focussed on your day to day activities in the street, it is possible you may feel some of this relates to share information such as your political or religious beliefs; your race or ethnic origin; and your health and wellbeing.

Interviews including those conducted online will be recorded and written up in field notes, for some observations this includes the walking tracks taken (not applicable during Covid-19 restrictions) and photos of features of the street that may be of interest (not of you or other people). Your name will be changed (anonymised by use of a pseudonym) in any findings. You can choose your own pseudonym.

The street name will also be changed in any findings, the city will be noted as Cardiff.

Where will the results of the research study be published?

Overall outcomes from the research will be published in a PhD thesis; journal publications; and presented at conferences – these publications will also be shared online and via social media. You will not be identified in any publication.

Within 5 years of completion of the research your personal data will be deleted and will not be stored for future.

At the end of the project research data anonymised by use of a pseudonym will be transferred to an academic research data repository where it will be publicly available to support future research. This includes audio

and visual data (e.g. interview recording and photos) with names and locations of people and places changed to protect your privacy and the privacy of other participants.

A copy of the will be made available to all research participants if you would like to see it.

You will be interviewed and this will be audio recorded and may also be transcribed and may also be quoted verbatim.

Who has ethically approved this research?

The project has been reviewed and approved by the Faculty Research Ethics Committee, Faculty of Environment and Technology, UWE Bristol, on 30th January 2020, reference FET.19.10.015. Any comments, questions or complaints about the ethical conduct of this study can be addressed to the Research Ethics Committee at the University of the West of England.

What if something goes wrong?

Please refer to Section 2: Complaints.

If you would like any further information about the research please contact in the first instance Mark Drane using the contact details at the top of this sheet.

3 PRIVACY NOTICE FOR RESEARCH PARTICIPANTS

Purpose of the Privacy Notice

This privacy notice explains how the University of the West of England, Bristol (UWE) collects, manages and uses your personal data before, during and after you participate in Healthy Street Life project. 'Personal data' means any information relating to an identified or identifiable natural person (the data subject). An 'identifiable natural person' is one who can be identified, directly or indirectly, including by reference to an identifier such as a name, an identification number, location data, an online identifier, or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

This privacy notice adheres to the General Data Protection Regulation (GDPR) principle of transparency. This means it gives information about:

How and why your data will be used for the research;

What your rights are under GDPR; and

How to contact UWE Bristol and the project lead in relation to questions, concerns or exercising your rights regarding the use of your personal data.

This Privacy Notice should be read in conjunction with the Participant Information Sheet and Consent Form provided to you before you agree to take part in the research.

Why are we processing your personal data?

UWE Bristol undertakes research under its public function to provide research for the benefit of society. As a data controller we are committed to protecting the privacy and security of your personal data in accordance with the (EU) 2016/679 the General Data Protection Regulation (GDPR), the Data Protection Act 2018 (or any successor legislation) and any other legislation directly relating to privacy laws that apply (together "the Data Protection Legislation"). General information on Data Protection law is available from the Information

Commissioner's Office (https://ico.org.uk/).

How do we use your personal data?

We use your personal data including special category data for research with appropriate safeguards in place on the lawful bases of:

- fulfilling tasks in the public interest, and for archiving purposes in the public interest, for scientific or historical research purposes
- in case of emergency for protecting your vital interests or those of another natural person
- your explicit consent

We will always tell you about the information we wish to collect from you and how we will use it.

We will not use your personal data for automated decision making about you or for profiling purposes.

Our research is governed by robust policies and procedures and, where human participants are involved, is subject to ethical approval from either UWE Bristol's Faculty or University Research Ethics Committees. The project has been reviewed and approved by the Faculty Research Ethics Committee, Faculty of Environment and Technology, UWE Bristol, on 30th January 2020, reference FET.19.10.015, email: researchethics@uwe.ac.uk. The research team adhere to the Ethical guidelines of the British Educational Research Association (and/or the principles of the Declaration of Helsinki, 2013) and the principles of the General Data Protection Regulation (GDPR).

For more information about UWE Bristol's research ethics approval process please see our Research Ethics webpages at: www1.uwe.ac.uk/research/researchethics

What data do we collect?

The data we collect will vary from project to project. Researchers will only collect data that is essential for their project. The specific categories of personal data processed are described in the Participant Information Sheet provided to you with this Privacy Notice.

Who do we share your data with?

We will only share your personal data in accordance with the attached Participant Information Sheet and your Consent.

Data Lifecycle Stage	Description	Any Sharing
During Research and for five years after completion.	All research data. Data storage	Not shared, within UWE Bristol only. UWE Bristol use Microsoft OneDrive cloud storage and ensures appropriate processing agreements and protections are in place for storage of data in line with GDPR requirements.
After Completion.	Anonymised text based research data. Audio recordings and graphic / visual material with pseudonyms applied.	UK based academic research data repository. (e.g. UWE Research Data Repository)
5 years after Completion.	Contact details	Destroyed: by deletion from UWE OneDrive.

How do we keep your data secure?

We take a robust approach to protecting your information with secure electronic and physical storage areas for research data with controlled access. If you are participating in a particularly sensitive project UWE Bristol puts into place additional layers of security. UWE Bristol has Cyber Essentials information security certification.

Alongside these technical measures there are comprehensive and effective policies and processes in place to ensure that users and administrators of information are aware of their obligations and responsibilities for the data they have access to. By default, people are only granted access to the information they require to perform their duties. Mandatory data protection and information security training is provided to staff and expert advice available if needed.

How long do we keep your data for?

Your personal data will only be retained for as long as is necessary to fulfil the cited purpose of the research. The length of time we keep your personal data will depend on several factors including the significance of the data, funder requirements, and the nature of the study. Specific details are provided in the attached Participant Information Sheet and in the above table including anonymised data (that falls outside the scope of data protection legislation as it contains no identifying or identifiable information) and research audio and visual data which may be stored in UWE Bristol's research data archive or another carefully selected appropriate data archive.

Your Rights and how to exercise them

Under the Data Protection legislation you have the following qualified rights:

- The right to access your personal data held by or on behalf of the University;
- The right to rectification if the information is inaccurate or incomplete;
- The right to restrict processing and/or erasure of your personal data;
- The right to data portability;

- The right to object to processing;
- The right to object to automated decision making and profiling;
- The right to complain to the Information Commissioner's Office (ICO).

Please note, however, that some of these rights do not apply when the data is being used for research purposes if appropriate safeguards have been put in place.

We will always respond to concerns or queries you may have. If you wish to exercise your rights or have any other general data protection queries, please contact UWE Bristol's Data Protection Officer (dataprotection@uwe.ac.uk).

