Evaluating active travel and health economic impacts of small streetscape schemes: An exploratory study in London

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EVALUATING ACTIVE TRAVEL AND HEALTH ECONOMIC IMPACTS OF SMALL STREETSCAPE SCHEMES: AN EXPLORATORY STUDY IN LONDON

1. HEALTH AND TRANSPORT PLANNING: THE CASE OF LONDON

Over the past century mass car ownership and use has transformed cities (Sheller & Urry, 2000; Urry, 2004; Nieuwenhuijsen and Khreis, 2016) with profound social, environmental, and health impacts (Banister, 2005; Douglas et al, 2011; Goodwin, 2012). There is increased awareness of how a societal shift from 'active travel' (walking and later cycling) to car use has led to decline in population physical activity. This is associated with increased risk of premature mortality and many chronic non-communicable diseases (Cohen et al, 2014).

In response, city authorities across the world are starting to conceptualise transport policy as fundamentally linked to the public health agenda. In the UK, regional transport authority Transport for London (TfL) has begun to focus on transport not just as creating injury and illness, but as potentially increasing health and wellbeing[1]. In 2014 TfL published its first Health Action Plan. It has since developed the 'Healthy Streets Approach', comprising tools sitting within a broader goal of encouraging planners to see health as a key goal of transport planning.

The Healthy Streets Approach (TfL, 2017) lists a set of attributes associated with streets that promote cycling and walking (including walking trip stages, particularly to reach public transport). The two key attributes are 'pedestrians from all walks of life' (inclusivity of walking behaviour) and 'people choose to walk, cycle, and use public transport' (high levels of sustainable mode use from choice rather than deprivation). TfL (2017) describes these

[1] https://tfl.gov.uk/corporate/about-tfl/corporate-and-social-responsibility/transport-and-health

outcome measures as supported by the other eight measures, which describe characteristics of the built environment that may affect people using the street.

FIGURE 1: THE HEALTHY STREETS INDICATORS (TFL 2017: 4)

Those eight indicators meld the subjective and objective, such that ‘feeling relaxed’ or ‘feeling safe’ (subjective, outcome measures) sits alongside measurable input characteristics of the built environment such as ‘shade and shelter’. Others combine the subjective and objective, such as ‘easy to cross’ (perceived ease of crossing may vary substantially by demographic factors). While each indicator may seem uncontroversial, the approach has been criticised for excluding factors important or even decisive to some groups of pedestrians, such as public toilet availability (Karlsson, 2018).

At the heart of the ‘Healthy Streets’ approach is the ambition to use street planning to radically increase mode share for sustainable and active modes; London having a target to reduce car mode share to 20% of trips by 2041. However, it remains challenging to causally link growth in active travel to changes in 'Healthy Streets' type indicators measured subjectively or objectively, despite an extensive cross-sectional literature linking 'walkability' characteristics to walking (Brookfield, 2017). Intervention studies find mixed results, with a recent systematic review concluding that while built environment infrastructure changes can increase active travel and physical activity, the evidence is inconclusive, especially for walking (Stappers et al 2018). Therefore, planners also need to develop the evidence base about the extent to which 'Healthy Streets' type interventions do increase walking and/or cycling, and hence improve health.

The method proposed here can be used to build up this evidence base. It outlines a low-cost method of estimating the impact of interventions, and hence calculating a health economic benefit (which could feed into a full cost-benefit or multi-criteria analysis). Authorities already often collect before-and-after count data on walking and cycling as part of routine scheme monitoring. Such data can become much more useful if combined with a intercept survey of users. These surveys can be conducted at low cost (the one reported here cost £5,000), making the method feasible for evaluating small-scale streetscape changes. If conducted across many schemes with varying characteristics and contexts, authorities could use the results to derive rules to apply in estimating the benefits of future active travel schemes.

