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# Pedestrian experiences of rental e-scooter use and parking

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**ABSTRACT**

The study explores pedestrian experiences of shared e-scooters in relation to safety and comfort, and issues of discrimination, considering disability as an important dimension. It differentiates between the views of those who have ridden e-scooters and those who have not. It draws on a survey ($N = 643$) and walk-along interviews ($N = 9$) as part of an evaluation of the West of England rental e-scooter trial. Participants expressed strong feelings from experiencing crashes or witnessing near-misses. Disorderly parking is particularly challenging for partially sighted people and people with balance issues. Participants noted that there is little e-scooter parking infrastructure, and this results in pedestrian space infringement. Also, the appropriateness, respect for, and enforcement of rules were questioned by the participants. We conclude that equitable city access is not possible without the provision of appropriate space, rules, and rule enforcement for e-scooters, and these need to be addressed quickly given e-scooter rental scheme popularity.

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E-scooter; micromobility; urban mobility; walking; walkability; cities for people

## 1. Introduction

Rental e-scooters are a recent and growing addition to the transport mix. In the United States, shared dockless e-scooters began operating in 2018 and there were over 70 million trips made in 2019 (National Association of City Transportation Officials (NACTO) and Better Bike Share Partnership 2022).

Research has focussed on user demographics and usage patterns (Christoforou et al. 2021; Mitra and Hess 2021), safety outcomes (The European Transport Safety Council (ETSC) and The Parliamentary Advisory Council for Transport Safety (PACTS) 2023) and users' experiences (James et al. 2019; Speak et al. 2023).

The narrative of operators, who compete for market share, emphasises positive valorisations of e-scooters, including their convenience, spontaneity in relation to decisions about whether to use them, the ease of access they provide, their contribution to climate action, and their playfulness. However, Wallius et al. (2022, 94) identify tensions between playfulness and 'several key aspects of civic life, including safety, urban accessibility, privacy and privatisation'.

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Some deployments became controversial in relation to pedestrian safety, walking experience, and use of public space (Louvet, Lagadic, and Krier 2019, based on interviews with local authorities and operators in France; Gössling 2020, based on media analysis; Guide Dogs 2022, based on a survey of people with sight loss). In Paris, for instance, an article in Le Figaro states that 'In a few months, e-scooters went from being seen as an eco-friendly mode of transport to a scourge' (Négroni 2019; first author translation). This controversy is supported by emerging evidence about barriers created for walkers and detriment to the walking experience (James et al. 2019, based on a survey and observational study of the generality of the issue of footway blocking due to e-scooters; Guide Dogs 2022; Speak et al. 2023, which uses a mixed methods approach and demonstrates that e-scooters exacerbate the issue of conflicts between users of urban space).

The place of e-scooters within different types of infrastructure, particularly footways, is contested. In New Zealand for instance, 42% of riders and 73% non-riders ($N = 341$) thought footways were not suitable for riding, even though such usage is permitted (Fitt and Curl 2020). Although 42% of rider-respondents thought e-scooters unsuitable for footway use, 90% of them had ridden on the footway during their last trip, and 51% did not use the carriageway at all.

Sherriff et al. (2021) undertook surveys in Manchester, UK, the location of one of the UK e-scooter trials. Their study focussed mainly on the use of e-scooters and they used surveys, interviews and reference group discussions. Safety issues were mentioned in interviews sometimes. In one of the reference groups, discussion focussed on issues for disabled people, which identified that the greatest challenge to disabled people posed by e-scooter is their use on footways. Footways were identified as already an 'over-burdened' space, e-scooters are quiet, and an e-scooter approaching from behind is a problem. Parked e-scooters on the footway were identified as a trip hazard and a potential source of obstruction.

Despite concerns about the effects of rental e-scooters on pedestrians, research on the interactions between e-scooters and pedestrians, and especially disabled pedestrians, remains limited. Only Sherriff et al. (2021) and Guide Dogs (2022) deal explicitly with issues linked with disability, with the latter limited to the issue of visual impairment. This is an issue, especially given the important role of urban environments in supporting walking and the need to minimise barriers to access, which are most acutely felt by disabled people (Equality and Human Rights Commission 2017).

The rules around the use of rental e-scooters are likely to continue evolving (Gössling 2020) and hence further research will help inform developments. In the UK, e-scooter usage has been lawful only in trials in England (Department for Transport, UK Government 2023). They may be used on the carriageway and in cycle tracks but not on footways. The UK Parliament Transport Committee consulted stakeholders representing street users. The committee concluded that, were e-scooters to be more widely legalised, impacts on pedestrians would need to be minimised and they would require monitoring, regulation, and enforcement (Transport Committee - House of Commons, UK Parliament 2020).

A national evaluation of the English e-scooter trials (Arup and NatCen Social Research 2022) suggested there is a perception of low levels of safety when walking near e-scooters especially amongst older people, but no significant difference was found in perceptions of safety between disabled and non-disabled people.

This study aims to develop a deeper understanding of pedestrian's, and especially disabled pedestrian's, experiences of rental e-scooters, while differentiating between the views of those who have ridden e-scooters and those who have not.

The study was carried out as part of a wide ranging and in-depth evaluation of the West of England e-scooter trial that significantly supplements the national evaluation. The West of England trial has been by far the UK's largest trial scheme in terms of usage with 3,681 e-scooters and 509,226 rides in Bristol and Bath in October 2022 (Chatterjee et al. 2023). In total, the evaluation examined safety, interactions between e-scooters and vehicles, usage patterns, mode shift, carbon emissions and parking.

Two theoretical models have helped inform the approach to the study. Firstly, the Social Model of Disability, which frames disability as the result of the interactions between an individual with impairments and the barriers they encounter that limit their ability to participate (Oliver 2013). Second, the Social Model of Walkability, which posits that perceptions or experiences mediate the relationship between the street environment and walking behaviour (Bozovic et al. 2021). Both frameworks emphasise the importance of understanding barriers, and in this case the ways e-scooters may produce barriers to walking. Hence, the focus of the research has been on understanding how barriers are created, and how they are then perceived. For the purposes of this paper, we use the term walking to encompass the use of mobility aids (e.g. manual or powered wheelchair, long cane).

The research questions are as follows:

(1) What are the levels of safety, comfort and discrimination perceived by pedestrians in relation to e-scooters and their use?
(2) How do pedestrians' perceptions and experiences of e-scooters and their use influence walking behaviour?

We used two data collection approaches. Firstly, we undertook surveys (an online survey and an on-street intercept survey with a common set of questions) in Bristol and South Gloucestershire to understand pedestrians' thoughts in relation to safety, comfort and discrimination. We refer to these as the *Experience Surveys*. Secondly, we undertook *Walk-along Interviews* with mainly disabled people to gather an in-depth understanding of the issues and barriers they perceive and experience. The Experience Survey partially acted as a recruitment method for the Walk-along Interviews.

We present the methodology in Section 2, and this is followed by the results in Section 3, and a discussion of the results in Section 4. We conclude in Section 5.

## 2. Methodology

The approach to gathering data to understand pedestrians' perceptions of e-scooters combined two methods: surveys and interviews.