If you have any complaints or queries relating to the research in which you are taking part please contact either the research project lead, whose details are in the attached Participant Information Sheet, UWE Bristol's Research Ethics Committees (research.ethics@uwe.ac.uk) or UWE Bristol's research governance manager (Ros.Rouse@uwe.ac.uk)

4 PARTICIPANT CONSENT FORM

This is a copy of the consent form you will be asked to sign prior to participating in the research.

University of the West of England

Coldharbour Lane

Bristol

Researcher: Mark Drane

Director of Studies: Prof. James Longhurst

Healthy street life: Pilot Study – Participants Consent Form

This consent form will have been given to you with the Participant Information Sheet. Please ensure that you have read and understood the information contained in the Participant Information Sheet and asked any questions before you sign this form. If you have any questions please contact a member of the research team, whose details are set out on the Participant Information Sheet.

If you are happy to take part in the observational methods in your street, please sign and date the form. You will be given a copy to keep for your records.

- I have been provided with the Participant Information Sheet before being asked to sign this form;
- I have been given the opportunity to ask questions about the study;
- I have had my questions answered satisfactorily by the research team;
- I understand I will be interviewed including whilst walking and this interview including walking tracks and any photos taken of the street will be recorded and may be transcribed and may also be quoted verbatim. Names and locations of people and places will

be changed to protect my privacy and the privacy of other participants. My photo and that of other people will not be taken.

- I am happy for the information I provide to be used (with names of people and location of the street changed) in academic papers and other formal research outputs.
- I understand that within 5 years of completion of the research my personal details will be deleted and will not be stored for future.
- I agree to anonymous written research data plus audio / visual data with names and locations of people and places changed to protect my privacy and the privacy of other participants being archived in a publicly accessible academic digital archive for use in future research studies.
- At any stage up to 3 months from today I may withdraw my data from the project by emailing mark2.drane@live.uwe.ac.uk.
- I agree to take part in the research.

Name (Printed)……

Signature……

Date……

5 MAKING A COMPLAINT

In all cases you may speak to the researcher, Mark Drane, directly about your concerns if you feel able to.

Mark2.Drane@live.uwe.ac.uk

Research conduct: if you have a concern about the conduct of the research or the researcher you may contact the Director of Studies, Prof. James Longhurst:

James.Longhurst@uwe.ac.uk

Ethical conduct: if you have a concern about the ethical conduct of this study you may contact the Research Ethics Committee:

Researchethics@uwe.ac.uk.

Data protection: if you have a concern about how your personal data is stored this may be raised with UWE Bristol's Data Protection Officer.

dataprotection@uwe.ac.uk.

You have the right to complain to the independent Information Commissioner's Office:

Online: via link

Tel: 0303 123 1113

UWE Bristol | University of the West of England

For further information contact:

Mark Drane, Doctoral Researcher, UWE Bristol

07342-145761 Mark2.Drane@live.uwe.ac.uk

Appendix 9 | Table: Comparison of Potential Analytical Methods

Comparison of potential analysis method/ology

Developed from Braun & Clarke (2021) except as noted. Note these can only be typical examples as there is lots of variation within each approach and categorisation reflects a predominant leaning of the approach.

Italics reflect MD developments.

	Research question	**Thematic Analysis – coding reliability approaches**	**Thematic Analysis – codebook approaches**	**Thematic Analysis – reflexive approaches**	**Qualitative Content Analysis (QCA)**	**Interpretative Phenomenological Analysis (IPA)**	**Grounded Theory (GT)**	**Discourse Analysis (DA)**
Small q / Big Q	More Big than small	Small q	*Small q*	Big Q	*Small q + Big Q*	*Big Q*	*Big Q*	*Big Q*
Potential level of interpretation possible	Moderate	Low	*Low-Medium*	*High*	Low	*High*	High	*Medium*
Summary description	"In what ways are people learning, working, playing and loving in the residential street: and which design characteristics of the street support or inhibit their resilience, integrity, equilibrium, and sense of wellbeing?"	"topic summaries—summaries or overviews of the most frequent things participants said" (p.39)[1]	"combine the qualitative research values of reflexive TA with the more structured approach to coding" (Braun and Clarke, 2021, p. 39)	Used to identify "…recognizable reoccurring topics, ideas, or patterns (themes) occurring within the data that provide insight… [commonly used] when investigating a phenomenon for which little prior understanding exists." (Allen, 2017) "Fully qualitative" (p.40) "themes developed from codes, and conceptualised as patterns of shared meaning underpinned by a central organising concept" (p.39) "themes are developed across cases from codes, following the coding of the entire data set." (p.41)	"Qualitative content analysis begins at the point where statistical presentation reaches its limits, and does so in order to reveal the significance of textual features that are latent or hidden in the manifest content or that have consequences beyond their immediate, obstrusive meaning." (Lewis-Beck, Bryman and Futing Liao, 2004) "…a method for identifying themes in qualitative data…" (p.40) "subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns (p.40)." Least interpretative qualitative method.	"to collect first-person accounts of personal experience" (p.41) "a detailed focus on the analysis of each case, before developing themes across cases" (p.41) "a focus on language use" (p.41) "a dual analytic focus: both a thematic orientation – the identification of themes across cases (participants) – and an idiographic approach – interest in and focus on the particular and unique details of each case." (p.41)	"…begins inductively by gathering data and posing hypotheses during analysis that can be confirmed or disconfirmed during subsequent data collection. Grounded theory is used to generate a theory about a research topic through the systematic and simultaneous collection and analysis of data." (Salkind, 2010) Diverse approaches: Glaser: positivist Strauss → Charmaz: symbolic interactionism, "…the creation of meaning and social order through human actions and interactions." (p.42) Research questions focused on lived experience. Constant comparative analysis – specifically associated with GT. Often a core GT category with related subsidiary categories. Concurrent fieldwork and analysis with theoretical sampling "a defining feature" (p.43)	"focuses on the use of language within a social context" (Salkind, 2010) "…underpinned by a view of language as a social practice, something active and performative, doing things, and bringing forth realities, rather than merely transparently reflecting participants' thoughts and feelings." (p.43) "…focusing on language practice" (p.43) Some approaches include detailed and fine grained tools for analysis of language practice. Considerable overlap with TA. Combined with TA described as "critical TA" (p.44): thematic de-composition; thematic DA.

