Working paper
Health inequalities and determinants in the physical urban environment: Evidence briefing

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This working paper has been written to support research into the spatial and physical determinants in the urban environment that lead to health inequalities.

The evidence is based on a rapid trawl for relevant research that we found whilst compiling an 'Evidence Review on the Spatial Determinants of Health in Urban Settings' (Grant et al., 2009) for the WHO European Centre for Environment and Health, Bonn; and a subsequent update for a briefing note prepared for the WHO European Healthy Cities movement annual meeting in Sandnes in 2010. We also include here a new brief conclusion and discussion.

The intention of the report is to serve as a discussion document and inspiration for those associated with research in this field.

Our WHO Collaborating Centre is developing a methodology suitable for undertaking a systematic review in such a field - comprising complex interventions, ill defined causal pathways, open systems and a wealth of grey literature. We are also looking for funding opportunities to establish a cognate research network.

SYNOPSIS

The built and natural environment is an important determinant of health. Evidence shows that a disproportionate burden of ill-health associated with the built environment is borne by poorer people living in poor quality built environments. Poorer families have lower mobility but greater exposure to the adverse environmental conditions related to transport such as air and noise pollution and higher traffic levels which cause respiratory disease, mental stress and road traffic injury. Deteriorating features of an urban environment such as dilapidation, vandalism, graffiti and litter are disproportionately found in disadvantaged areas and lead to a sense of insecurity on streets and in parks and play areas meaning that the more vulnerable in particular use them less, leading to reduced physical activity and social interaction and exacerbating health problems such as obesity and isolation. Green space has many benefits for physical and mental health and populations that are exposed to the greenest environments also have lowest levels of health inequality related to income deprivation, but poorer neighbourhoods often lack green space or have poorly maintained or vandalised green areas. Climate change will also impact significantly on the urban environment and disproportionately on the disadvantaged, particularly through increasing temperatures and flooding.

In conclusion, land use, transport and development policies and associated strategic decisions determining urban form are key to tackling health inequalities related to the built environment through housing, proximity of facilities, green space and viable modes of transport.

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Introduction

The built and natural environment that forms the backcloth to our lives is also an important determinant of health. This is particularly so for population groups disadvantaged by relative poverty, unemployment, low status and disability. Those who for financial, physical or cultural/racial reasons are more vulnerable, and have fewer choices find themselves typically in locations and settings that are less conducive to good health with little ability to move away from unhealthy working and living environments or to mitigate their impact.

Evidence shows that a disproportionate burden of ill-health associated with the built environment is borne by certain groups within the population (CSDH, 2008). Studies in the early 2000s used the term 'environmental justice' to describe spatial patterns where disadvantage and poor environmental quality coincide (e.g. Mitchell and Dorling, 2003). Several reviews indicate that poor people are more likely to live in poor quality built environments (including increased health risk exposure from noise and air quality) and this contributes to poor health. Socio-economic health trends have been well documented. We know for instance that the least well-off people in society suffer poorer health (Marmot, 2004). Layers of health risk can also overlap, for example Lavin et al. (2007) identify children and the elderly as being particularly vulnerable not only because of a biological vulnerability but also because of the significant numbers of children and elderly who are poor. However the spatial components of the urban environment that can be associated with, and sometimes contribute to, a divergence in health outcomes have not received systematic attention. We believe that there are some key spatial mechanisms which exaggerate health inequity. This briefing outlines some of the recent evidence that we have found in a review of metastudies, systematic reviews and policy reports that show potential inequalities in health literally built into urban environments.

The evidence has been grouped into six thematic headings based on the studies found:
Transport
Land use mix: Neighbourhoods and facilities
Crime and fear of crime
Housing and residential areas
Green space
The urban environment and climate change impacts

An evidence briefing

Transport

Access to active travel modes and local public transport networks is greatly affected by urban form. Critical physical parameters are land use mix, street network form and development density (Barton et al., 2010).

There are many connections between transport and health which impact more on poorer families who have lower mobility but greater exposure to the adverse environmental conditions related to transport such as air and noise pollution and higher traffic levels. People who are most deprived are also more susceptible to damaging health effects because of higher levels of pre-existing illness or other vulnerability.