2. METHODS: AN APPROACH TO EVALUATING SMALLER-SCALE ACTIVE TRAVEL SCHEMES

Traditionally transport infrastructure improvements have been made to improve conditions for existing users; primarily, time savings for drivers, ignoring induced demand (Beukers et al, 2012). However, active travel infrastructure investment often aims not (only) to improve conditions for existing walkers and cyclists, but to (i) induce new walk and cycle trips and (ii) encourage mode shift, particularly from the car. This shift in perspective is one reason for the evidence gap, as in the past transport evaluations have not been designed to collect the kind of data that local authorities need in the 'Healthy Streets' era.

The approach taken here is one way of starting to bridge the evidence gap and evaluate smaller-scale streetscape interventions. The evaluation method combines count data (often collected routinely) with small-scale new data collection, feeding subsequent uptake estimates into a government-approved model developed to estimate the health impact of changes in active travel uptake. The method is considerably less robust than using a longitudinal study to measure changes in travel behaviour and/or physical activity (see e.g. Aldred et al, 2018). However, longitudinal studies are expensive and funded rarely by research councils or transport authorities. It is unrealistic to expect these organisations to fund 'gold standard' evaluations for low-cost interventions. At present, little evaluation of such schemes is conducted beyond basic monitoring, primarily before-and-after count data. This count data does not, however, tell us about new usage or mode shift, which we would need to estimate health impacts. Uplift in pedestrian or cycle counts could instead be due to people having changed their routes to travel along an improved street. While this would suggest the street was more attractive to existing walkers and cyclists, it would not imply an increase in walking and cycling (c.f. Skov-Petersen et al, 2018).

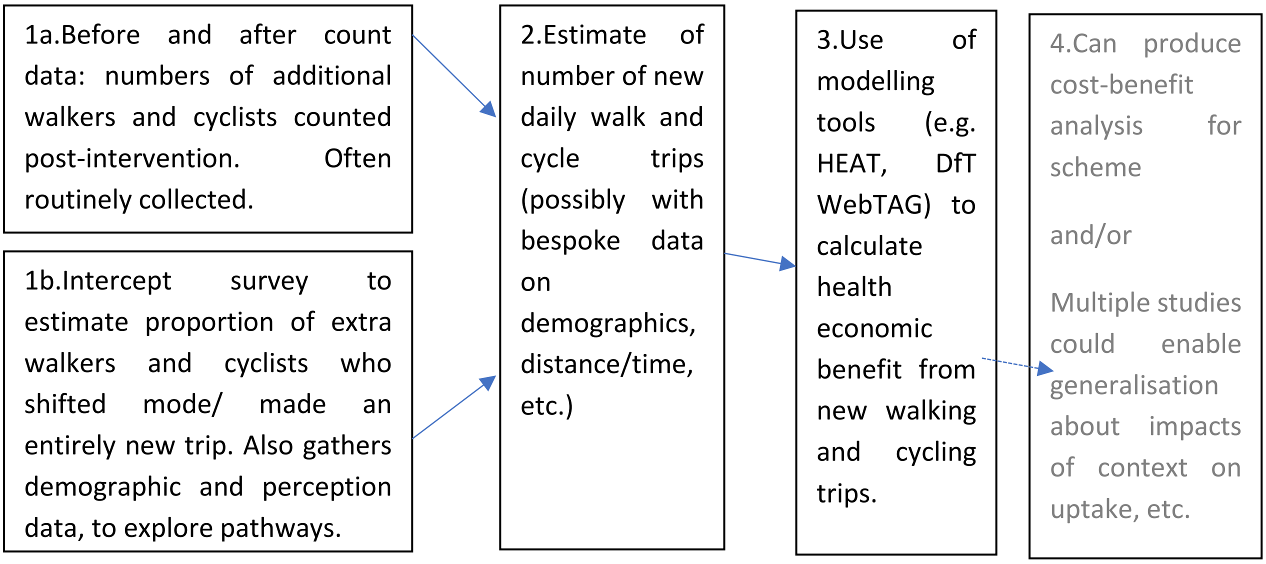

FIGURE 2: THE APPROACH TO EVALUATION PROPOSED HERE (STEP 4 NOT CONDUCTED IN THIS CASE STUDY)