[1] (Braun and Clarke, 2021)

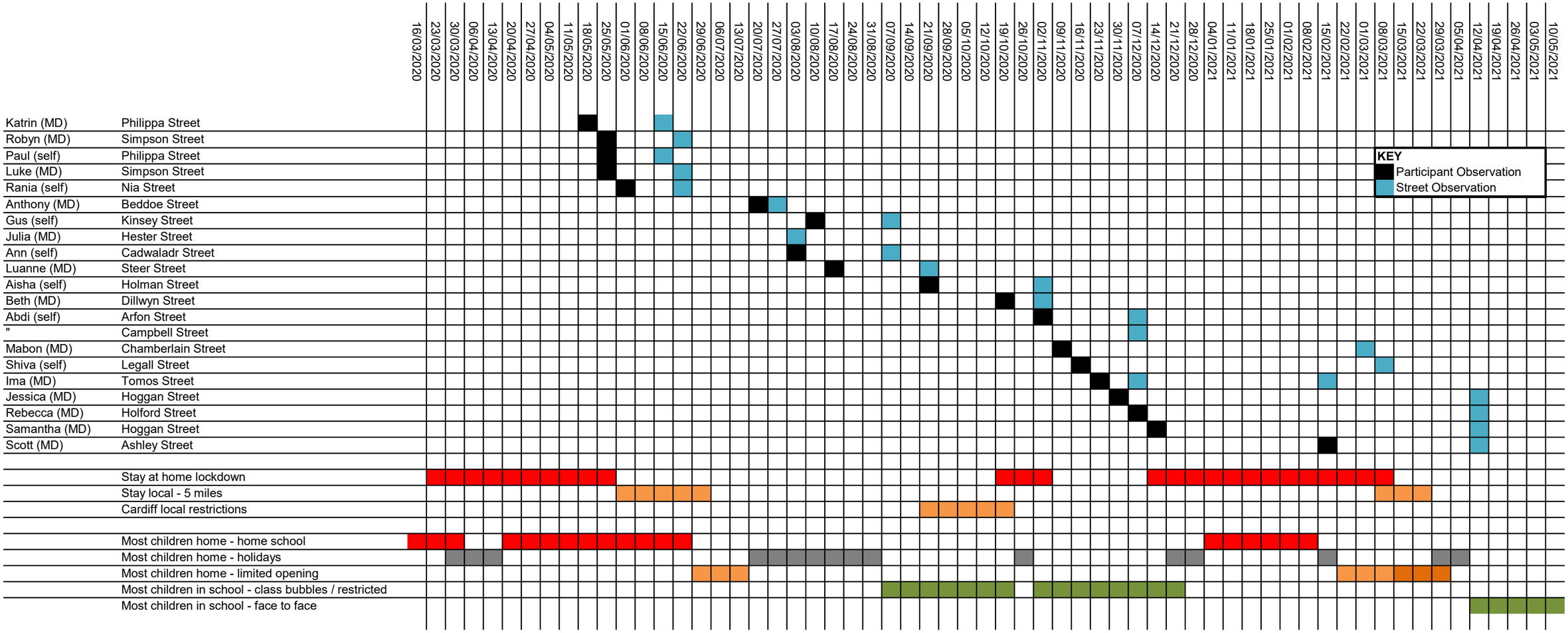
	Research question	**Thematic Analysis – coding reliability approaches**	**Thematic Analysis – codebook approaches**	**Thematic Analysis – reflexive approaches**	**Qualitative Content Analysis (QCA)**	**Interpretative Phenomenological Analysis (IPA)**	**Grounded Theory (GT)**	**Discourse Analysis (DA)**
							Theoretical sampling saturation a key concept. Most interpretive qualitative method.	
Inductive (data driven) / deductive (theory driven)	Inductive	Inductive + Deductive	Inductive + Deductive	Inductive	Inductive + Deductive	Inductive	Inductive	Inductive + Deductive
Explicit (face value / semantic) or latent (inferred) meaning?	Explicit and latent Practices in the residential street. Links between practices and health. Via a rich understanding of a diverse range of pathways.	Explicit	Explicit Latent	Explicit Latent	Explicit Latent	Explicit Latent	Explicit Latent	Explicit Latent
Typical data	Interview transcript *And also:* Field notes Research notes Drawings of streets (sketches & computer) Photos of street Photo montage of street MAPS survey	Interview transcript Possible other data sources	Interview transcript Possible other data sources	Interview transcript Possible other data sources	Interview transcript	Interview transcript Increasingly use of other sources	Interview typical Possible: Ethnographic field work Participant observation Secondary sources	Interview transcript
Researcher role in theme generation	Researcher creates themes working with the data which was to varying amounts co-produced with participants.	Researcher subjectivity seen as bias.	"Themes cannot exist separately from the researcher—they are generated by the researcher through data engagement mediated by all that they bring to this process…" (p.39)	"Themes cannot exist separately from the researcher—they are generated by the researcher through data engagement mediated by all that they bring to this process…" (p.39)	Researcher subjectivity central to some but not all approaches.	Researcher subjectivity central. Researcher seeks insider (or emic) perspective. (Thorpe and Holt, 2008)	Researcher subjectivity central.	*Researcher subjectivity central.*
What is being coded?	Health related practices.			*Coding is open and various interpretative frameworks can be used.*		"first person accounts of personal experience" (p.41) A focus on language.		Production of personhood (poststructuralist).
Sample	Large, but not big, heterogenous	Large, Big	*Varies*	*Varies*	*Varies*	Small, homogenous	*Varies*	*Varies*