Access to transport that enables residents to move outside of their own community has been shown to positively correlate with a reduced fear of social isolation and positive mental health (Whitley et al, 2005). For those on higher incomes, this is by car or taxi. However, for those on lower incomes, access to public transport is important (Whitely et al, 2005).

Health inequalities evidence found in relation to the distinct transport issues of air pollution, road casualties and mobility and physical activity are given below.

Air pollution
A comprehensive review report from Walker (2003) is especially useful here. Transport related air pollution impacts most on the disadvantaged with increased risk of respiratory diseases and other illness. People in the 10 per cent most deprived areas in England experience worst air quality, suffering for example 41 per cent higher concentrations of nitrogen dioxide than the average (Walker, 2003).

The report stated that:
> The relationship between poor air quality and deprivation in England is particularly strong for peak pollutant values, including exceedences of standards. The number of people in wards above pollution thresholds increases progressively with increasing deprivation.

The reverse pattern was found in Wales, a country with a much more rural population. This was due to the least deprived households in Wales tending to be more urban than their English equivalents and mostly located in the more urbanized south, where most of the poorest air quality occurs.

The report also describes "clusters of wards [local election areas] that have poor aggregate air quality and high deprivation" or "hot-spots … [of] … pollution-poverty", with large clusters in the parts of the main cities (Walker, 2003)

In the UK, in terms of NO_2, PM_{10} and SO_2, there is a tendency for the most deprived communities to experience the poorest air quality; these deprived areas often have a higher proportion of children living there, increasing the overall susceptibility of the population (NETCEN 2006, Mitchell and Dorling 2003).

Links between higher air pollution levels and deprived neighbourhoods have also been found in other countries such as Norway (Naess et al 2007). Other studies have highlighted that even in cities that might not follow this trend and where people with higher socio-economic status are exposed to the highest pollution concentrations, mortality rates from air pollution related causes are still highest amongst those with lower socio-economic status indicating a greater susceptibility to the effects of air pollution amongst people who are most deprived (Forastiere et al 2007).

Road casualties

The design of our transport networks at the local level is receiving attention from urban designers and public health with the advent of initiatives such as 20mph areas, home zones and cycle paths. Studies are in hand that are evaluating these against road traffic danger. Broad statistics indicate that, globally, road traffic collisions are the single largest cause of unintentional injury (WHO, 2008b). There are very wide socio-economic differentials in the levels of death and serious injury from road traffic. A study in England showed that children in the most deprived 10 per cent of areas are four times more likely to be hit by a car as children in the least deprived 10 per cent. Children aged 0-19 years and older adults aged 60 plus are particularly vulnerable to injury through road traffic accidents, (DfT 2005a; DfT 2004).

Mobility and physical activity

Individuals from low-income groups, older people and those with disabilities are less likely to have access to personal transport (Lavin et al., 2006). These groups may find that access to services such as shops and health care is reduced. Consequently, they may spend a higher proportion of their income on transport (Lavin et al., 2006).

Perceived physical danger posed by motorised traffic has been cited as one of the main barriers to engaging in walking and cycling (Davis, 2002). This has had a disproportionate effect on activity levels in both children and older adults. However, these issues do not seem to have been the focus of any recent systematic review studies.

On the positive side, walking to and from public transportation can help physically inactive populations, especially low-income and minority groups, attain the recommended level of daily physical activity (Besser and Danneberg, 2005). Therefore increased access to public transport may help promote and maintain active lifestyles.

Land use mix: Neighbourhoods and facilities

Urban land use pattern is one of the main influences on levels of physical activity, particularly among lower income groups who get much of their physical activity through active travel rather than recreation (RCEP, 2007).

Deteriorating features of an urban environment such as dilapidation, vandalism, graffiti and litter are disproportionately found in disadvantaged areas, leading to a sense of insecurity on streets and in parks and play areas (Lavin et al., 2006). This means that the more vulnerable in particular use them less and that children are less likely to be let out to play – both leading to reduced physical activity and exacerbating health problems such as obesity which is more prevalent in lower income groups.

