Developing a questionnaire to assess community severance, walkability, and wellbeing: results from the Street Mobility Project in London

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Abstract

This working paper describes the development of the survey questionnaire component of the toolkit designed to measure community severance, and assess its potential associations with transport and health. We discuss the cognitive testing and piloting of the questionnaire in two contrasting case-study areas in inner London, and present results from the survey data.

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1. Background

1.1. Definitions of community severance

Community severance is the 'barrier-effect' of the speed or the volume of traffic, or other transport infrastructure, on access to goods, services and people. Roads with high traffic levels or speeds can represent physical and psychological barriers separating local communities. The term was first used by Liepmann (1944), who described the "severance of dwelling and work-place" and the effects of this on community life. Since then, a number of definitions have been proposed. Many of these definitions were limited to the effect that severance has on travel behaviour, although some definitions did recognise that severance may have more wide-ranging effects. A recent paper reviewing the evidence up to 2010 for the impacts of community severance on health found that community severance impacts on travel behaviour, social networks, and the liveability of streets, all of which are important for health (see Figure 1 in Mindell and Karlsen 2012).

Appleyard and Lintell's seminal studies conducted in the 1970s on three streets in San Francisco, USA, demonstrated the effect of traffic on people's social networks. On average, residents on the street with light traffic had 3.0 friends and 6.3 acquaintances on their street; those on the street with moderate levels of traffic had 1.3 friends and 4.1 acquaintances; and those on the streets with heavy volumes of traffic had 0.9 friends and 3.1 acquaintances (Appleyard *et al.* 1981). As the figure in Mindell and Karlssen's study shows, the negative effects of traffic volume and speed on people's social networks may arise through multiple mechanisms including streets not being used as a social space, and the suppression of trips. Hart and Parkhurst (2011) recently repeated Appleyard's study on three streets in Bristol, UK, with similar findings. The relationship between traffic volume or speed and social networks, and the consequences for physical health and for positive mental well-being, has been recognised in a recent review (Boniface *et al.* 2015).

In light of greater recognition of the strong links between transport and health (Mindell and Karlsen 2012) and, more specifically, of the various ways in which community severance may impact on health and well-being, the development of better measures is

necessary. Street Mobility and Network Accessibility (www.ucl.ac.uk/street-mobility) is a three-year (2014-2016) research project at UCL (University College London) which aims to develop a toolkit to measure community severance at individual and area levels, such that the effects of community severance on travel mobility, health, and well-being can be assessed. The project is led by a cross-disciplinary team of UCL researchers.

The cross-disciplinary team began working together with a series of workshops to establish a framework and common language. This was summarised in a Working Paper (Anciaes 2015). As a result of the workshops the following definition of community severance was proposed:

> *Transport-related community severance is the variable and cumulative negative impact of the presence of transport infrastructure or motorised traffic on the perceptions, behaviour, and well-being of people who use the surrounding areas or need to make trips along or crossing that infrastructure or traffic (*Anciaes 2015, Anciaes *et al* 2015*).*

A separate glossary spelling out key terms used by people in different disciplines was also produced (Street Mobility and Network Accessibility 2014).

1.2. Measuring the impact of community severance on health

Community severance is often discussed by transport/planning professionals as a negative consequence of road expansion schemes, or as a positive result of schemes that aim to improve the street environment as a social space by encouraging active cycling and/or walking (e.g., road crossings, bike lanes). However community severance is rarely subject to detailed or systematic assessment in these plans. Practitioners therefore do not have the available tools to assess community severance and its potential effects on health. Evaluation of the effectiveness of interventions designed to reduce community severance, and economic appraisal of the value of interventions, are also not possible.

1.3. Aims of this paper

The Street Mobility project has various work-packages. This Working Paper describes the development of the survey questionnaire component of the toolkit designed to measure

community severance, and assess its potential associations with transport and health. Cognitive testing and piloting of the questionnaire in two contrasting case-study areas in inner London was undertaken. We also present and discuss results from the survey data.

2. Methods

2.1. Questionnaire development

a) Question selection and ordering

The questionnaire was designed to be administered to participants using pen and paper self-completion: participants would be contacted, recruited to take part in the study and left with a paper version of the questionnaire, which would then be collected in person some days later. Self-completion methods are considered the simplest and most cost-effective mode of administration for the intended end-users of the toolkit such as community groups and local government.

A literature search was undertaken in May 2014 to identify existing, validated survey questions under five broad topics: (1) individual and household demographics; (2) socio-economic status; (3) physical health and mental well-being; (4) civic/social participation, and social networks; and (5) travel behaviour/mobility around the local neighbourhood, including the volume and speed of traffic, and walkability (defined by Leslie *et al.* (2007) as *"the extent to which characteristics of the built environment and land use may or may not be conducive to residents in the area walking for either leisure, exercise or recreation, to access services, or to travel to work"*).

Where possible, questions were chosen that could be compared with those asked in existing nationally representative surveys in the UK, such as the Health Survey for England (HSE) (Mindell *et al.* 2012) and the English Longitudinal Study of Ageing (ELSA) (Steptoe *et al.* 2013). In addition to the existing questions identified in the literature search, new questions were developed from scratch because a number of themes crucial to the theoretical understanding of community severance had not been previously covered in UK or international surveys. In a small number of cases, existing questions were adapted to suit our purpose through a series of team meetings. Prior to fieldwork,

the full list of potential questions was discussed at a series of workshops, and the decision to include, exclude, or refine each question was reached by expert consensus.

Questions to measure participants' demographics, socio-economic status, well-being, and health characteristics were largely drawn from the HSE. Questions pertaining to social contacts with friends and neighbours, civic participation, and neighbourhood perceptions were taken or adapted from ELSA. Questions on travel were adapted from the National Travel Survey. Assessment of the number of flats/houses where participants knew someone on each side of the street where they lived was new, so required a new question to produce data comparable to Appleyard and Lintell's studies.