The purpose of the surveys (an online survey and an on-street intercept survey, referred to as the *Experience Surveys*) was to gather data on the extent to which people feel safe and comfortable around shared e-scooters, and the aspects of their operation and use that might make them feel unsafe or uncomfortable. It gathered pedestrians' and e-scooter riders' views on whether the operation and use of e-scooters is discriminatory, whether respondents experience any discrimination and whether they think others

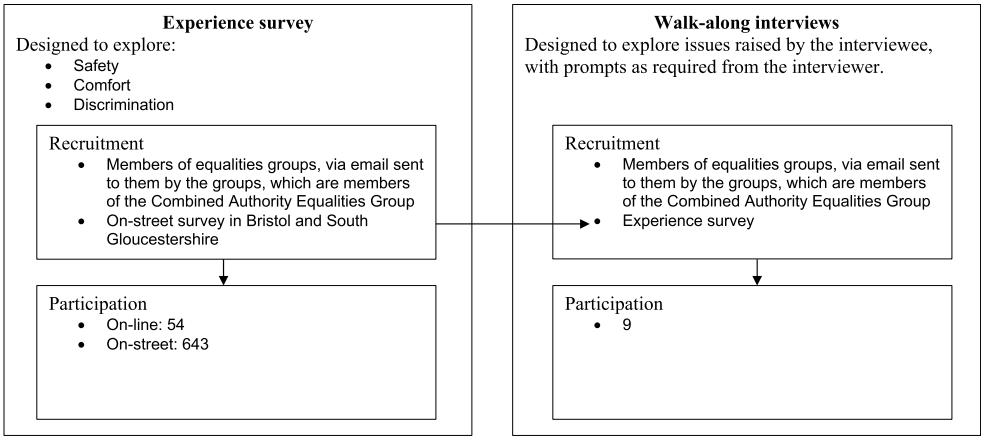


**Figure 1.** Schematic diagram of the methodology.

may experience discrimination. In addition, the survey gathered information (not reported here) on reasons for shared e-scooter use, journey purposes, whether more access opportunities were created by e-scooters, and reasons why riders may feel unsafe.

*Walk-along Interviews* were designed to gather an in-depth understanding of pedestrians' experiences in relation to e-scooters. The aim of the walk-along interviews was to explore participants' experiences of walking or using a wheelchair or other mobility aid in encounters with e-scooters and their riders. The interviews were undertaken after the analysis of the experience survey data, and as a way of further deepening understanding of pedestrians' experiences as revealed in the survey. Each of the two methods is described in turn.

Figure 1 presents a summary of the methodology.

## 2.1. Experience surveys (online and street intercept)

### 2.1.1. Participants

An Equalities Group was established by the West of England Combined Authority to help guide action in relation to the e-scooter trial (and this has subsequently been expanded to cover all the Combined Authority's transport planning work). That group has representatives from local authorities, the emergency services and the following: Bristol Disability Equality Forum; Bristol Physical Access Chain; Bristol Sight Loss Council; Bristol Walking Alliance; Guide Dogs for the Blind Association; Pocklington Trust (a blind and partially sighted people's charity); Royal National Institute of Blind People (RNIB); and South Gloucestershire Over 50s Forum. An email drafted by the research team was distributed by these representative groups to its members asking people to take part in the online survey.

In addition, an on-street survey gathered a sample of respondents from people walking on streets in central Bristol and on Gloucester Road in Filton, South Gloucestershire. Participants included a mixture of e-scooter users, who were requested to participate after just having completed a ride, and people who had not used an e-scooter.

In total, 643 responses were gathered to the Experience Surveys, 54 from online distribution and 589 from on-street intercepts. Table 1 shows the gender, age category,

**Table 1.** Experience survey respondents' demographic characteristics versus e-scooter use.

| | | Used an e-scooter | | | | | |
|---|---|---|---|---|---|---|---|
| Characteristic | Category | No | Yes | Percentage Yes | No response | Total | Percentage |
| **Gender** | Female | 150 | 81 | 35.1 | 0 | **231** | **35.9** |
| | Male | 174 | 144 | 45.3 | 0 | **318** | **49.5** |
| | Agender, non-binary, other definitions | 24 | 11 | 30.6 | 1 | **36** | **5.6** |
| | Not declared | 13 | 5 | 8.6 | 40 | **58** | **9.0** |
| **Age** | 18–29 | 171 | 163 | 48.7 | 1 | **335** | **52.1** |
| | 30–59 | 112 | 66 | 37.1 | 0 | **178** | **27.7** |
| | 60+ | 68 | 6 | 8.1 | 0 | **74** | **11.5** |
| | Not declared | 10 | 6 | 10.7 | 40 | **56** | **8.7** |
| **Ethnicity** | Black and Minority Ethnic | 118 | 69 | 36.7 | 1 | **188** | **29.2** |
| | Other ethnicity or not declared | 39 | 19 | 19.4 | 40 | **98** | **15.2** |
| | White | 204 | 153 | 42.9 | 0 | **357** | **55.5** |
| **Disability** | Has at least some difficulties with one or more of: walking / seeing / hearing / remembering or concentrating | 140 | 53 | 27.3 | 1 | **194** | **30.2** |
| | No difficulties declared in aspects noted above | 221 | 188 | 41.9 | 40 | **449** | **69.8** |
| **Total** | | **361** | **241** | **37.5** | **41** | **643** | **100** |

Note: the percentage answering in the affirmative is for the row (e.g. 35.1% is 81 out of 231 females).

ethnicity, and disability status of the respondents against whether the respondent declared they had used a shared e-scooter. It is discussed more fully in the results section.

### 2.1.2. Measures

The appendix provides the survey questionnaire outline. The surveys included levels of agreement on a five-point Likert scale (Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree) with the following statements. The questions referred to the name of the e-scooter operator, which, at the operator's request, is replaced by [trial] in this write-up and across all our research outputs:

- *I feel safe around people riding [trial]e-scooters*
- *I feel comfortable walking around people riding [trial] e-scooters*
- *I feel comfortable walking around parked e-scooters*
- *I feel discriminated against by the deployment of [trial] e-scooters*
- *I feel that the deployment of [trial] e-scooters might discriminate against others*

Follow-up questions inquired about the reasons for not feeling safe or comfortable, reasons for thinking the scheme discriminates against them or others, and demographic groups who the respondent might feel were discriminated against. The questionnaire gathered demographic data including disability status using the Washington Group Short Set questions identifying possible functional difficulties related to walking, seeing, hearing, or remembering and concentrating (Washington Group on Disability Statistics 2017). We describe respondents as disabled if they declared having at least some difficulty with at least one of these attributes.

### 2.1.3. Procedure

A link to the online survey was distributed by the representative groups noted above to their membership lists. The survey was replicated on-street by intercepting pedestrians

in Bristol and South Gloucestershire on five days: Tuesday 7th June 2022, Tuesday 14th June 2022, Saturday 18th June 2022, Thursday 30th June 2022, and Saturday 2nd July 2022. The locations were chosen to reflect a diversity of possible users and journey purposes mainly in the centre of Bristol (where most e-scooter activity is concentrated) and included locations at: Broadmead (a commercial and shopping area); University of Bristol (Queens Road at The Triangle, a shopping and university area); Stokes Croft (Cheltenham Road, a local focal point); Temple Meads (Temple Gate, near the main Bristol railway station); and Filton (Gloucester Road, a local shopping street).

The surveys were administered by eighteen trained surveyors recording responses via a tablet into the online survey form. Eight surveyors worked simultaneously, with oversight and support provided on-site by the first and third authors.

The first three days of surveys covered four locations each. The process was adjusted throughout the data gathering process to increase data gathering efficiency and ensure appropriate conditions and breaks for the surveyors. Two long shifts in the morning and the afternoon were adapted to create three shorter shifts targeting busy times of the day. The locations surveyed were adapted during the survey to maximise the response rate, with Broadmead replacing Stokes Croft and the final two days being carried out exclusively at Broadmead.