	Research question	Thematic Analysis – coding reliability approaches	Thematic Analysis – codebook approaches	Thematic Analysis – reflexive approaches	Qualitative Content Analysis (QCA)	Interpretative Phenomenological Analysis (IPA)	Grounded Theory (GT)	Discourse Analysis (DA)
	qualitative sample (n=20).							
Method / ology	-	Becomes methodology as applied. Most aligned to small q.	Becomes methodology as applied.	Becomes methodology as applied. Aligned to Big Q.	Method	Method + ology	Method + ology	
(A common) position towards knowledge creation	As stated: broadly constructivist-interpretivist, aiming to: "Gain understanding by interpreting subject perceptions" (Denzin, 2017 p114)	Flexibility toward theory (but not atheoretical) Post-positivist: Themes reflect a truth or knowledge that is identified by any trained researcher through the data. Critical qualitative research: Post-structuralist Constructionist "socially embedded patterns of meaning" (p.39)	Flexibility toward theory (but not atheoretical)	**Phenomenology** **Critical qualitative research:** Post-structuralist Constructionist "socially embedded patterns of meaning" (p.39)	Flexibility toward theory (but not atheoretical) Post-positivist: often imported when quality is considered – inter-coder reliability, minimising subjectivity, concern with accuracy of coding. (p.39) Realist	Phenomenology: to understand and interpret how people experience and make sense of the world. (p.41) Dealing with "…individuals' personal perceptions or accounts of phenomena rather than striving to arrive at objective statements regarding these phenomena." (Thorpe and Holt, 2008)	Constructivist (Charmaz) Positivist (Glaser)	Critical qualitative frameworks: e.g. post-structuralism, constructionism. Constructivism-structuralism. (Salkind, 2010)
Research values	Values are included and formative. Ethics are intrinsic. Research should be responsible to those studied... (Denzin ed., 2018, p30) Public Health ethical framework (FPH). Architecture (duty to society). Rights based approach to health & equity (WHO)	Can vary.	Qualitative values framework is included (p39).	Qualitative values framework is implicit (p39).				
Consideration of reasons TA may be most suitable. *NB: these questions are posed by experts in Reflexive TA so experts in other methods may have a different questions.*	n/a	n/a	n/a	n/a		The research question is focused on something other than (just) personal experience and sense-making: yes The data source is something other than interviews or another method that gathers in-depth first-person accounts of personal	When a researcher is beginning their qualitative research journey. TA is more straightforward than GT, the procedures are fewer and less complex, and there is a clearer pathway through them: yes The research questions are not those	When a researcher is fairly new to qualitative research. Reflexive TA offers much in the way of practical guidance, whereas the procedures for DA are less concrete and often based in concepts, ideas and practices, rather than guidelines: yes

	Research question	Thematic Analysis – coding reliability approaches	Thematic Analysis – codebook approaches	Thematic Analysis – reflexive approaches	Qualitative Content Analysis (QCA)	Interpretative Phenomenological Analysis (IPA)	Grounded Theory (GT)	Discourse Analysis (DA)
						experience and sense-making: yes The sample is relatively large (i.e. larger than N = 10) and/or: yes n=20 heterogeneous—such as when the aim is to capture diversity: yes (Fassinger, 2005). The analytic focus is solely on identifying themes across the data set, rather than also on the unique features of individual cases: not necessarily but need to consider practical limitations of time & resource The need for the research to have 'actionable outcomes' with clear implications for practice (Sandelowski & Leeman, 2012) requires organising the analysis into 'thematic statements' (shared meaning-based themes): yes The analytic interest is on how personal experiences are located within wider socio-cultural contexts.": yes (p. 42)	particularly suited to GT (the definitive GT research question centres on social processes): does not apply The goal is to identify patterns in data, to describe and interpret those patterns, and/or to provide a theoretically informed interpretation of them: yes The researcher does not intend to develop a grounded theory from the data set and analysis: could apply Data are collected independent from the analytic development (i.e. there is no intention to sample theoretically): key factor preventing GT, yes, this has been mainly due to Covid-19 imapct. The sample is relatively small and/or homogenous—as is often the case with samples of 'convenience' that are common in qualitative research: no, sample is fairly large & heterogenous. Time is limited by a particular and tight deadline. Reflexive TA, while not quick, can be faster than a 'full' GT project: yes, a consideration (p. 43)	When a researcher is not certain they are committed to a full discourse orientation in their analysis: yes The research questions and interests are not solely or primarily oriented to the effects of language (such as subject positions).": yes (p.44)

Appendix 10 | Cardiff Covid-19 Timeline, with Fieldwork Observations Mapped

APPENDIX: ANALYSIS OF FIELDWORK OBSERVATIONS X COVID RESTRICTION STATUS



Appendix 11 | Table: Chapter 4.2 Street Environment Characteristics – Illustrative Photographic Examples

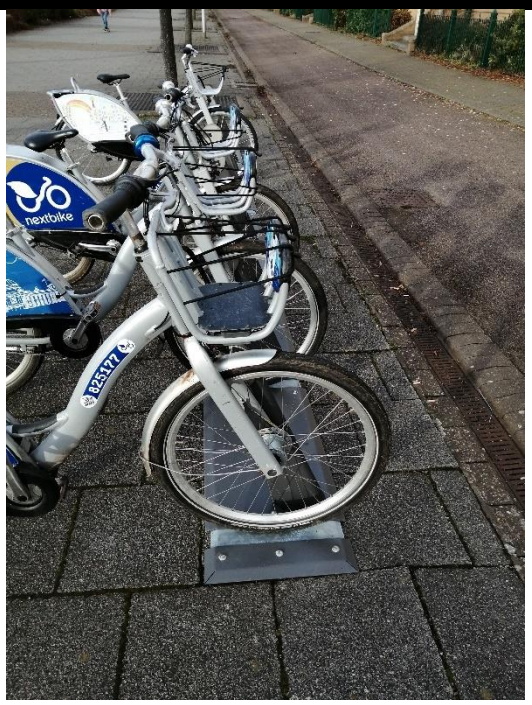
Street Physical Environment Illustrations

This appendix provides illustrative examples from fieldwork of code labels for street physical environment characteristics reported in Chapter 4.2.

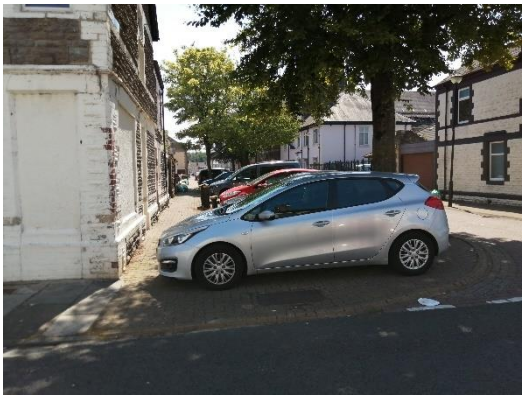
- Images have been redacted for signs with street names.
- Car number plates are not redacted as they are not personal data and access to personal data from these is controlled by law and not publicly accessible.
- House numbers are not generally redacted as they are not on their own personal data.

The following descriptive information provides illustrations of examples from across the whole dataset. Images are selected from across the whole dataset, they are not necessarily from the same street site where the item is coded in participant observations.

Table 1: Street observation example of each street environment characteristic

Coded Characteristic	Example from street observations
U_STREET CHARACTERISTICS	
U1_Bike hire & storage	
U_Bike hire station	 Arfon Street, Nextbike hire station and adjacent segregated cycle lane.

U_Bike storage, parking	 Arfon Street, cycle stands associated with public transport stop.  Dillwyn Street, bike stands associated with bus stop.  Tomos Street.
U1_Car charging & parking	
U_Cars, electric charging	*Not photographed.*

U_Parking, parked cars as a feature or issue in the street, residents parking, knock on effects	 Holman Street: car parked on pavement.  Simpson Street, car parked on pavement at junction.  Simpson Street, example of on street parking.  Hester Street, parking / storage of a caravan.