Question-ordering followed the conventional wisdom of beginning the questionnaire with straightforward questions, and grouping questions into clear themes (Krosnick and Presser 2012). To avoid participant fatigue, we aimed to produce a questionnaire that would take no longer than 20 minutes to complete.

Prior to questionnaire development, community engagement was undertaken in the local areas by the organisation Mapping for Change (MfC) to acquire diverse information from local community groups and individuals about their experiences of living on or near busy streets in the case study areas. This detailed work on-the-ground informed us that the theoretical idea of community severance would not be immediately clear or meaningful to local residents. We decided therefore to describe the study to participants as a study of "My Neighbourhood, My Streets". A full draft of the questionnaire was circulated for approval from the Street Mobility team, the partner market research agency (Accent), and an independent expert in the field before the questionnaire underwent cognitive testing. The research was approved by the UCL Research Ethics Committee (Project ID: 2832/002).

b) Cognitive testing

Cognitive testing of questionnaires involves interviewing people with the specific aim of understanding their thought processes when interpreting questions and formulating responses. Researchers use cognitive testing to ensure that survey participants interpret questions and give responses in ways that the researchers intended, leading to higher quality and more accurate data collection (Collins 2003).

Two community groups in the London Borough of Lewisham were contacted by the study team in the summer of 2014. A researcher trained in cognitive interviewing by NatCen Social Research wrote a cognitive interview probe sheet to guide the interviews. Briefly, the probe sheet is a comprehensive list of aspects of question-wording and response options which are used to explore how participants understood key concepts and terms. In order to prioritise the cognitive testing work, questions were classified for testing as: "essential" (new questions); "desirable" (questions that had been adapted from previous surveys); and "not required" (existing validated questions). Visits to Lewisham were arranged for September 2014. Guided by the probe sheet, 12 one-to-one cognitive interviews, semi-structured in nature, were conducted with adults from mixed demographic and socio-economic groups using Think-Aloud[2] and probing techniques to elicit information on overall design and, more specifically, on the wording and ordering of questions, response options, and to gauge how participants engaged with the survey task.

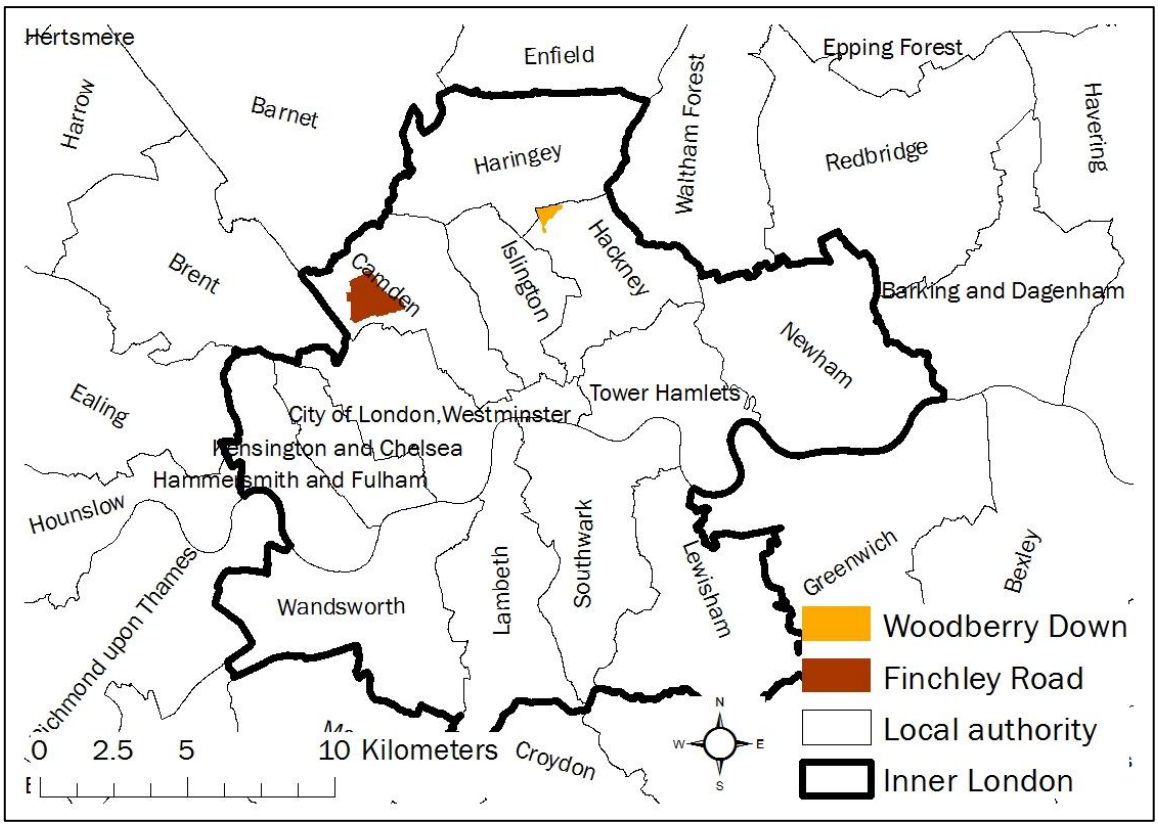
Data from the cognitive interviews was entered into a Microsoft Excel spreadsheet for framework analysis. The cognitive testing identified typing errors, additional answer options that were necessary, sections where question-wording could be improved, and parts of the questionnaire perceived by participants as repetitive. Changes were made and agreed before pilot work commenced in the first case study area.