The approach summarised in Figure 2Figure 3 proposes a model of evaluation which, while imperfect, is substantially better than what is currently (not) done. It combines routinely collected data (1a), a small amount of primary data collection (1b), and the use of already available modelling tools (3) to calculate health economic benefit from new walking and cycling trips. Transport authorities could use the approach in cost-benefit or multi-criteria analysis. Moreover, evaluations using this method could be routinely conducted across many schemes, enabling broader generalisations including conclusions about how context affects scheme impact within a given city, country, or region (4).

The approach involves gathering new data through an intercept survey (1b). Such surveys are used in academic and policy research to gather views of those using a facility, service, or location (Forsyth, 2010; Buck et al 2014). While the method is cheap and straightforward, asking respondents about behaviour change may yield answers reflecting preferences rather than actual behaviour. This is a broader problem with ‘stated preference’ type surveys, frequently used in transport research (Bradley, 1988). Intercept surveys do not capture non-user views (Forsyth, 2010), although how much this matters depends on the survey purpose.

Here an intercept survey is used to gather information on walking and cycling, following an intervention intended to promote these modes. Here a focus on users is defensible, especially given the survey's use alongside before-and-after count data on walking and cycling.

We suggest researchers using the approach gather information not just on reported behaviour, but also on perceptions of changes to the walking and cycling environment, helping them to develop understanding of perceived impacts of specific streetscape changes. We used questions broadly derived from the 'Healthy Streets' indicators (TfL, 2017), tailored to the study. One key change that we made compared to TfL's use of these indicators was to separate questions about walking and cycling, in asking about quality of the built environment and about safety. We thought this important as the two modes have distinct characteristics. In the UK walking is seen as much safer than cycling, despite comparable per-km risks. We further excluded questions related to indicators not affected by the intervention; specifically, shade and shelter, places to go, and places to sit.

More fundamental to this evaluation approach, however, is to ask about specific changes in behaviour related to the intervention. This data can then be combined with before-and-after count data to provide estimates of how much of an uplift in count data is due to truly 'new' trips, as opposed to people changing their route to use a more attractive street. This relies on people's beliefs about how their behaviour has changed or would change for a specific trip, based on the infrastructural changes made. However, for such small-scale interventions, this is both more appropriate and more likely to be implemented than larger-scale, more robust evaluation methods such as longitudinal household surveys.

In England, DfT have issued Active Model Appraisal Guidance (WebTAG[2]) on calculating health economic benefits from interventions that generate new active travel trips. This is relatively unusual in a global context, where transport appraisal remains dominated by traditional considerations of 'time savings' and if health impacts are considered at all, this is often limited to 'road safety'. The WebTAG guidance now includes a spreadsheet tool[3] requiring the user to input estimates of additional daily walk and cycle trips generated by an intervention. It then uses nationally-specific data to allocate uptake to different demographic groups (although the user may alternatively input bespoke values). This is important for health because older people gain more health benefits from physical activity than younger people; yet for cycling, UK uptake is concentrated among younger adults, reducing likely health benefits. The tool incorporates UK data on length and distance of walking and cycling trips, and hence does not require (but permits) entering data on these. It assumes a capped, log-linear dose-response relationship that incorporates levelling-off of physical activity benefits.

The WebTAG tool is one of a series of models developed by academics and/or practitioners to estimate health benefits of walking and cycling uptake (Mueller et al 2015). Other tools which could be used within this evaluation approach include the WHO Health Economic Assessment Tool for walking and cycling. None of these models hypothesise that an increase in walking and/or cycling is likely to be offset by decline in physical activity in other areas (the 'activitystat' hypothesis), and hence, none ask users to input data on changes in all physical activity. While the 'activitystat' hypothesis remains debated (Gomersall et al 2016), (i) it is

[2] https://www.gov.uk/government/publications/transport-appraisal-valuing-health-impacts

[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/639108/active-mode-health-benefits-worksheet.xlsx

perhaps least convincing for active travel uptake, and studies have found increases in active travel did not reduce recreational physical activity (e.g. Foley et al 2015); (ii) if models did posit activity reduction, there is no good evidence on what level of activity reduction they should use, and (iii) measuring changes in overall physical activity through post-hoc self-report is likely to have low validity, and there is no validated questionnaire to use for this.