Hoggan Street, parking commercial vehicle.

Tomos Street, on street parking and sensors in ground for parking mobile apps.

U1_Cycle lane & cycle friendliness	
U_Changes in street for cycle friendliness	 Philippa Street, existing dead end but now with dropped kerbs and route through for cyclists and pedestrians.

U_Cycle lane	 Arfon Street, the only segregated cycle lane on a street in the study.  Arfon Street, delivery van in cycle lane.
U1_Green space, planting, river, & trees	
U_Greenery, green spaces, planters, plant pots, a river on street, sustainable drainage	 Beddoe Street, view toward river across river path at end of street.

Beddoe Street

Beddoe Street

Chamberlain Street

Hester Street

Hoggan Street: community garden (not restricted access).

Holford Street: community garden, artwork at entrance, garden is restricted access.

Holman Street

Ashley Street, Sustainable Drainage System (SuDS).

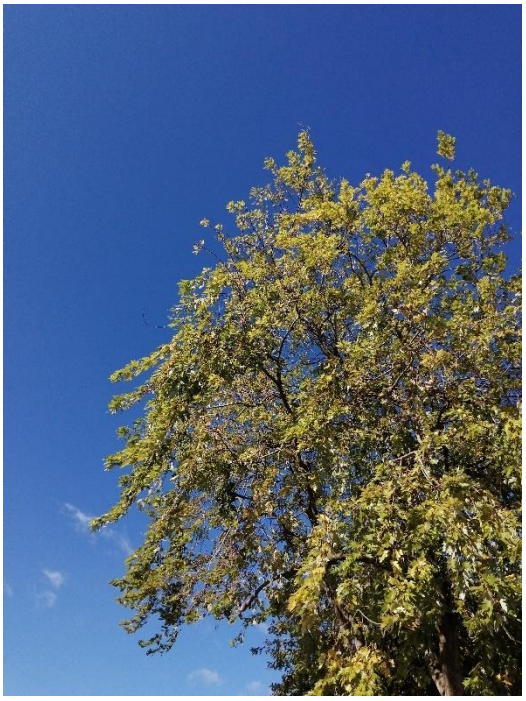
Holman Street: play park.

Holman Street: open space.

	 Hoggan Street, planters made from old car tires against retaining wall to major highway / road.
U_Street Tree	 Beddoe Street  Dillwyn Street  Holman Street

Ashley Street

Beddoe Street, damage to tree and debris from apparent car crash.



Steer Street, large street tree overhead.

	 Tomos Street, street tree with hard surfacing around it which interferes with tree growth.
U1_Living space	
U_Crowded, can't move freely, insufficient space, cramped living space impact	*No examples photographed.*
U_Houses, types, big, small	 Dillwyn Street, narrow terraced houses.  Hoggan Street, terraced houses.

	 Holford Street, terraced housing, larger houses.  Holman Street, maisonettes.
U1_Street holistic, layout, dimensions	
U_Cul-de-sac, dead end	

	Dillwyn Street, dead end with tree, bus stop, cycle racks.  Dillwyn Street, dead end with route through for pedestrians.  Hoggan Street, access to community garden but not beyond, several cul-de-sacs off the main street also.  Holford Street: two cul-de-sac, same street, split across another more main road.

	 Holman Street, an enclosed square with pedestrian access out at ends. 
U_Lanes, visibility, alleys, gated alleys, passageways, cut throughs	 Beddoe Street

	 Chamberlain Street  Dillwyn Street  Holford Street
U_Length of street, notable or relevant	*See also street plans, Appendix 1.*
U_Pavements, good size, narrow	 Holford Street, very narrow

	 Arfon Street  Arfon Street, very wide overall but don't feel like part of My Street for Abdi.
U_Street environment & holistic wider arrangement, specific mention	*Not photographed / not a visual characteristic.*
U_Street layout, terraced street, house sizes, historic field patterns	*Not photographed / not a visual characteristic.*
U_Width of street	 Chamberlain Street

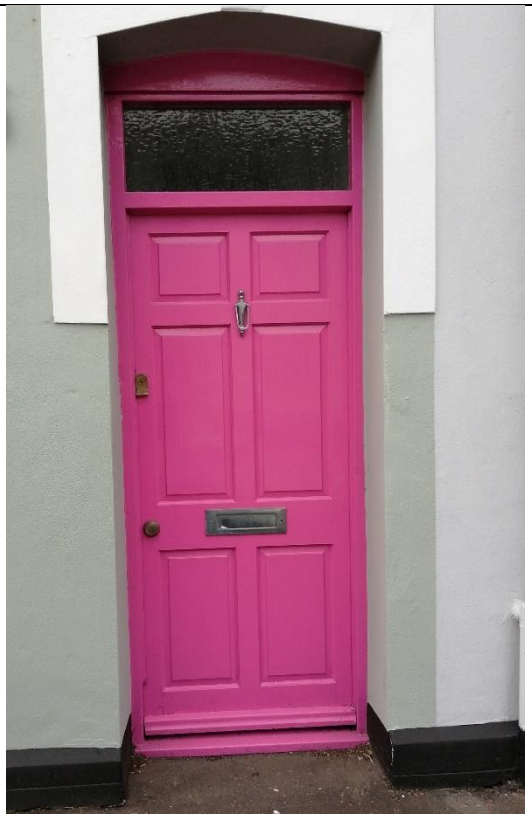
	 Holford Street
U1_Sun, temperature, wind	
U_Orientation to north, sun angle	 Near Kent Street: example of sun on a street where orientation and width restrict sunlight.  Beddoe Street, shadow pattern / shading of street trees.
U_Temperature of street or garden due to sun	*Not photographed / not a visual characteristic.*
U_Wind direction, sea air	*Not photographed / not a visual characteristic.*
U1_Visual appearance, housing design, materials, views	

U_Changes in street for cosmetic reasons, or with cosmetic effect	 Philippa Street, where Katrin notes hedges and front gardens were historically removed to be made more consistent with walls, railings, and concrete paved front gardens.
U_Concrete jungle	 Adjacent Arfon Street, underpass part of the concrete jungle described by Abdi.
U_Decorative features, Victorian tiles, original features, facades look good	 Cadwaladr Street, patterned brickwork.

Dillwyn Street, brickwork detail to eaves of houses.

Hester Street

Ashley Street, decorative tiles.

	 Kinsey Street, pink front door.  Steer Street, decorative brick / stone walling.
U_Houses look the same	 Hoggan Street, houses similar appearance. Samantha notes how this provides continuity across different house types / sizes.