## 2.2. Walk-along interviews

### 2.2.1. Participants

Participants were recruited by two methods. Firstly, there was a recruiting question to the Walk-along Interviews as part of the online and street intercept surveys, with 103 respondents indicating willingness to take part. Secondly, a further email was distributed on behalf of the research team by the representative groups on the Combined Authority Equalities Group. People with and without disabilities were eligible, but the approach was designed to ensure a predominance of people with disabilities.

Eight survey respondents and four people who heard about the interviews through the Equalities Group expressed interest in participating. Nine interviews were finally completed. Four interviewees were aged 30–59 and five were older than 60. Three participants identified as female, and six as male. Two participants (both aged 30–59) were not disabled, while the other seven indicated impairments: three participants could not walk (two used electric wheelchairs and one a manual wheelchair), one participant had a lot of difficulty walking and seeing (used walking sticks), one had a lot of difficulty seeing and used a long cane, one reported multi-level mechanical disabilities, chronic pain, and fatigue, and one reported some difficulty walking.

Table 2 summarises the nine participants' gender, age, reported difficulty, and the mobility aid used. It is discussed more fully in the results section.

### 2.2.2. Measures

The measures were verbatim responses to experiences while walking, with prompts provided by the interviewer (first author). Participants were invited to choose the area of the city through which they would like to walk, and the duration of the walk. The responses were set against the environment in which the interviews took

**Table 2.** Walk-along interviewees' gender, age, reported difficulty and mobility aid.

| Pseudonym | Gender | Age group | Reported difficulty | Mobility aid |
|---|---|---|---|---|
| Sam | Male | 30–59 | Cannot walk | Electric wheelchair |
| Jesse | Male | 30–59 | Cannot walk | Manual wheelchair |
| Alasdair[a] | Male | 60+ | A lot of difficulty walking and seeing | Walking sticks |
| Jay | Male | 60+ | Cannot walk | Electric wheelchair |
| Alex | Male | 30–59 | [None] | [None] |
| Attila | Male | 60+ | Some difficulty walking | [None] |
| Fran | Female | 60+ | Multi-level mechanical disabilities, chronic pain and fatigue | [None] |
| Nicole | Female | 30–59 | [None] | [None] |
| Anna[b] | Female | 60+ | A lot of difficulty seeing | Long cane |

[a]Sit-down interview.
[b]Contribution by email.

place. Five participants chose to walk in central Bristol, one in Cotham, and one in Kingswood. Figure 2 shows the approximate areas covered by the seven walk-along interviews.

### 2.2.3. Procedure

Eight interviews were undertaken in October and November 2022, with one person preferring to submit comments via email, and the other sat with the interviewer. Both participants who chose not to walk had good reasons: one was partially sighted and described navigating her environment as 'terrifying', the other had acute difficulties with both seeing and balance. Their inputs were accepted on the basis we wanted to be as inclusive as possible and to value the experiences of everyone, especially those who struggle the most.

A Participant Information Sheet was issued and, to respect possible difficulties people might have walking, it highlighted that, while the interviews were expected to last 20–45 min, participants were welcome to stop the interview at any point. After answering any questions about the process, the interview time and place were agreed, with the aim that both would be as convenient as possible for the participant.

On the day of the interview, participants were given a brief reminder of the process, asked to sign a consent form, and provided with a £20 shopping voucher as appreciation

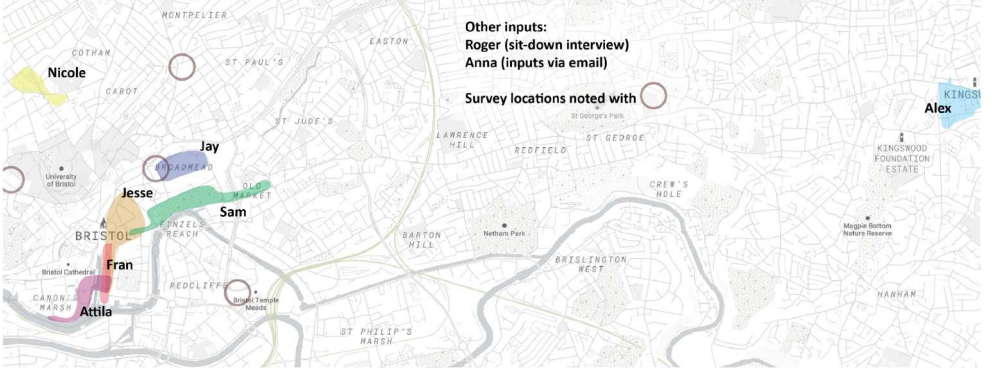


**Figure 2.** Areas covered by the Walk-along Interviews.

for their time. Following that, they were invited to guide the researcher along the route of their choosing and to comment on any aspect of e-scooters and their use that was relevant or of interest to them. The researcher primarily listened to participants' comments and asked follow-up questions as required. Prompts, if required, were as follows:

- What are your top of mind thoughts and feelings about e-scooters
- What are the benefits as you see them of e-scooters?
- Who benefits and in what ways do they benefit?
- Are e-scooters problematic? If so, in what ways are they problematic?
- Who may be impacted as a result of these problems?
- Thinking about e-scooters when they are being ridden: what are the issues with them?
- Who is impacted by these issues?
- Thinking about e-scooters when they are parked, what are the issues with them?
- Who is impacted by these issues?

On the day of the interview, participants were given a brief reminder of the process and invited to guide the interviewer (first author) along the route of their choosing.

### 2.3. Analysis

For the Experience Surveys, descriptive statistics were used to characterise perceived levels of safety, comfort and discrimination across the demographics. The sampling was purposive rather than random and hence the basis for inferential statistical analysis does not hold.

Walk-along interviews were transcribed and analysed qualitatively using deductive content analysis (Elo and Kyngäs 2008) and NVivo software (QSR International 2021). The first author coded the transcripts, and the third author separately coded two randomly selected interviews. Codes were compared, a discussion took place and differences were rationalised. Next, the relationships between the themes were examined by the first author, with emphasis on how e-scooter riding and parking mediated participants' perceptions or experiences between the street environment and walking behaviour. Hence, the focus of the research has been on understanding how barriers are created, and how they are then perceived.

### 2.4. Ethical approval

The methods presented above were approved by Chatterjee et al. (2023).

## 3. Results

We first describe the results of the Experience Surveys, and then of the Walk-along Interviews.

### 3.1. Experience surveys

Table 1 shows the nature of the sample obtained from the on-street intercept survey and the online survey. 35.9% of the sample identified as female and 49.5% as male, and hence

males are over-represented. A sizeable proportion identified as agender, non-binary, or other definitions (5.6%) or did not declare (9.0%).

The sample over-represents young people (18–29-year olds, 52.1% of respondents) and just under a third (27.7%) of the sample was aged 30–59, with 11.5% being aged 60 or over, with again a substantial minority not declaring their age (8.7%). While our age classifications did not exactly match the 2021 census classifications, census data for Bristol (Office for National Statistics, no date) indicates 34.1% of the population is in the three age brackets from 16 to 34 inclusive, and 12.9% in age bracket 65 and over. This indicates we have over-sampled young people and under sampled older people.