[2] Think-Aloud techniques is a direct observation method that involves asking participants to think out loud as they are performing a task (e.g. participants are asked to say what they are thinking of when choosing a particular response to a question).

3. Case studies

Woodberry Down (hereafter referred to as WD) and Finchley Road (FR) were chosen as two contrasting case study areas in inner London (Figure 1).

Figure 1: WD and FR, two contrasting case study areas in inner London



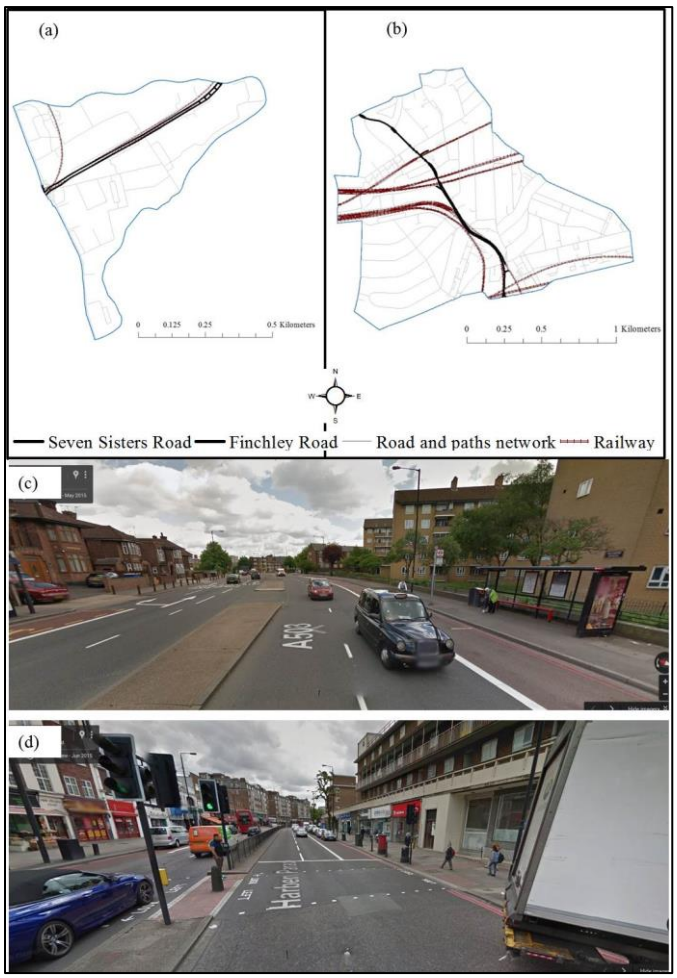
3.1. Woodberry Down

WD (Figure 2a) is a small area in the London Borough of Hackney. The area is mainly a social housing estate that was built in the 1950s and is currently undergoing a large amount of regeneration, with old blocks being demolished and new ones being built. The regeneration of WD has been controversial (Chakrabortty and Robinson-Tillett 2014). The area is bisected by Seven Sisters Road (Figure 2c), a six-lane road which is a major trunk road into the heart of London, with heavy volumes of traffic. Initial observations, however, suggested that pedestrians frequently cross the road through gaps in the traffic in accordance with desire lines. The main housing estate (Woodberry Down estate) formed a natural boundary for the case study area.

3.2. Finchley Road

FR (Figure 2b) is a much larger area in the London Borough of Camden and is quite different to WD. The area mainly comprises houses from the 19th century (many of which have been converted into apartments) and apartment blocks. Finchley Road itself (the A41) (Figure 2d) is a busy high street with many shops and restaurants (unlike Seven Sisters Road which has very few). FR was chosen as a number of advisors to the project considered it a 'gold-standard' of community severance: the dual carriageway has a number of guardrails and lowered pavements, making it impossible for pedestrians to cross the road except at designated crossing points.

Figure 2 (a) WD case study area, with its busiest road (Seven Sister Road) running through the social housing estate, and (b) FR case study area bisected by its busiest road (Finchley Road). Google Street View Image captures of the busiest road in (c) WD (May 2015 ©2015 Google), and (d) FR (June 2015 ©2015 Google)



3.3. Sampling, recruitment, and piloting

Fieldwork for the pilot studies took place in WD and FR sequentially in late 2014 to early 2015. Addresses were randomly selected from a UK database of non-commercial addresses (the small user Postcode Address File). An advance letter and information sheet, explaining the purpose of the survey, was sent to 300 addresses in WD and 450 in FR. An interviewer visited each selected address and attempted to recruit one adult member of the household, leaving the questionnaire for participants to complete in their own time, and obtained contact details. Members of the study team then contacted the first 34 and 39 participants from WD and FR respectively and arranged to collect the questionnaire in person. This provided an opportunity for researchers to discuss with participants the content of the questionnaire in detail, including clarification of any questions if necessary. 25 and 30 pilot interviews were conducted in WD and FR respectively. Each participant was given a £10 gift voucher as a token of appreciation.

Following the WD pilot study, some minor changes were made to the wording and formatting of the questionnaire prior to further pilot work in FR. Questions on the use of mobility aids and difficulties using public transport were dropped. A routing question was introduced to avoid participants' repeating information (e.g., on the speed and volume of traffic) if they lived on what they reported as being the busiest street in their local area.

Following the FR pilot study, further minor revisions were made before the questionnaire was rolled out in the main study (to be conducted in the first two case study areas). The major change involved replacing the full, 14-item version of the Warwick-Edinburgh Mental Well-being scale (WEMWBS) with the shorter, 7-item version (Short-WEMWBS, hereafter referred to as SWEMWBS). WEMWBS is used to measure positive mental well-being (Tennant *et al.* 2007). Our pilot work revealed that a significant number of participants did not complete any of the 14-items of WEMWBS, suggesting a lack of engagement with this part of the questionnaire.