The impacts are confirmed by Ellaway et al. (2005) in the secondary analysis of a European cross sectional survey of 12 cities. They found that, compared to respondents from areas with low levels of litter and graffiti, those from areas with higher levels, were 50% less likely to be physically active and 50% more likely to be overweight.

Lack of facilities such as public toilets (Greed, 2006) impacts on vulnerable groups, for example young children, older people and those with illnesses or chronic diseases. Lack of suitable areas for resting, for example benches and seating may also limit the ability for certain groups to explore or walk longer distances. With respect to the elderly this impacts negatively on social isolation.

Moreover, lack of availability and accessibility of municipal services such as libraries, health facilities, doctors' surgeries, schools and social support can have a negative social impact on communities and affect both physical and mental health (Horowitz et al, 2005; Lavin et al, 2006). Places which lack facilities often become ghettoised fostering a risk of further criminal activities (Horowitz et al, 2005).

If facilities, jobs and social contacts are within certain distance thresholds of households, with routes that are perceived as relatively pleasant and safe, then walking and cycling will be common (Lee and Moudin 2008). Moreover not only will active travel be the rule, but social networks and the sense of community may be enhanced (Calve Blanco 2009).

Crime and fear of crime

One of the main social impacts related to urban form, is residents' perceived fear of violence or crime (Horowitz et al, 2005; Whitley et al, 2005). These aspects have been shown to negatively affect mental health. Groups who feel most vulnerable include women, in particular mothers on a low income, and those with mental illness (Horowitz et al, 2005; Whitley et al, 2005). Perceptions of safety are influenced by fear of street crime but also injury from traffic (Croucher et al. 2007) and a reaction to the aesthetic impression, which includes the presence of graffiti, litter and state of disrepair of the surrounding community (Lavin et al, 2006). The latter is disproportionately high in low-income and disadvantaged areas (Lavin et al, 2006).

Evidence from an inner urban area in North London found that residents experienced a 'time-space inequality' as a consequence of crime and other related factors (Whitley et al, 2005). This has been shown to result in poor mental health including feelings of social isolation, negative mood and low self-esteem. 'Time-space inequality' describes the variation in ability of community residents to access and use spaces both within their immediate and wider environment at different times during the day or night. This was less prevalent in mentally healthy men or middle-income women. Time-space inequalities seemed to be diminished by interventions that encouraged spatial and temporal movements and encourage connectivity to a wider geography, for example comprehensive local public transport systems and government-issued free travel passes for vulnerable populations.

Fear of crime has been shown to be a barrier to the use of bicycles as transport or for recreation (Stafford et al, 2007).

Housing and residential areas

Older, poorer quality housing which is harder and more expensive to heat is also more likely to be occupied by poorer households. Extra deaths between December and March are attributed to the cold weather with children, older people and people with long term illnesses the most vulnerable (RCEP, 2007). Rising fuel prices exacerbate the problem for people in poorly insulated homes causing more fuel poverty and worsening health.

Environmental noise problems have been shown to lead to sleep disturbance, cardiovascular disease and impaired mental health. Most urban noise in residential areas is traffic related. Nightclubs, bars and parties are other sources of noise in more central areas. In non-industrial urban environments, opinion poll research conducted in 2003 (cited in RCEP, 2007) found that environmental noise problems are worse in areas of high density housing, rented accommodation (both social and private sectors), areas of deprivation and areas which are highly urbanised.

Green space

There is much evidence for the benefits of green space for physical and mental health and wellbeing; these include decreases in general health complaints, cholesterol, blood pressure and stress levels and improved perceived general health and resilience (eg RCEP, 2007). Evidence suggests that populations

that are exposed to the greenest environments also have lowest levels of health inequality related to income deprivation (Mitchell and Popham, 2008). The inequality in mortality is lower in populations living in the greenest areas. However, green space is not equally available to all of the population, with poorer neighbourhoods often lacking in green space or with poorly maintained or vandalised green areas. The benefits of increases in physical activity and improved mental health only arise where the green space is high quality, accessible and safe (Croucher et al, 2007).

According to several reviews, access to green spaces and nature has been shown to positively affect mental health, possibly through reducing stress and through providing a distraction and distancing ourselves from the everyday activities (HCN, 2004; Pretty et al., 2005; Lavin et al, 2006). Additionally, green spaces have a positive effect on promoting social interaction and cohesion (Greenspace Scotland, 2008).