U_View, long distance across city	*Redacted for anonymising streets.*
U1_Waste	
U_Bins, household waste, being an obstacle, commercial bins, litter bins	 Chamberlain Street, household waste bins, multiple bins suggests flats in a House in Multiple Occupation (HMO).  Hester Street: refuse across pavement on bin collection day.  Hoggan Street, a household waste bin 'wheelie bin' with 'thank you' written on top.

Arfon Street, litter bin.

Near Beddoe Street, litter bin at bus stop at end of Beddoe Street.

Hester Street, litter bin at bus stop.

	 Tomos Street, litter bin, pink bags are left by litter picking volunteers for collection by local authority but can only be done at a bin location.
U_Rubbish, being everywhere, glass, dog shit, plastic pollution, cigarrette butts	 Dillwyn Street, fly tipping / waste.  Holman Street, nitrous oxide canisters .

Beddoe Street, damage to tree and debris from apparent car crash.

Hester Street, rubbish overflowing from bin, notably present close to junction with a main road.

Simpson Street, rubbish bags burst with food pulled out, likely by animals like seagulls.

	 Simpson Street, waste and rubbish in street including disposed fridge / freezer.
U2_Sounds from street, pleasant or noise, incl. speed bumps, quiet U2_Specific buildings on street, wet house, block of flats, care home, businesses, shops, chip shop	

Individual codes not developed into themes (individually identified within ≤4 / 20% of participant observations)	
U_Air pollution, fumes, filth in air	*Not photographed / not a visual characteristic.*
U_Barriers, metal street ones, bollards	 Chamberlain Street

U_Benches, as sitting places	 Philippa Street, new bench provided.  Arfon Street  Steer Street, stool outside a house for sitting on.

U_Building works	 Hester Street  Ashley Street  Kinsey Street, note scaffold restricts pavement width.

U_Bus stop, being a timed stop, bus route	 Beddoe Street  Chamberlain Street, bus stop poster with Covid-19 warnings.  Arfon Street

	 Hester Street, raised kerb associated with bus stop.
U_CCTV	 Arfon Street, CCTV signage, ‘for the purpose of crime prevention and community safety’.

	 Chamberlain Street, CCTV signage on private building.
U_Community space, having communal space	 Hoggan Street, community garden
U_Condition, of places to walk	 Cadwaladr Street

Chamberlain Street

Dillwyn Street

Holford Street

U_Disused space, waste land	*Not photographed.*
U_Flooding, risk, river, water level, ground water, drainage	 Chamberlain Street
U_Front garden, having or not	 Chamberlain Street  Dillwyn Street

Hester Street

Holford Street

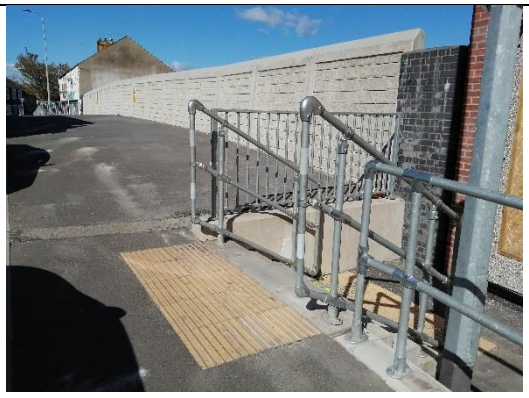
Simpson Street, a multiple residential building (supported living or similar) with front garden area around but fenced off and not seemingly accessible to residents.

	 Simpson Street, no front gardens at this part of street.
U_Level crossing, dropped kerb, pram access	 Hester Street  Hester Street

U_lighting, street lighting	 Kinsey Street, street light.  Tomos Street, much larger lighting of a highway type not a street type.
U_Location in wider city, as an important factor	*Not photographed / not a visual characteristic.*
U_Nature, wildlife, presence of	*Not photographed.*

U_Neighbourhood watch scheme	 Ashley Street, Neighbourhood Watch window sticker and political poster.  Beddoe Street
U_Notable people on street	*Not photographed / not a visual characteristic.*

U_Phone boxes, dilapidated	 Simpson Street  Simpson Street
U_play areas, sports facilities, astroturf	 Holman Street, children's play ground.

	 Adjacent Holman Street, astroturf sports pitch.
U_Public-private side of house with two streets	*Not photographed / not a visual characteristic.*
U_Railway line	 Steer Street, bridge over railway.  Steer Street, view over bridge parapet above head height.

	 Arfon Street, underpass under railway.  Nia Street, view toward railway behind street. *See signage below also.*
U_Safety of junction, street turning	*Not photographed / not a visual characteristic.*
U_Satellite dishes, aerials, restrictions on placement	 Campbell Street, satellite dishes all on street away from main public street due to legal restriction.

U_Satnav routes, directing large vehicles, being on a thoroughfare, a major cut through, busy road	 Steer Street, Luanne notes a busy route for motor traffic.  Arfon Street, designed like a dual carriageway and major highway with signage in keeping.
U_Signage, street signs, stickers, warnings, poles, house numbers, Welsh signs	 Beddoe Street

Arfon Street, large scale highways signage.

Cadwaladr Street

Philippa Street

Chamberlain Street

Chamberlain Street

	 Dillwyn Street  Dillwyn Street

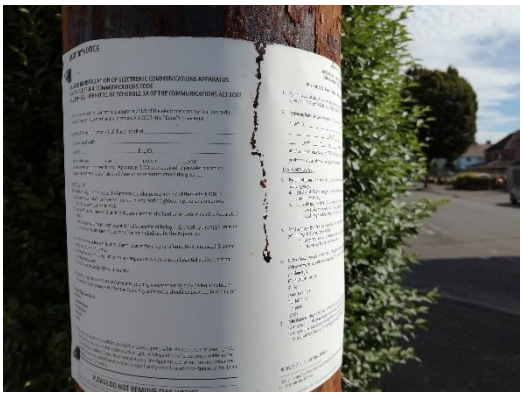
Dillwyn Street: “Friends are like rainbows… they brighten your life after you’ve gone through a storm”.

Dillwyn Street: Halloween posters in window.

Beddoe Street, old street sign / notice singed by HT Crippin Chief Executive. Notably Crippin died in 2001.