We aimed to obtain survey responses from 100 participants in WD and 200 in FR. Sampling and recruitment of an additional 76 participants from WD (main-stage study) as per the pilot studies was done between March and May 2015, giving a total achieved sample of n=101 in WD. Recruitment of 179 participants in the FR main-stage study was

completed between June and August 2015, giving a total achieved sample of *n*=209 in FR.

3.4. Data management

Data from the pilot samples was entered manually; data from the main-stage samples was completed electronically by Accent and returned to the research team in a secure environment as a Microsoft Excel spreadsheet. Data was transferred into Stata (StataCorp LP, College Station, Texas, USA) for data management and analysis.

3.5. Key sections of the questionnaire covering community severance, neighbourhood social capital, and positive mental well-being

a) Community severance

Questions covering community severance included the following:

Identify barriers to walking around local area. Participants were asked whether the speed of traffic affected their ability to walk to places they would like to go to in their local area. Participants could answer 'Never', 'Occasionally', 'Often', or 'Always'. A similar question was asked about the volume of traffic. An open-ended question gave participants the opportunity to describe other barriers that they may experience walking to places in the local area.

Identify problems on the street where participants lived. Participants were asked whether any of the following were a problem on the street where they lived: (1) busy road or danger from traffic; (2) lack of crossing points; (3) crossings that do not allow adequate time to cross; (4) poor lighting, pavements or paths; (5) noise or air pollution; or (6) fear of crime.

Participants asked to rate their own street and the busiest street in their local area. For their own street, participants were asked to rate: (1) the amount of traffic ('very light', 'fairly light', 'average', 'fairly heavy', 'very heavy'); (2); the speed of traffic ('very slow', 'fairly slow', 'average', 'fairly fast', 'very fast'); and (3) how long they usually have to wait before crossing ('no wait', 'few seconds', 'half a minute', 'one or two minutes', 'a few

minutes'). These questions were repeated for what participants reported to be the busiest street in their local area.

b) Neighbourhood social capital

People's perceptions of the neighbourhood in which they live was measured by presenting participants with the following nine pairs of contrasting statements and asking them to indicate which are closer to how they feel about their local area (Breeze and Laing 2008):

- 'I really feel part of this area / I feel that I don't belong in this area'
- 'Vandalism and graffiti are a big problem in this area / There is no problem with vandalism and graffiti in this area'
- 'I often feel lonely living in this area / I have never felt lonely living in this area'
- 'Most people in this area can be trusted / Most people in this area can't be trusted'
- 'People would be afraid to walk alone in this area after dark / People feel safe walking alone in this area after dark'
- 'Most people in this area are friendly / Most people in this area are unfriendly'
- 'People in this area will take advantage of you / People in this area will always treat you fairly'
- 'This area is kept very clean / This area is always full of litter and rubbish'
- 'If you were in trouble there are lots of people in this area who would help you / If you were in trouble, there is nobody in this area who would help you'.

Each statement was scored from 1 (least positive about the local neighbourhood) to 7 (most positive), with a global score computed from the summed scores. Scores can range from 9 (those who answer least positive on every statement) to 56 (those who answer most positive to all statements).

c) Positive mental well-being

The WEMWBS was developed to capture a broad concept of positive mental well-being (Tennant *et al.* 2007). The full version contains 14 statements which cover psychological

functioning, cognitive-evaluative dimensions, and affective-emotional aspects of well-being. For each statement participants are asked to tick the box that best describes their experience over the previous two weeks, with answers on a five-point scale as follows: 'None of the time'; 'Rarely'; 'Some of the time'; 'Often'; or 'All of the time'. SWEMWBS, the shortened version (Stewart-Brown *et al.* 2009), contains the following seven items:

- 'I've been feeling optimistic about the future'
- 'I've been feeling useful'
- 'I've been feeling relaxed'
- 'I've been dealing with problems well'
- 'I've been thinking clearly'
- 'I've been feeling close to other people'
- 'I've been able to make up my own mind about things'.

The responses, numbered 1 to 5, are aggregated to form the overall score, which can range from 7 (those who answer 'Rarely' on every statement) to 35 (those who answer 'All of the time' to all statements).

4. Statistical analysis

Questionnaire development commonly involves producing an initial lengthy questionnaire, followed by the application of statistical techniques such as Rasch analysis to create and validate a shortened version that produces comparable data to the longer instrument (Stewart-Brown *et al. 2009*, Las Hayas *et al.* 2010). The first version of the questionnaire, administered in Case Study Areas 1 and 2 in the inner London area, contained a maximum of 40 items to avoid participant fatigue. Our short-term aim was to produce a shorter version of the questionnaire to be administered in Case Study Area 3 (an area outside London), to be tested against a longer instrument in Case Study Area 4.

The next section of the Working Paper describes the analysis undertaken of survey data from Case Study Areas 1 and 2 to examine the face validity of the questionnaire; thereby informing potential revision of the questionnaire prior to administration in Case Study Areas 3 and 4. Our analysis was conducted in two parts. First, we computed

descriptive statistics for demographics, socio-economic status, social/civic participation, neighbourhood social capital, positive mental well-being, general health, limiting long-standing illness, and the suite of indicators of community severance described above for the sample as a whole, and separately for the two case study areas. Secondly, we examined bivariate associations between the survey items and our developed indicators of community severance. These associations were examined for the sample as a whole, and separately for the two case study areas. For example, we were interested in comparing the prevalence of community severance across subgroups separately in each of the case study areas to explore the role of area as a source of heterogeneity in observed associations. We expected, for example, that participants in WD would report the speed of traffic (along Seven Sisters Road) as a barrier to walking, while FR participants would report the volume of traffic (along Finchley Road) as a barrier. As we will see in the next section, knowledge of the compositional and contextual differences between WD and FR informs interpretation of the associations found. Differences for categorical variables were analysed using the χ^2 test; differences for continuous variables were analysed using the *t*-test. P-values less than 0.05 have been considered statistically significant. However we also examined how practically important the associations between the survey items and the indicators of community severance appeared to be.