The census indicates the population of Bristol is 81.1% white and this compares with the sample proportion of 55.5%, hence our survey over-represents non-white ethnicities. While the census asks whether people are limited in their abilities 'a lot' or 'a little', our measure for disability was more detailed. The census indicates that 80.6% of the population are not disabled, with our sample proportion of 69.8% indicating we have over-sampled disabled people.

Table 3 presents the result of the questions about feeling safe and (separately) feeling comfortable around people riding e-scooters and feeling comfortable around parked e-scooters.

Most respondents felt safe (56% overall; 75% for users, 47% for non-users) and comfortable (58%; 77% for users, 48% for non-users) around e-scooters. However almost a third of respondents felt unsafe (29%; 15%, 37%) or uncomfortable (27%; 12%, 37%). The majority of respondents (73%; 92%, 63%) felt comfortable around parked e-scooters, with 13% (3% for users, 19% for non-users) feeling uncomfortable.

Respondents were able to provide free-text responses. The reasons for not feeling safe were stated as mostly relating to riders' behaviours, with words used by several respondents including 'people who ride too fast / too close to them and 'recklessly'. These behaviours can compound issues of inadequate infrastructure and respondents noted words and phrases such as 'narrow footway', 'absence of cycleways', presence of 'shared space' and hostile traffic conditions, with words and phrases such as 'high speeds', 'heavy traffic' and 'multiple lanes'. One respondent said, for instance:

> I have observed too many [e-scooter] users swerving between the road and pavement [i.e. the footway] to avoid red lights, joining pedestrians as they cross the road and cutting them / us up. (F, 60+, not disabled)

> E-scooters terrify me as they have no noise and most people who seem to ride them have no care for other pedestrians. (F, 30–59, blind)

Table 4 summarises perceptions relating to discrimination by demography.

A minority (15%) of 594 participants who answered this question felt discriminated against by the trial, 18% were neutral or did not answer, and 67% did not feel discriminated against. The respondents were however more likely to think that the scheme might discriminate against *others* (27% agreed or strongly agreed to that statement). A slightly higher proportion of disabled people reported feeling discrimination than non-disabled people (21% versus 13%).

For those who felt discrimination, most of them (103 out of 156, 66%) noted issues from the pedestrian perspective, including for instance that e-scooters cause risk, discomfort or obstructions. Conditions for walking were noted by 74% of those older

**Table 3.** Pedestrians' perceptions of safety and comfort by demography.

| | Demography | | Users | | | | | Non-users | | | | | Total | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Statement | Dimension | Levels | N resp. | N agree | % agree | N disagree | % disagree | N resp. | N agree | % agree | N disagree | % disagree | N resp. | N agree | % agree | N disagree | % disagree |
| X1 'I feel safe around people riding [trial] e-scooters' | Age | 18–29 | 125 | 99 | 79% | 12 | 10% | 208 | 121 | 58% | 53 | 25% | 333 | 220 | 66% | 65 | 20% |
| | | 30–59 | 56 | 38 | 68% | 12 | 21% | 122 | 50 | 41% | 53 | 43% | 178 | 88 | 49% | 65 | 37% |
| | | 60+ | 2 | 1 | [NA] | 1 | [NA] | 72 | 19 | 26% | 44 | 61% | 74 | 20 | 27% | 45 | 61% |
| | Disability | Disabled (see definition) | 40 | 23 | 58% | 8 | 20% | 154 | 67 | 44% | 59 | 38% | 194 | 90 | 46% | 67 | 35% |
| | | Non-disabled | 146 | 116 | 79% | 19 | 13% | 261 | 129 | 49% | 95 | 36% | 407 | 245 | 60% | 114 | 28% |
| | Gender | Agender, non-binary, other definitions | 10 | 4 | [NA] | 3 | [NA] | 25 | 9 | 36% | 9 | 36% | 35 | 13 | 37% | 12 | 34% |
| | | Female | 58 | 39 | 67% | 8 | 14% | 172 | 77 | 45% | 71 | 41% | 230 | 116 | 50% | 79 | 34% |
| | | Male | 115 | 95 | 83% | 14 | 12% | 203 | 108 | 53% | 65 | 32% | 318 | 203 | 64% | 79 | 25% |
| | Total | | 183 | 138 | 75% | 25 | 14% | 400 | 194 | 49% | 145 | 36% | 583 | 332 | 57% | 175 | 30% |
| X2 'I feel comfortable walking around people riding [trial] e-scooters' | Age | 18–29 | 67 | 54 | 81% | 6 | 9% | 84 | 47 | 56% | 16 | 19% | 151 | 101 | 67% | 22 | 15% |
| | | 30–59 | 38 | 27 | 71% | 6 | 16% | 65 | 37 | 57% | 22 | 34% | 103 | 64 | 62% | 28 | 27% |
| | | 60+ | 0 | 0 | [NA] | 0 | [NA] | 45 | 9 | 20% | 34 | 76% | 45 | 9 | 20% | 34 | 76% |
| | Disability | Disabled (see definition) | 20 | 14 | [NA] | 4 | [NA] | 85 | 35 | 41% | 38 | 45% | 105 | 49 | 47% | 42 | 40% |
| | | Non-disabled | 87 | 68 | 78% | 9 | 10% | 115 | 60 | 52% | 36 | 31% | 202 | 128 | 63% | 45 | 22% |
| | Gender | Agender, non-binary, other definitions | 3 | 1 | [NA] | 1 | [NA] | 13 | 7 | [NA] | 1 | [NA] | 16 | 8 | [NA] | 2 | [NA] |
| | | Female | 32 | 26 | 81% | 3 | 9% | 80 | 32 | 40% | 36 | 45% | 112 | 58 | 52% | 39 | 35% |
| | | Male | 70 | 54 | 77% | 8 | 11% | 97 | 55 | 57% | 31 | 32% | 167 | 109 | 65% | 39 | 23% |
| | Total | | 105 | 81 | 77% | 12 | 11% | 190 | 94 | 49% | 68 | 36% | 295 | 175 | 59% | 84 | 28% |
| X3 Comfortable walking around parked e-scooters | Age | 18–29 | 68 | 66 | 97% | 2 | 3% | 81 | 53 | 65% | 10 | 12% | 149 | 119 | 80% | 12 | 8% |
| | | 30–59 | 36 | 31 | 86% | 1 | 3% | 64 | 42 | 66% | 8 | 13% | 100 | 73 | 73% | 9 | 9% |
| | | 60+ | 0 | 0 | [NA] | 0 | [NA] | 45 | 22 | 49% | 17 | 38% | 45 | 22 | 49% | 17 | 38% |
| | Disability | Disabled (see definition) | 20 | 17 | [NA] | 1 | [NA] | 83 | 41 | 49% | 26 | 31% | 103 | 58 | 56% | 27 | 26% |
| | | Non-disabled | 86 | 82 | 95% | 2 | 2% | 112 | 79 | 71% | 11 | 10% | 198 | 161 | 81% | 13 | 7% |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gender | Agender, non-binary, other definitions | 3 | 2 | [NA] | 0 | [NA] | 14 | 3 | [NA] | 3 | [NA] | 17 | 5 | [NA] | 3 | [NA] |
| | Female | 32 | 31 | 97% | 1 | 3% | 79 | 52 | 66% | 12 | 15% | 111 | 83 | 75% | 13 | 12% |
| | Male | 69 | 64 | 93% | 2 | 3% | 93 | 63 | 68% | 16 | 17% | 162 | 127 | 78% | 18 | 11% |
| Total | | 104 | 97 | 93% | 3 | 3% | 186 | 118 | 63% | 31 | 17% | 290 | 215 | 74% | 38 | 13% |

Notes: NA: Percentage values not included when $N \leq 20$; Note that the table does not include missing responses (a) to each statement – i.e. in which no level of agreement was indicated; and (b) to the corresponding demographic dimension – for instance, 3 users did not indicate their age, and are therefore not represented in the age split.