In the case study reported here, we used a hypothetical question to ask respondents about whether they would have made the same trip if Church Street were re-opened to motor traffic. We did this because there was a gap of over 18 months between the trial intervention going in, and our intercept survey. With a shorter gap, researchers might prefer to use a more direct question about actual past behaviour (i.e. did the person make the same trip before the intervention). Following response to this question, 'behaviour changers' can then be asked how the trip did or would change; allowing the distinguishing of completely new trips and those shifted from other modes from trips where the route or destination has changed. Researchers can ask for details of the mode shift where this has occurred, which could be used to calculate other impacts; for example, WebTAG has guidance on converting a change in driving into a change in air pollution or carbon emissions. In terms of health impacts of active travel, however, researchers generally find physical activity benefits far outweigh other health impacts (Doorley et al 2015).

3. 'Modal Filtering' as a Healthy Streets intervention

TfL (2017:6) summarise the healthy streets agenda as meaning that '[w]alking, cycling and using public transport should be the most attractive ways to travel.' One approach to re-balancing the attractiveness of different modes has been dubbed 'filtered permeability' by Melia (2012). This implies that neighbourhoods should have a permeable street network grid for walking and cycling, but not for motor traffic. Some Dutch municipalities have adopted such an approach, entailing separation of core motor traffic routes from core active travel corridors (Schepers et al, 2017). The approach has recently been used in some North American cities as part of ‘Neighbourhood Greenways’ (Ma and Dill, 2015). Filtered permeability often involves ‘modal filters’ restricting motor traffic: for instance, planters, diverters, gates, or bollards (see Figure 3), although sometimes filters are virtual (signs and cameras with number plate recognition, to allow resident access but prohibit passing cars). Such filtering does not completely remove car traffic, as would full pedestrianisation, but limits it to those seeking to access properties or services within the filtered area.

FIGURE 3: MODAL FILTER IN CHURCH STREET, HOUNSLOW

Filtered permeability aims to disincentivise car travel and provide benefits for people walking and cycling in speed, distance, attractiveness, and convenience (Melia, 2016). It may contribute to reducing injury risk and increasing perceived safety, as fear of being injured by a motor vehicle is a major barrier to active travel uptake (Christie, 2017; Sanders, 2014) and that higher motor traffic speeds and volumes are associated with elevated injury risk (Bunn et al, 2003; Elvik, 2001). While by contrast to 20mph limits, the UK has seen very little policy and public discussion of filtered permeability, it has some public support. The British Social Attitudes Survey found in 2017 that "Closing residential streets to through traffic" is supported by 30% of respondents against 27% in opposition (DfT, 2018).

However, the approach remains controversial (Aldred et al, 2018; Melia and Shergold, 2016). Reasons for opposition vary, from fears that problems will be displaced to habitual attachment to driving (Domarchi et al 2008), while wider distrust of officialdom and fears of neighbourhood change may play a role (Özdemir and Selçuk, 2017). Aggravating this controversy, filtered permeability remains under-researched compared to more expensive interventions such as cycle tracks and new public transport systems. There is little research on how such interventions may affect levels of active travel, including health impacts; increasingly important in the current policy context.