5. Results

The analytical sample consisted of *n=310* participants: 25 and 76 from WD (pilot and main-stage; 30 and 179 from FR (pilot and mainstage). The demographic, socioeconomic, and health characteristics, as well as the prevalence of community severance, for the whole sample, and separately for participants in the WD and the FR subsamples are shown in Table 1.

56% of the sample was female, and 35% was aged 55+ years. 23% owned their home outright / buying it with the help of a mortgage or loan, whilst 44% rented from the local government. 39% of the sample was in full-time work, 24% retired, and 6% were looking after children/home/carer. 21% had a long-standing illness or disability, and 5% rated their general health as bad/very bad. The mean SWEMWBS score was 26.3.

Generally, the analytical sample was in poorer health compared with England as a whole, but similar for positive mental well-being. Analysis of the HSE 2013 for adults (Craig *et al.* 2014) showed the following: female (51%); aged 55+ (35%); own-outright/buying their home with a mortgage or loan (67%); in paid-employment (56%); retired from paid-work (22%); looking after home or family (7%); limiting long-standing illness (24%); bad/very bad general health (7%); and mean SWEMWBS (26.1).

Table 1 shows a number of compositional differences between the two case study areas. Compared with the participants in FR, WD participants were more likely to be female, younger, rent from the local authority, be in full-time work or looking after children/home/carer than be retired, report better general health, and have higher, on average, scores of SWEMWBS. WD participants also reported higher scores on average for the number of houses/flats on either side of their street where they knew someone; but perceptions of neighbourhood social capital were less positive on average than those reported by FR participants.

Overall, 46% of participants reported both the speed and the volume of traffic as at least occasional barriers to their ability to walk to places in their local area. 14% of participants reported both the speed and the volume of traffic as “Often” or “Always” affecting their ability to walk to local places. 38% of participants reported danger from traffic as a problem on their street, with just under one-quarter reporting a lack of crossing points, and noise or air pollution, as problems.

Just over one-third of participants (37%) reported a fairly or very heavy amount of traffic on their street as a problem, whilst 28% reported a fairly or very fast speed of traffic. 31% of the 213 participants who did not live on what they considered to be the busiest road in their area reported that they avoided using that road: the most common reasons for avoidance were danger from traffic, noise or air pollution, lack of crossing points, insufficient time to cross, and preference for an alternative route.

The proportion of participants reporting the speed and the volume of traffic as at least occasional barriers to walking was similar in both study areas. Participants in WD were however more likely to cite danger from traffic, lack of crossing points, and noise or air pollution as problems on their own street. A similar finding was observed for the proportion of participants who reported a fairly or very heavy amount of traffic, and a

fairly or very fast speed of traffic as problems on their street. These results are consistent with the finding that WD participants were more likely than those in FR to live on what they themselves identified as the busiest street in their local area (51% *vs.* 17% respectively).

Looking at problems on the busiest street in their local area (irrespective of whether they lived on that street), a higher proportion of participants in FR reported fairly or very heavy amount of traffic, and a waiting time to cross longer than 30 seconds, as problems. The proportion of participants who reported fairly or very fast speed of traffic as a problem on the busiest street was similar in the two areas.

5.1 Bivariate associations between survey items and indicators of community severance

a) Identify barriers to walking

Table 2 shows the bivariate associations between the survey items and the suite of indicators of community severance identifying the following barriers to participants' ability to walk to places in their local area: the percentage of participants who reported they were often or always affected (1) by the speed of traffic, and (2) by the volume of traffic.

The proportion of participants who reported that their ability to walk to places in their local area was often or always affected by the speed of traffic was similar in the two areas (13% in WD and 14% in FR). Being aged 55+, retired, reporting bad / very bad health, having a long-standing illness/disability, and lower SWEMWBS scores were significantly associated with the speed of traffic and also with the volume of traffic as barriers to walking. Reporting bad / very bad health and being aged 55+ were associated with the volume of traffic as a barrier to walking in FR but not in WD. Participants in FR who reported the volume of traffic as a barrier to walking reported on average a higher number of flats or houses where they knew someone on their side of the street than those who did not report this barrier.

b) Identify problems on the street where participants lived

Table 3 shows the bivariate associations between the survey items and the indicators of community severance identifying the following reported problems on the street where participants lived: (1) busy road or danger from traffic; (2) lack of crossing points; and (3) crossings that did not allow adequate time to cross.

The proportion of participants who reported "busy road or danger from traffic" as being a problem on their street was significantly higher for participants in WD (55% in WD and 30% in FR). Among participants in FR, mean scores of positive neighbourhood social capital were significantly lower on average for those who reported the busy road / danger from traffic as a problem on their street. The proportion of participants who reported a lack of crossing points as being a problem on their street was significantly higher for participants in WD (38% in WD and 17% in FR): but this indicator of community severance did not vary significantly across subgroups. The proportion of participants who reported crossing points with inadequate time to cross as being a problem on their street was similar in both areas (19% in WD and 17% in FR). Participants in WD who reported looking after home / children / carer and those who meet / see their neighbours at least three times a week were more likely to report crossing points with inadequate time to cross as being a problem on their street. Being female, retired, and having a long-standing illness or disability was significantly associated with this indicator of community severance for participants in FR only.

c) Ratings of the street where participants lived and ratings of the busiest street in their local area

Table 4 shows the bivariate associations between the survey items and the following reported ratings of the street where participants lived: (1) fairly or very heavy amount of traffic; (2) fairly or very fast speed of traffic; and (3) time waiting to cross longer than 30 seconds.