**Table 4.** Perceptions relating to discrimination by demography.

| | Demography | | Users | | | | | Non-users | | | | | Total | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Statement | Dimension | Levels | N resp. | N agree | % agree | N disagree | % disagree | N resp. | N agree | % agree | N disagree | % disagree | N resp. | N agree | % agree | N disagree | % disagree |
| X4 Feeling discriminated | Age | 18–29 | 125 | 4 | 3% | 105 | 84% | 207 | 33 | 16% | 138 | 67% | 332 | 37 | 11% | 243 | 73% |
| | | 30–59 | 55 | 8 | 15% | 41 | 75% | 120 | 20 | 17% | 74 | 62% | 175 | 28 | 16% | 115 | 66% |
| | | 60+ | 2 | 1 | [NA] | 1 | [NA] | 70 | 23 | 33% | 31 | 44% | 72 | 24 | 33% | 32 | 44% |
| | Disability | Disabled (see definition) | 40 | 7 | 18% | 30 | 75% | 150 | 32 | 21% | 73 | 49% | 190 | 39 | 21% | 103 | 54% |
| | | Non-disabled | 145 | 7 | 5% | 118 | 81% | 259 | 46 | 18% | 178 | 69% | 404 | 53 | 13% | 296 | 73% |
| | Gender | Agender, non-binary, other definitions | 10 | 2 | [NA] | 8 | [NA] | 24 | 3 | 13% | 10 | 42% | 34 | 5 | 15% | 18 | 53% |
| | | Female | 58 | 4 | 7% | 46 | 79% | 169 | 35 | 21% | 108 | 64% | 227 | 39 | 17% | 154 | 68% |
| | | Male | 114 | 7 | 6% | 93 | 82% | 202 | 35 | 17% | 129 | 64% | 316 | 42 | 13% | 222 | 70% |
| | | Not declared | 3 | 1 | [NA] | 1 | [NA] | 14 | 5 | [NA] | 4 | [NA] | 17 | 6 | [NA] | 5 | [NA] |
| | Total | | 185 | 14 | 8% | 148 | 80% | 409 | 78 | 19% | 251 | 61% | 594 | 92 | 15% | 390 | 66% |
| X5 Are others discriminated against | Age | 18–29 | 125 | 20 | 16% | 73 | 58% | 207 | 45 | 22% | 99 | 48% | 332 | 65 | 20% | 172 | 52% |
| | | 30–59 | 56 | 18 | 32% | 28 | 50% | 122 | 38 | 31% | 49 | 40% | 178 | 56 | 31% | 77 | 43% |
| | | 60+ | 2 | 0 | [NA] | 1 | [NA] | 71 | 33 | 46% | 22 | 31% | 73 | 33 | 45% | 23 | 32% |
| | Disability | Disabled (see definition) | 40 | 12 | 30% | 18 | 45% | 153 | 48 | 31% | 57 | 37% | 193 | 60 | 31% | 75 | 39% |
| | | Non-disabled | 146 | 28 | 19% | 85 | 58% | 258 | 72 | 28% | 119 | 46% | 404 | 100 | 25% | 204 | 50% |
| | Gender | Agender, non-binary, other definitions | 10 | 4 | [NA] | 3 | [NA] | 25 | 8 | 32% | 8 | 32% | 35 | 12 | 34% | 11 | 31% |
| | | Female | 58 | 12 | 21% | 28 | 48% | 171 | 45 | 26% | 79 | 46% | 229 | 57 | 25% | 107 | 47% |
| | | Male | 115 | 22 | 19% | 71 | 62% | 203 | 63 | 31% | 83 | 41% | 318 | 85 | 27% | 154 | 48% |
| | | Not declared | 3 | 2 | [NA] | 1 | [NA] | 12 | 4 | [NA] | 6 | [NA] | 15 | 6 | [NA] | 7 | [NA] |
| | Total | | 186 | 40 | 22% | 103 | 55% | 411 | 120 | 29% | 176 | 43% | 597 | 160 | 27% | 272 | 46% |

[NA] displayed if total <20

Notes: NA: Percentage values not included when $N \leq 20$; Note that the table does not include missing responses (a) to each statement – i.e. in which no level of agreement was indicated; and (b) to the corresponding demographic dimension. NA: Percentage values not included when $N \leq 10$.

than 30, compared to 49% for those aged 18–29. They were also more frequently noted by disabled respondents (73% vs 60% for non-disabled respondents).

When participants thought that the scheme discriminated against others, they cited most often disabled and older people (66% and 53% respectively of mentions). Other groups mentioned included children and young people (36%), people on low income (13%), and pregnant women (11%). The respondents cited possible discrimination against disabled and older people at similar rates regardless of age or gender.

The main reason why respondents reported that other people might be discriminated against was safety (78 responses, noted by 49% of the participants who felt others were discriminated against). The other reasons noted were also predominantly from the pedestrian perspective, including obstructions caused by parked e-scooters, riders' behaviours causing discomfort, or issues connected with the use of public space.

### 3.2. The walk-along interviews

The content analysis suggested three themes as follows:

- The ways e-scooter usage influences pedestrian experiences
- Factors contributing to issues for pedestrians
- Broader thoughts about e-scooters

#### 3.2.1. The ways e-scooter usage influences pedestrian experiences

All participants noted disrespect for rules as being an issue and stressed particularly that users ride on footways, despite not being allowed to, and that parking is generally disorderly. The participants described three negative impacts on walking experiences as follows: creation of barriers to access, a sense of risk, and a sense of loss of pedestrian space. One participant also noted that e-scooters contribute to streets looking unkempt or disorderly.

The creation of **barriers to access** includes the ways in which e-scooters make it difficult or impossible to walk to a destination, mostly by blocking off a part of the footway. Participants often considered other pedestrians' needs or remembered having witnessed other people struggle, as in the quote below.

> I noticed because he was on two sticks […] walking down Blackboy Hill and he actually had to turn sideways to walk down the public footpath. And I've seen often people having to walk into the road in order to get along, in other words putting themselves at severe risk. (Alasdair, difficulties walking and seeing)

**A sense of risk** characterised the reports of participants who had witnessed or experienced crashes or near-misses. Anna, partially sighted, has been '*knocked in [her] back*' by a rider. Fran has '*seen four elderly pedestrians [having] to jump out the way and […] three [e-scooters] racing each other*.' Alasdair recalled being hit on the footway and his helplessness, as a pedestrian. He also noted the absence of registration numbers on e-scooters. Trial e-scooters have registration numbers, but it is not clear whether he had encountered a trial e-scooter but could not see the number (he is sight impaired), or whether the incident involved an illegal e-scooter.

> I've been hit by an e-scooter [while walking on the footway]; […] the handlebar caught me on my side. I turned round and yelled, and he just carried on. […] No. I didn't report it. I

> mean, the point is, there is no registration number on an e-scooter and if there were I couldn't see it anyway. (Alasdair, difficulties walking and seeing)

Both Anna and Alasdair, who are partially sighted, described parked e-scooters as potential threats. Alasdair knows that he cannot see a parked e-scooter outside his narrow cone of vision and imagines he would probably fall if he walked into one, as he struggles with balance. Anna, on the other hand, used the word 'terrifying':

> Negotiating my neighbourhood, as described, is terrifying because too often these scooters are just thrown on the ground. (Anna, partially sighted)

**The sense of loss of pedestrian space** refers to footways not being perceived as safe spaces anymore. Participants described being forced to move out of the way as in the quotes below.