4. Context: Church Street, Hounslow

In Spring 2017, Hounslow Council asked us to carry out a small-scale 'intercept survey' of people walking and cycling in Church Street. The aims of the research study were to (i) gather perceptions of the impacts of a modal filtering scheme from people walking and cycling in that street, and (ii) estimate increased uptake in active travel based on the intervention, and hence health economic benefit, using the new Department for Transport (DfT) appraisal tool referred to above. This study, while small and hence exploratory, is used as an example to demonstrate the evaluation approach proposed here, which we believe could lead to substantial improvement in routine monitoring and evaluation of smaller streetscape schemes and hence the evidence base surrounding these.

Church Street, where the intervention took place, is near the River Thames and close to Syon Park. Figure 4 below illustrates its location within its immediate neighbourhood. Most of the street is residential as illustrated in Figure 3 with a short riverside stretch containing a public house. Most residents have off-street parking, some in the form of garages and others in the form of a car park accessed just before the modal filter. The street is approximately 375m long and is designated as part of London's core walking and cycling network. Prior to the intervention it was used by approximately 500 cyclists and 850 pedestrians per day.

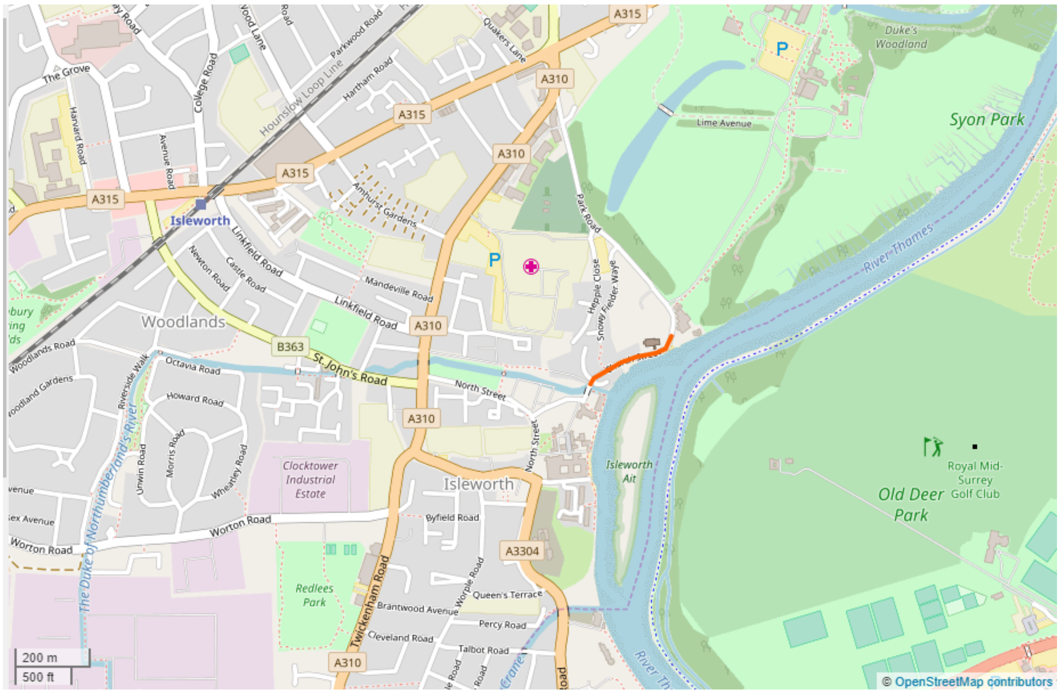

FIGURE 4: CHURCH STREET, LOCAL AREA

Land-use on Church Street is predominantly residential except for a church and public house.

Prior to the scheme, two-way through motor traffic was permitted. Automated Traffic

Counts[4] found that pre-closure, 454 motor vehicles used the street during the 8:00-9:00 AM peak hour and 469 in the 17:00-18:00 PM peak (SDG, 2017). This resulted in approximately 3,500 motor vehicles per day in total, many using Church Street as a cut-through to avoid congestion on Twickenham Road (the A310). While high for a narrow residential street, such volumes are not unusual in London neighbourhoods, given regular congestion on major roads and a growing use of sat-nav and smart app technology directing traffic through quieter, residential streets.[5]