Participants in WD were significantly more likely than participants in FR to rate the amount of traffic on their street as being fairly or very heavy (48% and 31% respectively); the speed of traffic as being fairly or very fast (41% and 21% respectively); and time

waiting to cross longer than 30 seconds (40% and 29% respectively). Among participants in WD, high SWEMWBS scores, more frequent contact with neighbours, and having a higher number of flats/houses where participants knew someone on the other side of their street was associated with reporting a fairly or very heavy amount of traffic. Among participants in FR, mean scores of positive neighbourhood social capital were significantly lower on average for those who reported a fairly or very heavy amount of traffic. Also for FR participants, mean scores of positive mental well-being were significantly lower on average for those who rated their street as having a fairly or very fast speed of traffic. Having a long-standing illness or disability was associated with a time waiting to cross longer than 30 seconds.

Table 5 shows the bivariate associations between the survey items and the following reported ratings of the busiest street in the participants' local area: (1) fairly or very heavy amount of traffic; (2) fairly or very fast speed of traffic; and (3) time waiting to cross longer than 30 seconds. Participants in FR were significantly more likely than participants in WD to rate the amount of traffic on the busiest street as being fairly or very heavy (79% and 66% respectively); and to report the crossing time as longer than 30 seconds (67% and 49% respectively). The proportion of participants reporting a fairly or very fast speed of traffic on the busiest street was similar. Being aged 55+, retired, and having a long-standing illness/disability were associated with a time waiting to cross longer than 30 seconds. Among participants in FR, mean scores of positive mental well-being were significantly lower on average for those rating the busiest street as having a fairly or very fast speed of traffic and a waiting time to cross longer than 30 seconds.

6. Discussion

Whilst literature reviews have found that community severance impacts on health through disruptions to travel mobility and social networks, the systematic assessment of community severance does not feature in transport planning and appraisals as practitioners do not have the tools available to assess it. As part of a Street Mobility and Network Accessibility toolkit being designed to measure community severance at individual and area levels, we have developed a survey questionnaire to produce better

measures of community severance and facilitate assessment of its associations with travel behaviour, social networks, physical health and positive mental well-being.

Development work for the questionnaire (including cognitive testing and pilot interviewing), and the data for the analyses presented in this paper, was obtained from two contrasting case-study areas in inner London selected as exemplars of community severance. WD and FR are distinctive in terms of their demographic profile and socioeconomic status: compared with residents in FR, residents in WD are younger, rent rather than own their home, and look after children/carer. In addition to compositional differences, the two areas have different built environments, including different transport infrastructure barriers: lowered pavements and guardrails in FR, and few crossing points along a busy and fast-moving six-lane road in WD. Both the compositional and contextual differences between the areas informed our interpretation of the associations between transport infrastructure, community severance, social networks, and health.

Developing a questionnaire for the systematic assessment of community severance was not an easy task. For example, although the connections between community severance and health are well-established in transport research, such connections were not immediately obvious to survey participants.

Short questionnaires go through an extensive iterative process. As part of that process, we examined the face-validity of the questionnaire by examining bivariate associations between the survey items and our newly developed indicators of community severance. Expected associations confirmed the usefulness of our chosen items, whilst null associations identified redundant items that could be dropped.

Our findings suggest that a sizeable proportion of local residents in these two case study areas experience transport infrastructure barriers to street mobility and network accessibility, including: the speed and volume of traffic as barriers to walking; a lack of crossing points; crossing points with inadequate time to cross; and noise or air pollution. As we would expect, the impacts of such barriers are unequally distributed, with older residents, retired participants, and those having a long-standing illness being most affected. Multivariate analysis using data from our four case study areas will be conducted to examine which of these influences is the key driver of community severance, or whether each contributes independently. A number of community

severance indicators showed a significant association with wellbeing, with positive mental wellbeing scores being lower for participants reporting the presence of community severance. The association with social networks however was less clear; in some cases, participants with more social contacts were more likely to report the presence of community severance. This association highlights the possibility that local residents do not suppress trips but are able to demonstrate resilience when moving around their area. Future work will investigate the extent to which our indicators of community severance are geographically clustered within the case study areas.

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TABLE 1: Characteristics and indicators of community severance for the analytical sample and the Woodberry Down and Finchley Road subsamples

Characteristics and indicators of community severance	Whole study sample (*n*=310)	Woodberry Down (*n*=101)	Finchley Road (*n*=209)
	%	%	%
Female	56	60	54
Aged 55+	35	30	38
Own outright / with mortgage	23	7	31
Rent from local authority	44	63	35
In full-time work	39	34	42
Retired	24	16	28
Looking after children / home / carer	6	14	3
Bad / very bad health	5	7	4
Long-standing illness / disability	21	29	17
Meets / sees neighbours in person ≥3 times weekly	23	32	18
Meets / sees friends and family in person ≥3 times weekly	33	35	32
	Mean (SD)	Mean (SD)	Mean (SD)
Flats/houses where participant knows someone:			
On *their side* of the street	4.5 (3.4)	4.7 (3.6)	4.4 (3.3)
On the *other side* of the street	2.5 (3.2)	3.3 (3.6)	2.2 (3.0)
SWEMWBS	26.3 (4.8)	26.7 (4.9)	26.2 (4.7)
Neighbourhood social capital	42.8 (9.0)	36.0 (5.6)	45.8 (8.6)
	%	%	%
Barriers to walking:			
At least occasionally affected by *speed* of traffic	46	45	46
Often or always affected by *speed* of traffic	14	13	14
At least occasionally affected by *volume* of traffic	46	43	47
Often or always affected by *volume* of traffic	14	13	15
Problems of own street:			
Danger from traffic	38	55	30
Lack of crossing points	24	38	17
Crossings with inadequate time to cross	18	19	17
Noise or air pollution	24	31	21
Fairly- or very-heavy amount of traffic	37	48	31
Fairly- or very-fast speed of traffic	28	41	21
Problems with busiest road:			
Fairly- or very-heavy amount of traffic	75	66	79
Fairly- or very-fast speed of traffic	53	50	54
Waiting time to cross >30 seconds	59	53	62