> Well especially at pedestrian crossings, because you're concentrating on the pedestrian light, you're not always aware of an e-scooter coming towards you [on the footpath] or overtaking you because you only get a limited amount of time to cross the road. […] I would say it's dangerous, but it's also stressful. (Jay, electric wheelchair user)

> […] more often they keep their momentum and just carry through […]. I'm generally the one who stops first and gives them space. (Sam, electric wheelchair user)

It is interesting to note how frequently participants spoke of other people's experiences. Participants typically thought about disabled people or parents with prams.

> I've seen mothers with pushchairs had to really move over to let the e-scooter get by. This, unfortunately, personally I feel that the misuse far outweighs the correct usage. (Fran, multi-level mechanical disabilities, chronic pain and fatigue)

> And also, another thing is, you know, you see elderly people, you know, might see the husband pushing his wife in an ordinary wheelchair. Again, you know, they're the sort of people who do suffer, you know. (Jay, electric wheelchair user)

> I wouldn't say every day but every second day at least I see something which is frightening. Not for myself […] but for example elderly people it can be kind of threatening I would say. (Attila, some difficulties walking)

### *3.2.2. Factors contributing to issues for pedestrians*

Participants spoke about four topics that may contribute to the problems they had observed: inappropriate infrastructure; lack of regulation; lack of enforcement; and insufficient rider training and rider ability.

**Inappropriate infrastructure:** participants had a certain sympathy with riders using footways, given the limited availability of cycle tracks. They also expressed ideas around e-scooter usage compounding existing issues such as narrow footways. For instance:

> My complaints are more about the built environment infrastructure, like the pavements [i.e. footways] and the cars parked on the pavements […] (Sam, electric wheelchair user)

This comment provides a backdrop to e-scooter riders using footways, which may be already narrow and/or obstructed, a point made, for instance, by Alasdair.

> [Many] premises have now been given permission to put tables and chairs outside their premises. That takes away a lot of the public footpath. Then there are things like A-

> boards […]. There are street signs. There's litter bins. There's commercial, sometimes domestic, waste bins and bags. […] All these other things had already happened before e-scooters came along so they could see what the situation was before they actually had to add their devices to the problem. (Alasdair, difficulties seeing and walking)

**Lack of regulation:** participants talked about rules that are inappropriate or absent, often associating this idea with a need for enforcement. Several participants spoke of the need to regulate parking and have designated parking areas. Parking for the e-scooter trial is in fact geofenced to specific allocated parking areas but there are no visible indications of this on the ground. In participants' experiences, e-scooters often seemed to be scattered and left in a disorderly manner.

> […] there should be various e-scooter points […] – like you have with the bicycles. People can – they can lock their bicycles away on bike racks but there's nothing for e-scooters. (Jay, electric wheelchair user)

**Lack of enforcement** was noted by five participants in relation to rider behaviour and parking, as illustrated by the quotes below.

> But what I don't understand is why people who do this [park badly] cannot be sanctioned, in other words cannot be, for example, banned from using a scooter for a month. I mean, the software must allow that […]. I would like to be assured that [the trial operator] […] is able to track that back to the renter and penalise that renter and enforce. (Alasdair, difficulties seeing and walking)

> The police don't do anything, nothing, I don't wholly blame the police, they've got a lot of work, they're very understaffed and they have a lot of major crimes and they have to prioritise. (Fran, multi-level mechanical disabilities, chronic pain and fatigue)

**Lack of rider training and rider ability** was noted by participants who doubted that riders' have an adequate knowledge of the Highway Code, or an ability to steer an e-scooter effectively and safely. This is compounded by the perception that the e-scooter is a relatively powerful vehicle. Some participants had also seen riders who they thought looked too young to have a driving licence.

> If you've never used an electric wheelchair or an electric scooter around the area, somebody from shop mobility would show you how to do […]. But you don't have any of that [training] with e-scooters. People can just pick them up and don't quite know how they go about it. (Jay, electric wheelchair user)

> There is a kind of logic that says if you've got your driving licence, you're okay to drive […] but there are plenty of times I've seen people swerving all over the place and I think they haven't been trained. (Alex, non-disabled)

> They have to have a provisional driver's licence. […] All you need to do is apply for a provisional driving licence, get it and then you've got this e-scooter. (Fran, multi-level mechanical disabilities, chronic pain and fatigue)

### *3.2.3. Broader thoughts about e-scooters*

Some participants spontaneously highlighted positive qualities of the shared e-scooter scheme, such as providing a convenient and relatively cheap mode of transport or providing an alternative that feels safer than walking at night for some people (especially

women). Two participants also thought that e-scooters could benefit people with some impairments, hence creating new mobility possibilities:

> I said to [my partner] 'they'd be really handy for me if I was in the centre because I can get the bus into the centre because I can walk a little bit, if I wanted to go to a museum or up to the downs or something. The downs is rubbish for access. […] so I was thinking 'oh, I could take an e-scooter and have a tour of Bristol' for as long as I can stand […] (Jesse, manual wheelchair user)

> I think also if you have impaired mobility but could walk a little bit […] maybe an e-scooter would be good because you could then go further, it would broaden your horizons and you would feel more satisfied with life and your mental health would be better from not being so stuck in that position of not being able to go very far. (Fran, multi-level mechanical disabilities, chronic pain and fatigue)

Four of the participants also questioned the advertised positive environmental benefits of e-scooter use, noting that e-scooter trips were not necessarily substituting trips that would have been driven.[1]

> I think the argument has been to get more people out of cars, but I cannot see too many people using an e-scooter for a journey that they would use for the distance of a car but I could well be wrong. (Sam, electric wheelchair user)

> From the environmental point of view, yes, it's better than driving a vehicle, but it's known that it has actually reduced the walking, people being active, which is a serious no no. (Fran, multi-level mechanical disabilities, chronic pain and fatigue)

Some participants also thought there was a certain carelessness amongst riders, and two participants noted the vehicle is virtually silent. Two participants talked about the broader topic of the ethics of use of public space, asking who has the ultimate responsibility over riders' misbehaviours, and questioning the rationale that allows a private company to take up space in the public domain.

> [The Council] has given licence to a private organisation like [the trial operator] to actually take up another massive, massive piece of that public domain. [But] there are people that need to use it and it's absolutely fundamental to getting around. Remember that Bristol has styled itself as a walking city and if we're making it more difficult for people to walk, it's actually blowing a hole in its own policy. […] However positively we feel about this, we are not in the business of saying, 'Here's our city. Use it any way you want to make money.' That is not acceptable. There has to be regulation and the regulation has to suit the city and its citizens, not [the trial operator]. (Alasdair, having difficulties walking and seeing)

## 4. Discussion

This study has undertaken surveys and walk-along interviews to develop understanding of pedestrian experiences of rental e-scooters. The discussion is structured around the two research questions, followed by a summary of the strengths and limitations of the research.

### *4.1. Pedestrian perceptions of safety, comfort and discrimination*

The first research question was 'What are the levels of safety, comfort and discrimination perceived by pedestrians in relation to e-scooters and their use?'