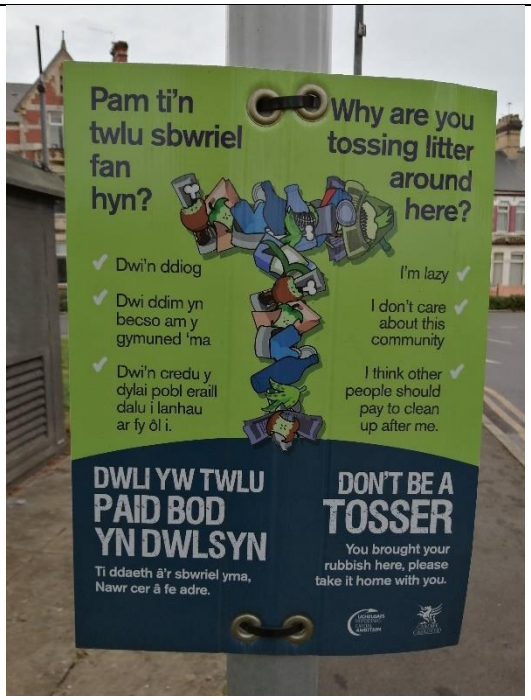
Adjacent Dillwyn Street: “In 1832 on this spot nothing happened.”

Hoggan Street: Danger of Death, Keep Out



	Beddoe Street, Statutory Notice for installation of electronic communications apratus – a telephone pole. Notably with details of location not completed.  Near Beddoe Street, road sign fixed within a hedge and graffiti written on it.  Beddoe Street, private sign on gate.

	 Beddoe Street, disabled access sign on private gate.  Simpson Street, fire assembly point sign for a building.



Tomos Street, 'Don't be a Tosser' litter sign.

Steer Street, railway electrical warning.

	 Steer Street, railway bridge sign, “Funded by UK Government”.
U_Smells	*Not photographed / not a visual characteristic.*
U_Speed bumps, traffic calming	 Kinsey Street, speed bump with evidence of vehicle strikes creating noise.  Ashley Street, a raised table where whole junction is raised to pavement level.

U_Street clutter, poles and things	 Cadwaladr Street  Chamberlain Street  Chamberlain Street
U_Tarmac & paving, impervious to water	*Not photographed.*

U_Topography, being flat, being hilly	 Hoggan Street:
U_Vibration, whole house shakes	*Not photographed / not a visual characteristic.*
U_Ward boundary	*Not photographed / not a visual characteristic although often following a major feature like river or main road.*

Appendix 12 | Table: Health-Related Outcomes compared to Disease Classification

The table below relates to Chapter 4.4 and is an analysis of health-related outcomes identified in this research compared to the International Classification of Diseases (ICD) (World Health Organization, 2022a)

Health Outcome or Topic	ICD-11 Categorisation
W1_MENTAL	
Autism, neurodiversity, impacts on	06 Mental, behavioural or neurodevelopmental disorders
Confidence, impacted	*Not a health outcome* (V Supplementary section for functioning assessment)
Fear, being scared in a primal sense, scared of dogs, allergic to dogs, worried and scared for someone else, parent worry for children	06 Mental, behavioural or neurodevelopmental disorders
Feeling safe, having a secure base, feeling unsafe in street	Not specifically listed
lack of control or permission, being able to take control of health, using your voice and power, having some control	Not specifically listed
mental health, +ve, feeling hopeful, positive, sense of achievement, satisfaction, feeling good	06 Mental, behavioural or neurodevelopmental disorders
mental health, -ve, stress, anger, anxiety, depression, suicidal thoughts, frustration, upset, stress from separation from family	06 Mental, behavioural or neurodevelopmental disorders
relatives who passed, reminder of, remembrance, depression from grief	24 Factors influencing health status or contact with health services
W1_PHYSICAL	
Covid-19, having, vulnerability to	25 Codes for special purposes

Food, healthy, affordable	*Not a health outcome* (24 Factors influencing health status or contact with health services)
Mobility, difficulties walking	*Not a health outcome* (V Supplementary section for functioning assessment)
physical health, exercise, weight	Physical health: more of an overall measure, ICD codes are more specific. Exercise: *not a health outcome* (24 Factors influencing health status or contact with health services) Weight: 05 Endocrine, nutritional or metabolic diseases
Respiratory problems	12 Diseases of the respiratory system
Rubbish impact on health, dead rat	Not specifically listed. Rat: varies, can be cause e.g., bite (Section 23) or an agent of another disease.
W1_INJURY AND VIOLENCE	
Domestic abuse, emotional abuse	*Not a health outcome* (24 Factors influencing health status or contact with health services)
Injury, from falling	23 External causes of morbidity or mortality (unintentional)
Injury, from violence, stabbing	23 External causes of morbidity or mortality (assault)
Suicide	23 External causes of morbidity or mortality (intentional self-harm)
Traffic injury, fatality	23 External causes of morbidity or mortality (unintentional)
W1_SOCIAL	
Social, connectivity, cohesion, being included, having friends locally, feeling homely; isolation, being alone, relationship	

breakdown - splitting up, peer support at work	Relationships: *not a health outcome* (24 Factors influencing health status or contact with health services) Loneliness: not specifically listed
W1_OVERALL HEALTH	
Generally affect health, somehow	ICD-11 not overall measure
Ill health, generally, being ill	ICD-11 not overall measure
Satisfaction, life priorities, work (latent, or explicit)	ICD-11 not overall measure

Appendix 13 | Logic Model for Healthy Streetlife Research

- Logic model for a PhD, 2017 (Project Registration Stage)
- Logic model for a PhD / future research, 2024 (revised at completion of research)

Logic Model | 2017 | Start of PhD | How do streets make us sick?

Situation: The design of streets has a negative impact on people's health. People's health is therefore worse as a result of street design. In the 18th and 19th century society was afflicted with communicable diseases such as cholera. Street design was seen as part of the problem and evolved to overcome this, for example getting rid of courtyard and back-to-back housing and developing new forms such as the terraced house with improved sanitation, daylight, and ventilation. Entering the 21st century society is afflicted by chronic diseases and conditions such as obesity. Design needs to evolve again but we currently don't know how.
Key: *items in italics* – these were not taken forward or were adjusted once the literature review informed the gaps that needed to be addressed and therefore altered research design.