Abbreviations: SD: standard deviation; SWEMWBS: Short Warwick-Edinburgh Mental Well-being Scale

TABLE 2: Associations between survey items and barriers to walkability

Characteristics	Ability to walk to places that you'd like to go in your local area...					
	Often or always affected by the *speed* of traffic?			Often or always affected by the *volume* of traffic?		
	All (*n*=303)	Woodberry Down (*n*=98)	Finchley Road (*n*=205)	All (*n*=300)	Woodberry Down (*n*=95)	Finchley Road (*n*=205)
	%	%	%	%	%	%
All	14	13	14	14	13	15
Female	12	12	13	16	14	17
Aged 55+	21*	27*	18	22**	21	22*
Retired	28***	38**	25**	31***	36**	30***
Looking after children / home / carer	11	15	0	16	15	17
Bad / very bad general health	46**	29	67***	46**	29	67***
Longstanding illness	39***	34***	42***	40***	27*	50***
Meets / sees neighbours in person ≥3 times weekly	11	7	14	11	7	14
Meets / sees friends and family in person ≥3 times weekly	9	6	11	9	3*	12
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Flats/houses where participant knows someone:						
On *their side* of the street	4.8 (3.2)	4.5 (3.8)	5.0 (3.0)	5.5 (3.2)	4.3 (3.9)	6.0 (2.9)**
On the *other side* of the street	2.7 (3.2)	4.6 (3.9)	1.9 (2.5)	3.3 (3.3)	4.1 (3.4)	3.0 (3.2)
SWEMWBS	24.9 (5.1)*	25.4 (5.8)	24.6 (4.8)	24.1 (5.2)**	24.5 (6.0)	23.9 (4.8)**
Neighbourhood social capital	42.1 (7.9)	37.0 (6.6)	44.0 (7.5)	41.8 (6.3)	37.7 (2.6)	43.3 (6.6)

Abbreviations: SD: standard deviation; SWEMWBS: Short Warwick-Edinburgh Mental Well-being Scale

Table shows percentage of participants who reported being often or always affected by the speed / volume of traffic, and the mean scores of continuous variables for those who reported being often or always affected. Bivariate associations (e.g., gender differences in the % who reported being often or always affected) examined separately in the whole sample, and by case study area.

*P-value <0.05; **P-value <0.01; ***P-value <0.001

TABLE 3: Associations between survey items and reported problems on the street where participants lived

	Are any of the following a problem on your street...								
	Busy road or danger from traffic?			Lack of crossing points?			Crossings do not allow adequate time to cross?		
	All (*n*=309)	WD (*n*=100)	FR (*n*=209)	All (*n*=309)	WD (*n*=100)	FR (*n*=209)	All (*n*=309)	WD (*n*=100)	FR (*n*=209)
	%	%	%	%	%	%	%	%	%
All	38***	55	30	24	38	17	18	19	17
Female	40	57	31	27	39	21	23*	23	22*
Aged 55+	41	57	35	20	40	13	19	20	19
Retired	42	63	36	23	50	16	26*	25	26*
Looking after children / home / carer	55	71	17	25	36	0	40**	50**	17
Bad / very bad general health	47	57	38	33	57	13	27	29	25
Longstanding illness	47	59	37	31	52	14	28*	28	29
Meets / sees neighbours in person ≥3 times weekly	46	60	34	22	30	16	21	20	21
Meets / sees friends and family in person ≥3 times weekly	36	62	23	19	32	12	18	26	14
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Flats/houses where participant knows someone:									
On *their side* of the street	4.8 (3.4)	5.1 (3.7)	4.6 (3.2)	4.7 (3.4)	5.1 (3.9)	4.4 (2.8)	5.0 (3.3)	5.8 (3.9)	4.6 (2.9)
On the *other side* of the street	2.7 (3.1)	3.6 (3.6)	2.0 (2.4)	3.1 (3.4)	3.7 (3.8)	2.6 (2.8)	3.3 (3.4)	5.2 (4.0)*	2.5 (2.9)
SWEMWBS	26.4 (4.8)	27.6 (4.9)	25.4 (4.6)	26.0 (4.3)	26.5 (5.1)	25.4 (3.3)	24.8 (4.9)*	25.6 (4.8)	24.3 (4.9)*
Neighbourhood social capital	40.3 (6.7)***	37.0 (4.7)	42.8 (7.0)**	41.7 (8.6)	36.7 (4.1)	46.6 (9.1)	43.4 (10.1)	34.5 (5.8)	47.4 (9.0)

Abbreviations: SD: standard deviation; SWEMWBS: Short Warwick-Edinburgh Mental Well-being Scale

Table shows percentage of participants who reported busy road / danger from traffic; lack of crossing points; and crossings that do not allow adequate time to cross as problems on their street, and the mean scores of continuous variables for those who reported those problems. Bivariate associations (e.g., gender differences in the % who reported those problems) examined separately in the whole sample, and by case study area.