While just over half of respondents felt safe and comfortable around e-scooters that were being ridden, there was a large minority, around a third who did not feel safe or comfortable. Nearly three-quarters of respondents felt comfortable around parked e-scooters indicating that there appear to be fewer issues of comfort with parked as compared with ridden e-scooters.

Perhaps unsurprisingly, three-quarters of those who had ridden e-scooters felt safe around e-scooters that were being ridden by others compared to just over half of respondents who had not ridden e-scooters. Few previous studies considered differences in perceptions of e-scooters depending on whether people have used e-scooters. James et al. (2019) found however similar differences to ours with 76% non-users feeling unsafe around dockless e-scooters, compared with 24% of users.

In relation to the issue of discrimination, just under one in seven people suggested they felt discriminated against by the deployment of e-scooters, with twice that proportion suggesting that e-scooters discriminate against others. This suggests either a good deal of social awareness, or perhaps a projection of issues on to others as a way of making a comment on e-scooter deployment. However, overall there is little difference in the feelings of discrimination between disabled people and people who are not disabled.

The specific issue of conditions for walking being a factor in discrimination was cited by three-quarters of people aged 30 and over, but by only half of people aged 29 and under. This therefore hints at a difference in perception based on age. There was a more modest difference in conditions for walking being a factor in discrimination based on disability status (cited by nearly three out of four disabled people against 6 in 10 non-disabled people).

This indication that older people and disabled people perceive more issues with e-scooters than other people is consistent with the UK national evaluation of e-scooter trials. Our finding of a lesser difference between disabled and non-disabled people's perceptions is also consistent with the national evaluation which found no significant difference in perceived safety between disabled and non-disabled people (Arup and NatCen Social Research 2022).

Our findings are also in line with the testimonies from organisations representing older people and disabled people (Guide Dogs 2022; Transport Committee - House of Commons, UK Parliament 2020) and (Fitt and Curl 2020). There is evidence in media reporting of issues, and the reporting is based on information from representative organisations.

In sum, literature on safety, comfort and discrimination associated with e-scooter schemes is relatively limited. The findings from this study align with reported issues about shared e-scooter schemes from a pedestrian perspective, especially relating to older and disabled people (Transport Committee - House of Commons, UK Parliament 2020).

### 4.2. Influence of perceptions and experiences on walking behaviour

The second research question was 'How do pedestrians' perceptions and experiences of e-scooters and their use influence walking behaviour?'. This is where our study has added value in comparison with the extant literature.

The walk-along interviews provided wide ranging perspectives including comments that would be expected, but also a range of extended thinking about the concept of introducing a new mode into an established urban area.

Participants demonstrated a range of emotional responses to the impacts of e-scooters which went as far as being 'terrified'. These responses arose from either observing or experiencing crashes or near-misses, with the silence of the e-scooter being cited as a contributory factor from some participants.

In relation to parked e-scooters, participants thought parking was disorderly and often blocked or partially blocked the footway. These issues were exacerbated particularly for those who were partially sighted people, and this was compounded if the person also had balance issues.

These findings are in line with, but add depth to, previous research. James et al. (2019) undertook observational studies of parking that were descriptive and quantitative, rather than discussing the impacts of observed parking practices with disabled people. Speak et al. (2023) note an exacerbation of conflicts, but the sample was limited to staff and students at a university.

The behaviour of e-scooter riders was discussed in the context of the apparent absence of appropriate rules, disrespect for rules that did exist (e.g. riding on footways), and lack of enforcement. This is a deeper analysis than offered by Sherriff et al. (2021), whose respondents identified issues when footway riding occurred, but did not extend into discussions of the rider behaviour. Participants' observations of the footway riding ban not being respected align with the concerns organisations shared with the UK Parliament Transport Committee (Transport Committee - House of Commons, UK Parliament 2020).

There were questions raised about rider training and rider ability, with an overarching question being around who it is who takes ultimate responsibility for controlling riders' behaviours. While Fitt and Curl (2020) used Social Practice Theory to construct and analyse their survey of 341 users, they focussed on the transport geographical issues and did not draw out practice implications in relation to training, for example.

Concerns about behaviours were part of a wider concern frequently expressed about other public realm users. Participants frequently considered other users and their potential difficulties, such as parents with pushchairs. The net of concern was cast very wide by the participants with some expressing sympathy for e-scooter riders stemming from the lack of infrastructure provided for them, with this being the root of the cause of the infringement of pedestrian space. Furthermore, participants recognised the value of e-scooters as a convenient, cheap mode that may feel safer than other transport modes from a personal security point of view for some users. It was also noted that e-scooters may benefit people with impairments.

At a broader level, participants questioned the levels of mode substitution from other modes, noting that little to no mode substitution from the car would render environmental benefits questionable. There were also concerns about the principle of an e-scooter rental scheme generating income from consuming space within the public highway.

### 4.3. Strengths and limitations

This study contributes evidence about pedestrian experiences of e-scooters. This is needed and particularly important at a time when decisions about the long-term future of rental e-scooter schemes and the legal status of private e-scooters in the UK are being considered. It explores the reasons pedestrians may feel unsafe, uncomfortable,

or discriminated against and provides an analysis of pedestrians' experiences gathered through walk-along interviews with disabled and non-disabled participants.

The study has four limitations. Firstly, the data collection for the survey was not a random sample and hence this has limited the inferences that can be drawn. Second and so far as the survey was concerned, disabled people were considered as a single group, however it is important to acknowledge heterogeneity of impairments and/or mobility devices used. Third, the sample size of nine for the walk-along interviews was relatively small. However, the interviews have elicited a wide range of responses and insights of value. Fourth, we did not include participants unable to provide informed consent and hence we have not accounted for the views of children, young people, and people with learning difficulties, who might have specific perspectives that need to be understood.

### 4.4. Future research

The rapid increase of rental e-scooter schemes has potentially created disruptive and unsettling interactions between e-scooter riders and pedestrians, and changes in the way public spaces are being used. Future research should (a) investigate experiences controlling for both age and disability, including children and people with learning difficulties; (b) examine different geographical locations and policy contexts; and (c) use mixed methods to better understand the magnitude of the possible issues experienced, the underlying factors, and the consequences.

## 5. Conclusion

The study examines the effects of rental e-scooters on pedestrian experiences, especially for disabled people, while differentiating between the views of those who have ridden e-scooters from those who have not.

A large minority of around a third of respondents did not feel safe or comfortable around e-scooters that were being ridden, but there are fewer issues with comfort around parked e-scooters. Those who had ridden e-scooters felt safer and more comfortable than other pedestrians. Just under one in seven people suggested they felt discriminated against by the deployment of e-scooters, with little difference between disabled people and non-disabled people. Conditions for walking were cited as a factor in discrimination by older people more than younger people, and by disabled people more than non-disabled people.

Participants expressed emotions including, at the extreme, being terrified. These feelings are born of experiencing crashes or witnessing near-misses. The disorderly nature of parking caused footways to be partially blocked and this is particularly challenging for those who are partially sighted or have balance issues. There were many comments from participants about the need for appropriate rules, respect for rules, and appropriate rule enforcement. Participants also expressed concerns about the level of rider training and ability.

Participants recognised a general absence of infrastructure for e-scooter riders, with this resulting in pedestrian space infringement and its consequences, noted above. Some participants also thought that e-scooters may be of benefit for people with impairments.