Conversely, restricted access to green spaces has been associated with poorer mental health (Guite et al, 2006; Kuo 2001). Residents in urban social housing who had views of trees and open spaces demonstrated a greater capacity to cope with stress compared to those who did not have such access (Kuo, 2001). Older people in particular benefit from such access (Orsega-Smith et al, 2004). Access to green space also has an accentuated positive effect on physical health for those from low income groups (Mitchell et al, 2008).

However, in the UK, those who live in disadvantaged areas are less likely to benefit from green spaces and parks (Lavin et la, 2006). According to a UK report on urban green spaces (Department of Transport, 2002), in the 100 most deprived authorities, 40% of parks were in decline and 88% of parks that were already assessed as being in poor condition were in further decline.

A negative impact on health regarding the social impact of green space is a community's perceived risk of crime, in particular fear from assault or violence (Croucher et al, 2007). This fear manifests itself in a reduced ability to accrue the positive benefits to mental health from accessing green spaces (Croucher et al, 2007).

The urban environment and climate change impacts

There are two particular aspects of climate change which are likely to impact significantly on the urban environment and disproportionately on the disadvantaged; increasing temperature and flood risk.

Increasing temperatures
Exposure to heat is a cause of morbidity and mortality in the urban environment, and heat stress is a condition that can cause illness and death. Human exposure to excessively warm weather, especially in cities, is an increasingly important public health problem. Harlan (2006) examined heat-related health inequalities within one city in order to understand the relationships between the microclimates of eight diverse urban neighbourhoods, population characteristics, thermal environments that regulate microclimates and the resources people possess to cope with climatic conditions. Statistically significant differences were found in temperatures between the neighbourhoods during the entire summer, which increased during a heat wave period. Lower socioeconomic and ethnic minority groups were more likely to live in warmer neighbourhoods with greater exposure to heat stress. High settlement density, sparse vegetation, and having no open space in the neighbourhood were significantly correlated with higher temperatures. People in warmer neighbourhoods were more vulnerable to heat exposure because they had fewer social and material resources to cope with extreme heat. Interestingly this mirrors the case previously proven about the inequitable impacts of cold weather on residents.

In terms of population effects at a settlement level, older people, children and infants are more

susceptible to prolonged exposure to heat (RCEP, 2007). There may also be an uneven distribution in heat in relation to income, with more wealthy residents tending to live in areas with more micro-climate moderation through being less low-lying and having a greater proportion of green space.

Flooding
Urban flooding from sea level rise and fluvial inundation will present an increasing risk to health. Health effects from flooding include drowning, injuries, infectious diseases, stress and loss of essential urban services. In terms of health inequality, the effects of flooding can be particularly devastating to already socially vulnerable populations such as children, older people and/or disabled people, ethnic minorities and those with low incomes (WHO, 2003b).

A study in the United Kingdom (Walker et al., 2003) found that for England, living in the tidal floodplain had a clear relationship with deprivation. Of the population within the tidal floodplain, there were eight times more people in the most deprived decile compared to the least deprived. In contrast, for the fluvial floodplain, there was an inverse relationship with deprivation, although of lesser strength, with a higher proportion of the floodplain population in the more affluent compared to the more deprived deciles. For Wales, the pattern of social distribution was less distinct but showed some similarities to England.

Discussion

Potential of using spatial planning to mitigate inequalities caused by urban form

Spatial or built environment factors which affect health unevenly across the socio-economic spectrum tend to compound the effect of exiting social and economic determinants. They also reflect the much bigger policy context, spatial planning, in which land use, transport and development policies are shaped. In other words, strategic decisions determining urban form can affect a person's proximity to facilities, green space and their viable option of modes of transport. This effects the determinants of mental and physical health in places where people live and work.

So what can be done?

An illustration of the effect of proactive town planning can be found in the German city of Freiburg where existing trends towards a more car orientated and dispersed society have been reversed. Freiburg has, for the last 40 years, pursued a committed, progressive and comprehensive land use / transport strategy based on walking, cycling and public transport. People on all incomes have moved away from car use and been given the freedom to travel around the city, giving equal access to jobs and housing in a healthier environment free from the dominance of the car. Recent urban development in the new neighbourhood of Vauban has established extensive virtually car-free areas, where children can play freely and community is strengthened.