*P-value <0.05; **P-value <0.01; ***P-value <0.001

TABLE 4: Associations between survey items and participants' ratings of the street where they lived

	How would you rate the amount of traffic on your street?			How would you rate the speed of traffic your street?			How long do you usually have to wait before crossing your street?		
	Fairly or very heavy			Fairly or very fast			Longer than 30s		
	All (*n*=308)	WD (*n*=100)	FR (*n*=208)	All (*n*=306)	WD (*n*=99)	FR (*n*=207)	All (*n*=306)	WD (*n*=99)	FR (*n*=207)
	%	%	%	%	%	%	%	%	%
All	37	48	31	28	41	21	32	40	29
Female	38	51	31	30	45	22	38*	43	35*
Aged 55+	46*	60	41*	29	47	22	42*	59*	35
Retired	42	56	38	27	56	19	43*	69*	36
Looking after children / home / carer	50	64	17	60**	79**	17	37	46	17
Bad / very bad general health	47	57	38	36	57	14	40	29	50
Longstanding illness	45	55	37	38*	48	29	61***	69***	54***
Meets / sees neighbours in person ≥3 times weekly	47	67*	32	39*	57	24	39	41	37
Meets / sees friends and family in person ≥3 times weekly	33	50	24	30	56*	17	40	52	34
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Flats/houses where participant knows someone:									
On *their side* of the street	4.9 (3.4)	5.5 (3.6)	4.5 (3.2)	5.4 (3.6)**	5.8 (3.6)**	5.0 (3.5)	4.9 (3.4)	5.1 (3.5)	4.8 (3.4)
On the *other side* of the street	2.7 (3.3)	4.1 (3.9)*	1.8 (2.4)	3.2 (3.5)*	4.4 (3.9)*	2.2 (2.7)	2.8 (3.2)	3.9 (3.8)	2.1 (2.7)
SWEMWBS	26.5 (4.9)	28.1 (4.9)**	25.5 (4.7)	25.7 (5.0)	27.4 (4.9)	24.4 (4.7)**	25.7 (5.5)	26.2 (5.2)	25.5 (5.7)
Neighbourhood social capital	40.6 (7.8)**	35.8 (5.4)	43.7 (7.6)*	40.6 (7.8)**	36.5 (6.0)	43.8 (7.6)	41.6 (8.2)	36.4 (5.2)	44.3 (8.2)

Abbreviations: SD: standard deviation; SWEMWBS: Short Warwick-Edinburgh Mental Well-being Scale

Table shows percentage of participants who reported the amount of traffic on their street as being fairly- or very-heavy; the speed of traffic on their street as being fairly- or very-fast; and the length of time waiting to cross their street as longer than 30 seconds, and the mean scores of continuous variables for those who reported those problems. Bivariate associations (e.g., gender differences in the % who rated the amount of traffic on their street as being fairly- or very heavy) examined separately in the whole sample, and by case study area.

*P-value <0.05; **P-value <0.01; ***P-value <0.001

TABLE 5: Associations between survey items and ratings of the busiest street where participants lived

	How would you rate the amount of traffic on the busiest street?			How would you rate the speed of traffic on the busiest street?			How long do you usually have to wait before crossing the busiest street?		
	Fairly or very heavy			Fairly or very fast			Longer than 30s		
	All (*n*=301)	WD (*n*=97)	FR (*n*=204)	All (*n*=298)	WD (*n*=96)	FR (*n*=202)	All (*n*=294)	WD (*n*=93)	FR (*n*=201)
	%	%	%	%	%	%	%	%	%
All	75	66	79	53	50	54	59	49	67
Female	76	66	81	57	53	59	67**	56	72**
Aged 55+	84**	79	86	57	54	58	73***	77**	72*
Retired	84*	73	86	60	67	58	77**	93**	73*
Looking after children / home / carer	80	86	67	75*	79*	67	65	57	83
Bad / very bad general health	69	50	86	62	50	71	83	67	100*
Longstanding illness	75	58	88	65*	58	71*	82***	80**	84**
Meets / sees neighbours in person ≥3 times weekly	89**	90**	89	64*	62	65	69	56	79*
Meets / sees friends and family in person ≥3 times weekly	76	74	77	53	70**	44*	64	63	65
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Flats/houses where participant knows someone:									
On *their side* of the street	4.7 (3.4)*	4.7 (3.5)	4.7 (3.3)**	5.0 (3.4)**	5.3 (3.8)	4.8 (3.3)*	4.9 (3.3)**	5.4 (3.6)	4.8 (3.3)*
On the *other side* of the street	2.6 (3.2)	3.4 (3.7)	2.4 (3.0)	3.0 (3.5)*	4.0 (4.0)	2.6 (3.2)	2.4 (3.1)	3.5 (3.8)	2.1 (2.7)
SWEMWBS	26.5 (4.6)	27.6 (5.1)*	26.2 (4.4)	25.9 (4.8)	27.1 (5.1)	25.4 (4.7)*	25.6 (5.0)**	26.1 (4.9)	25.5 (5.0)**
Neighbourhood social capital	43.2 (9.0)	36.2 (5.3)	45.8 (8.7)	43.7 (9.2)	36.8 (6.0)	46.6 (8.7)	43.4 (9.1)	36.7 (6.0)	45.7 (8.9)

Table shows percentage of participants who reported the amount of traffic on the busiest street as being fairly- or very-heavy; the speed of traffic on the busiest street as being fairly- or very-fast; and the length of time waiting to cross the busiest street as longer than 30 seconds, and the mean scores of continuous variables for those who reported those problems. Bivariate associations (e.g., gender differences in the % who rated the amount of traffic on the busiest street in their area as being fairly- or very heavy) examined separately in the whole sample, and by case study area.

*P-value <0.05; **P-value <0.01; ***P-value <0.001