Our findings are important in the context of the rapid expansion of rental e-scooter schemes. The study contributes original insights into pedestrians' perspectives regarding rental e-scooter deployment. Our findings suggest the following areas need to be addressed in the future deployment of e-scooters:

- The provision of appropriate space within the public realm for e-scooters. This includes:
  - A comprehensive network of cycle tracks separated from both motor traffic in carriageways and pedestrians on footways. Cycle tracks are the only space besides carriageways that e-scooters are allowed to use in the trials. Provision of cycle tracks is limited in the UK to date, but is improving. Such networks would reduce the inclination e-scooter riders may have for illegally using the footway as opposed to the carriageway, which is the only other space legally available to them to use.
  - Parking space within clearly delineated bays in either the carriageway or the footway. If in the footway, parking should be so positioned as to leave sufficient room for pedestrian movement with no possibility of spill over beyond the parking boundary.
- The enforcement of rules of use.
- The development of better rider training to develop better abilities amongst e-scooter riders.
- An exploration of developments in e-scooter design in ways that people with impairments can then benefit themselves from e-scooter use.

These aspects are important areas where improvement is required to ensure equity in access to a city.

## Note

1. The wider evaluation found about two-thirds of e-scooter trips were replacing walking, cycling and bus use with about one-third replacing car, taxi and ride-hailing (Chatterjee et al. 2023).

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## Appendix. Survey questionnaire outline

### *Questions about safety, comfort and discrimination*

1. To what extent do you agree with the statement 'I feel safe around people riding Voi e-scooters'? 5-point Likert strongly agree to strongly disagree
2. 1b. Could you tell us why you don't feel safe around people riding Voi e-scooters? Narrow footpaths / People riding too fast /People riding too close to me / People swerving / Other (please specify)
3. To what extent do you agree with the statement 'I feel comfortable walking around people riding Voi e-scooters'? 5-point Likert strongly agree to strongly disagree
4. 2b. Could you tell us why you don't feel comfortable walking around people riding Voi e-scooters? Narrow footpaths / People riding too fast /People riding too close to me / People swerving / Other (please specify)
5. To what extent do you agree with the statement 'I feel comfortable walking around parked e-scooters'? 5-point Likert strongly agree to strongly disagree
6. 3b. Could you tell us why you don't feel comfortable walking around parked e-scooters? Risk of tripping and falling / Others risk tripping and falling / It causes a barrier / It causes a barrier to others / It makes me feel annoyed / Other (please specify)
7. To what extent do you agree with the statement 'I feel discriminated against by the deployment of Voi e-scooters'? 5-point Likert strongly agree to strongly disagree
8. 4b. What is/are the main reason(s) for feeling discriminated against? People riding cause risk to my safety / People riding cause discomfort / Parked scooters cause obstructions / E-scooters use public space / E-scooters are too expensive / E-scooters are unavailable in certain areas / E-scooters cannot be used without drivers' license / Other (please specify)
9. To what extent do you agree with the statement 'I feel that the deployment of Voi e-scooters might discriminate against others'? 5-point Likert strongly agree to strongly disagree
10. 5b. What is/are the main reason(s) for that? People riding cause risk to my safety / People riding cause discomfort / Parked scooters cause obstructions / E-scooters use public space / E-scooters are too expensive / E-scooters are unavailable in certain areas / E-scooters cannot be used without drivers' license / Other (please specify)
11. 5c. Could you tell us which group(s) of people is/are discriminated against? Tick all the relevant categories. (11 categories)
12. Have you ever used a Voi e-scooter in Bristol/ South Gloucestershire/ Bath? Yes / No

## Questions for those who have not written

1. To what extent do you agree with the statement 'I would be keen to try riding a Voi e-scooter'? 5-point Likert strongly agree to strongly disagree
2. 7b. Could you tell us why you wouldn't be keen to try riding a Voi e-scooter? I don't feel safe riding on the streets / I don't feel I am capable of riding an e-scooter / Too expensive / I am satisfied with other transport options / Unavailable in certain areas / Unavailable without drivers' licence / Image (e.g. my friends or family would make fun of me) / Social norms (e.g. it would be frowned upon by my friends or family) / Other (please specify)

## Questions for those who have ridden

R1. How often have you ridden a Voi e-scooter? (six levels of frequency)
R2. Why do you usually use a Voi e-scooter? Select all the relevant responses. It is quick / It is cheap / the cheapest way / free / It is the most convenient way to get to my destination / It is easy to park / lock up / I enjoy using an e-scooter / There is a choice of routes / I can take routes which could not take with another mode / It is better for the environment / reduces CO2 emissions / It gives flexibility / freedom / I do not own / have access to a car / I do not own / have access to a cycle / There is no parking available / I cannot walk to my destination / Public transport services do not meet needs / No particular reason / Other (Please specify)
R3. For what purposes (to reach which destinations) do you use a Voi e-scooter? Going to or from work / Other work-related reasons e.g. travelling to a meeting outside my usual place of work / Visiting friends, family / Going shopping / Just a ride / Going to or from place of education / Going to or from a leisure activity / Going to or from a medical appointment / I'm interested in buying my own e-scooter / Other reason (please specify)
R4. How far did you travel on a Voi e-scooter the last time you rented one? Sliding scale to 20 miles
R5. How did you travel to the location where you rented a Voi e-scooter the last time you rented one? 12 options
R6. After you finished using the e-scooter, how did you travel to your next destination the last time you rented one? 12 options
R7. If you hadn't used an e-scooter on your last Voi e-scooter journey, which mode of transport would you have been most likely to use instead, if any? 12 options
R8. Has riding a Voi e-scooter allowed you to travel to places that previously you didn't, because, for example the journey was too long or expensive? Yes / No
R9. Has renting an e-scooter made it easier for you to access any of the following things? (10 journey purpose options)
R10. To what extent do you agree with the statement 'I find it easy to access a Voi e-scooter'? 5-point Likert strongly agree to strongly disagree plus don't know
R10b Can you tell us why you think it's not easy to access a Voi e-scooter? Too expensive / Unavailable in certain areas / Unavailable without drivers' licence / App is difficult to use / Other (please specify)
R11. To what extent do you agree with the statement 'Voi e-scooters contribute to my health'? 5-point Likert strongly agree to strongly disagree plus don't know
R12. To what extent do you agree with the statement 'Voi e-scooters contribute to my well-being'? 5-point Likert strongly agree to strongly disagree plus don't know
R13. Can you tell us why you think Voi e-scooters contribute to your well-being? They make it easier to reach destinations / Riding is fun / Fresh air, being outside / They give me greater independence / It's a social activity (going places with friends or family) / I don't know / Other (please specify)

## Demographics

D1. What gender do you identify as? Male / female / agender, non-binary / other / prefer not to say
D2. How old are you? 9 classes plus prefer not to say
D3. What is your ethnic group or background? 5 classes plus prefer not to say
D4. Do you identify as belonging to the LGBTIQ + community? Yes / no / ally / prefer not to say
D5. Do you have difficulty walking or climbing stairs? No difficulty / some difficulty / a lot of difficulty / cannot do
D6. Do you have difficulty seeing, even if wearing glasses? No difficulty / some difficulty / a lot of difficulty / cannot do
D7. Do you have difficulty hearing, even if using a hearing aid? No difficulty / some difficulty / a lot of difficulty / cannot do
D8. Do you have difficulty remembering or concentrating? No difficulty / some difficulty / a lot of difficulty / cannot do
D9. What is your current employment status? 11 classes
D10. What is your full home postcode? (for mapping purposes)

## Future participation

Ca. Would you be willing to participate in interviews that will be organised at a later stage, to better understand attitudes to e-scooters? Yes / No
Cb. What is the best way to contact you? (options etc.)