Freiburg went down this route, not due to a specific vision of a public health outcome, but due to a quest for improved quality of life within the local constraints imposed by its setting. Being surrounded by the Black Forest, not only would physical growth of the city encroach on the forest, but the forest was already, in the 1970s, starting to show damage from acid rain caused by pollution - much of it from road transport.

In the absence of such specific circumstances, other tools need to be brought in. Health equity checks could be one mechanism applied to both strategic plans and neighbourhood proposals to ensure that health inequalities are not introduced or exaggerated. One approach could be through bringing greater health and health inequality focus into Strategic Environmental Assessments, or through Health and Equality Impact Assessments.

A useful example of good practice can be found in Whitechapel, London. A physical masterplan underwent a Sustainability Assessment which included an Equality Impact Assessment. This identified lower life expectancy and vulnerable groups as a key inequality issue and recommended actions to reduce inequalities. These included improving outdoor space and indoor leisure facilities to make them inclusive and safe for all – including minority ethnic groups who have tended to use them less and those with ill-health.

Questions remain about the role of the built environment in the causal chain. Does the built environment acts a confounder in the relationship between health and deprivation, or *vice versa*?

At the WHO Collaborating Centre for Healthy Urban Environments, we feel is important to keep the evidence base and potential resultant actions close together in our research. As such, the next stage in this research would be to conduct a systematic review of the literature attempting to locate better quality evidence and also to yield some case studies, where these could be authoritatively evaluated. Case studies are a very valuable way of communicating with the policy and practice communities.

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Appendix: Search strategy

This review was extracted from a larger report that sought to provide a brief overview of the major health challenges and risks in urban settings (Grant at al. 2009). All evidence relating to disparities between population groups was extracted.

Due to the timeframe and resources available, the original study was not a systematic review of the literature. In the main, sources reviewed were meta-studies, reviews of the literature and reviews of reviews. Where particularly relevant, seminal peer review articles and key national and international reports published by noted agencies in the field of health and the built environment have also been included.

The search strategy was a filtered snowball technique. Early searches advised later search decisions, searches were extended through following citations until a point of saturation was reached when additional searches did not further enrich the literature already obtained. Filtering was applied such that literature relevant to health and the urban environment but without a spatial planning dimension was excluded, such as literature on (noise or air pollution) emissions from specific plant or processes. The initial search strategy was limited by the following:

‒   Years; 2005-2009
‒   Humans only
‒   Published in the English language
‒   Reviews and meta-studies only

Search terms: health, environment, transport, green space, urban design, urban servicing, air quality, air pollution water pollution, physical activity, social pathologies, mental health, air pollution, noise exposure, injuries and accidents, urban form and crime.

Primary data sources: CBA abstracts, Encyclopaedia of Life Sciences, Geobase, GreenFILE, Science Citation Index, Science Direct, Social Sciences, Citation Index and the Cochrane library.

Primary websites for reports: Department of Health, UK; National Institute of Clinical Excellence; Department for the Environment, Food and Rural Affairs, UK; South West Public Health Observatory; Department for Transport, UK and the World Health Organisation.

Some material lying outside the search parameters, such as refereed articles, has been included where it has been cited by items recovered using the initial search items and it is relevant to the study.

Many existing studies shedding light on health risk in the urban environment do not meet the medical professions' requirements for robust clinical and quantitative evidence. This can result in a tendency to discount a range of in-depth and rich qualitative studies. Such research is important for analysing and explaining relationships in the urban system and has been included where relevant.

Additionally, a bibliography resource, related to the effect of the built environment on health, which is currently under development by the WHO Collaborating Centre for Healthy Urban Environments, commissioned by the Department of Health, was used to identify key literature.

This material was supplemented by new literature added when a briefing note was prepared for the WHO European Healthy Cities Network annual meeting in Sandnes, Norway in 2010. This was not a further comprehensive trawl through the literature but rather a brief snapshot of key interactions and effects of elements of the built environment on health equity.

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