Inputs	Outputs		Outcomes		
	Activities	**Participants**	**Short During PhD**	**Medium At End of PhD**	**Long After PhD**
Researcher time & resource. Supervisory team time. An existing evidence base. *Health outcome data: from existing data.* *Data linkage support may be required.* *Built environment data: collected by researcher.* *Deprivation: existing data sets.*	Systematic review of the literature on street design quality and links to health. Identifying gaps in existing literature and knowledge. *Developing a tool for measuring street variables.* *Identifying the applicable cohort for the study.* Undertaking surveys of streets. *Linking street variables to health data.* *Analyse data.* *Test for confounding factors.* *Assess findings.* Write up PhD. Identify and submit journal article. Present work at a conference.	*Citizen panel to inform factors that are important to people.* Minimum 3 No. street typologies *covering cohort of 500 people and potentially up to 30,000*.	Creation of new methodological approach to assessing street design quality as related to healthcare outcomes. *Demonstrate use of physical environment assessment tool across a wide range of street level factors.* Raise awareness of the issues with designers and public health. *Learning of statistical regression.* Development as a rounded research professional. (Vitae RDF framework) An understanding of how research and design professions can work more closely to integrate practice & evidence base.	Demonstrate *association* between street level design factors and health. Demonstrate *relative* impact of factors and priority for designers and planners. Increase understanding of building in health. Contribute to joining up discussion between designers, planners, and public health A written PhD thesis. Identify areas for future research. Demonstrate rounded qualities as a research professional (Vitae RDF framework)	Ongoing researcher development (Vitae RDF framework) Integration of practice & evidence base.

Assumptions	*Existing healthcare cohort data can be accessed. It will be possible to linking existing healthcare cohort data to built environment factors – in a technical sense. For example large databases may require cohort of 30,000 to be statistically significant.*
External Factors	Project approval and ethical approval will be required before proceeding with the study.

Logic Model | 2024 | End of PhD *(based around postdoctoral fellowship application)* | Healthy streetlife: practising health in the street environment.

Situation: In the same decade that the Ottawa Charter (World Health Organization, 1986) linked everyday health settings and community empowerment as vital for health, Appleyard (1981) drew attention to the centrality of streets for quality of life. There has been no shortage of street design toolkits since, more recently with an explicit focus on health (Healthy Streets, 2023; Muller *et al.*, 2023) streets are after all "the most common public space" globally (UN Habitat, 2015, p.iv). However, streets remain relatively overlooked in environment-health research. The literature does not address holistic health and is focused on the physical not the social environment. Research tools prioritise objective survey by researchers (Millstein *et al.*, 2013; Boarnet *et al.*, 2006; Pikora *et al.*, 2002) who are increasingly disembodied from the street through tools like Google Street View (Steinmetz-Wood *et al.*, 2019). Practice tools address inclusion of different groups through topics like traffic speed and bus stops (Healthy Streets, 2023) but do not address systemic drivers of exclusion and urban design practitioners treat local knowledge as secondary to their own expertise. It is recognised that programmes like Healthy Cities have been too top-down and need to also address the grassroots (Dooris, 2013). My PhD shows how existing local health data like postcode data does not address the context of how residents experience their streets and the importance of street cultures. Local knowledge, key to understanding these, is excluded as the norm (Community Voices Cardiff, 2023). Communities and designers think better processes are needed and inclusion is a policy intent but gaps remain in implementation.
Future direction: A Transdisciplinary CoLab is proposed that conceptually links the social and physical environment with local knowledge. It aims to address implementation gaps such as calls for good health and community empowerment in policies from the Ottawa Charter to the Well-being of Future Generations (Wales) Act (2015). Looking beyond the PhD my future direction aims to achieve this by fostering local knowledge; involving all kinds of expertise; and addressing multilevel governance from inclusive streets to healthy cities.

Inputs	Outputs		Outcomes		
1-2 Years	**Activities**	**Participants**	**1-2 Years**	**3-5 Years**	**5-10 Years**
Resources = costs, time, knowledge, skills, networks to do… Researcher time 50%. CoLab pilot including partner resources. Conference attendance: academic, practice / professional. Community oriented exhibition of visual outputs. Visits to streets + CoLabs. Mentor resources. Plus practice resources & inputs.	1. Strategic publications from PhD thesis. 2. Transdisciplinary CoLab pilot: developing my thesis recommendation. 3. Communicate up, out, and beyond health (Dooris, 2013). 4. skills & knowledge development: for myself and for stakeholders. Plus practice-based research activities & research strategy development.	Actors in: The transdisciplinary field of health and built environment design incl.: disciplines of sociology, public health, urban design, and urban health. Healthy urbanism, built environment, and place-based practice: professional designers; professional bodies; policy and law makers. Partners: initially Public Health & a CIC. Organisational & practice networks / collaborators.	*Make the case for wider-wider determinants of health.* Establish track record as a professional researcher. Developed methodology for CoLab approach with partners. Create impacts with audiences: scholars, practitioners, policymakers, communities. Delivered examples of practice-based research projects. Peer support with other practice-based researchers.	*Approach taken up more including internationally.* Increased track record internationally as a professional researcher. Develop as skilled integrator for practice-based research. Embed CoLab methodology in practice with live example(s). Continue to create influence with audiences. Evidence impacts across: instrumental, conceptual, and capacity building.	*Approach widely accepted and starts to shift paradigm.* The long-term impact of such systemic change could be for the built environment what Bevan achieved for healthcare in creating NHS. Shift the dial on values through evidence-informed and co-produced approach: better population health; better planetary health; lower inequalities.

Assumptions	Ability to secure resources including income to pursue this programme of work including practice-based approaches and the CoLab.
External Factors	Future direction of climate change, tipping points that may accelerate impacts. Social and political: e.g. politicisation of streets and design guidance.

Appendix 14 | Conference Paper: Typologies of knowledge for healthy streets: the need for an interdisciplinary paradigm for public health and design practice

This appendix refers to:

Drane, M. and Carmichael, L. (2018) Typologies of knowledge for healthy streets: *The need for an interdisciplinary paradigm for public health and design practice.* In: City Street 3. Beirut, Notre Dame University Louaize.

Full paper available from: http://eprints.uwe.ac.uk/38616 [Accessed 28 August 2023].

Abstract

Non-communicable diseases (NCDs) are a global health challenge and physical environment factors play a material role in NCDs. The residential street is a building block of the physical environment and has been identified a place to integrate health and placemaking. However disciplinary differences between the two disciplines of street design and public health frustrate this.

Street design is by nature interdisciplinary and beyond the control of one sub-group of designers. Some design and placemaking practitioners seek new frameworks for interdisciplinary understanding: however this article explores why such frameworks cannot emerge with validity across disciplines without an underlying position toward evidence and knowledge. This challenge is explored through epistemology; methods; and values in practice. Taking a socio-ecologic systems perspective a new interdisciplinary understanding is proposed to integrate public health and street design at each of these levels.

Both street design and public health share, to some degree, values of promoting population health and have the potential to do so but this potential is not being realised. Opening interdisciplinary understanding between the two disciplines may reveal new ways to support population health. Where current disciplinary silos prevent investigation of these issues then both disciplines risk acting unethically measured against the benchmark of the values stated in their professional codes of conduct.