Church Street experienced a substandard pedestrian level of service along approximately 60% of its length, according to TfL footway width criteria (Frost, 2017). At the narrowest point it is 5.75m building to building, so two-way motor traffic could only pass by mounting the footway, itself less than 60cm. Since 1976 residents had been complaining about increasing volumes of motor traffic[6]. Following consultation with the local community in Spring 2015, an 18-month experimental traffic order restricted access to a section of Church Street with the exception of pedal cycles from December 2015. A statutory consultation was carried out during this period combined with an 'end of trial' forum meeting in which over 50% of respondents expressed opposition to the closure being made permanent. However, the decision to retain the closure was taken in March 2017 and it remains today.

Church Street is heavily used for journeys to and from work and school, meaning that people may be unwilling to stop, so we decided to distribute leaflets containing a survey URL. Three

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[4] Data was collected for Hounslow Council over a one-week period, and used to calculate an average weekday flow (averaged over five days) or average weekend flow (averaged over two days).

[5] https://www.telegraph.co.uk/news/2017/12/31/block-streets-stop-smart-apps-turning-sleepy-roads-polluted/

[6] Width and weight restrictions were introduced in the 1980s and 1990s, a 20mph speed limit in 2000s, and a trial chicane in 2014.

weekday peak times and a Sunday afternoon were selected to increase the number and diversity of potential participants. We gave out approximately 650 leaflets, to all people walking and cycling (for any purpose) along Church Street who were willing to take one. 124 valid survey responses were received. The response rate of just under 20% is comparable to related surveys where people were asked to complete a questionnaire with the researcher (e.g. Shaheen et al, 2011).

Analysis was carried out using SPSS and Microsoft Excel. This involved (i) simple descriptive statistics illustrating respondent perceptions of changes to the street and (ii) combined analysis of self-report behaviour change and count data, to generate estimates of new walk and cycle trips for use in the health economic benefit calculation. Confidence intervals were generated to estimate uncertainty.

5. Results

4.1 About the respondents and their trips

The analysis conducted here should be viewed as exploratory, having a low sample size.

Of 124 respondents, 57% were cycling and 43% were on foot. This reflects a higher proportion of cyclists responding to the survey, compared to count data (SDG, 2017). Perhaps regular commuters, more likely to be cyclists, were particularly motivated to respond, compared to occasional users walking to the pub or park[7]. From 118 respondents who stated their gender, 68% were male and 32% female. For participants 'on foot' 57% were male, while 75% of cycling participants were male. This reflects the gender balance of

[7] As we are calculating pedestrian and cyclist uptake separately, this is in principle not a problem.

cycling in the UK and London, more skewed than for walking (Aldred et al, 2016).

Respondents tended to be working age adults aged 25+. Of 120 respondents who stated their age, 35 to 54-year olds were around half (52%). Only 3% were 18–24 and 5% were 65–74.

Respondents were asked to state their trip purpose. When coding, five categories were used: being commute or business travel; shopping or personal business; leisure (e.g. dog walking); food, drink, or socialising; and school run. Of 122 responses that stated trip purpose, 62% were for 'commute or business purposes' (almost all commute trips); followed by leisure (16%). Most participants were making return journeys: 89% of 123 respondents answering this question. Trip distances were calculated by using origin and destination data provided by participants. These were converted into longitude and latitude co-ordinates, with Google Maps used to generate estimated route network (not crow-fly) distances for walking or cycling. The mean walking distance was 1.7 miles (one-way) and for cycling 6.8 miles (one-way). Due to small sample size, however, when calculating health impacts we used default values in the WebTAG tool.

4.2 Changes to Church Street: impacts on the street environment

The questions about perceived impacts on the street environment covered the eight topics displayed in Figure 5 below. The majority in each case saw slight or substantial improvements, ranging from 66% saying that air quality had improved, to 80% saying that the environment was safer or more relaxing. The figure excludes 'don't knows' which ranged between 4% and 16% of respondents.

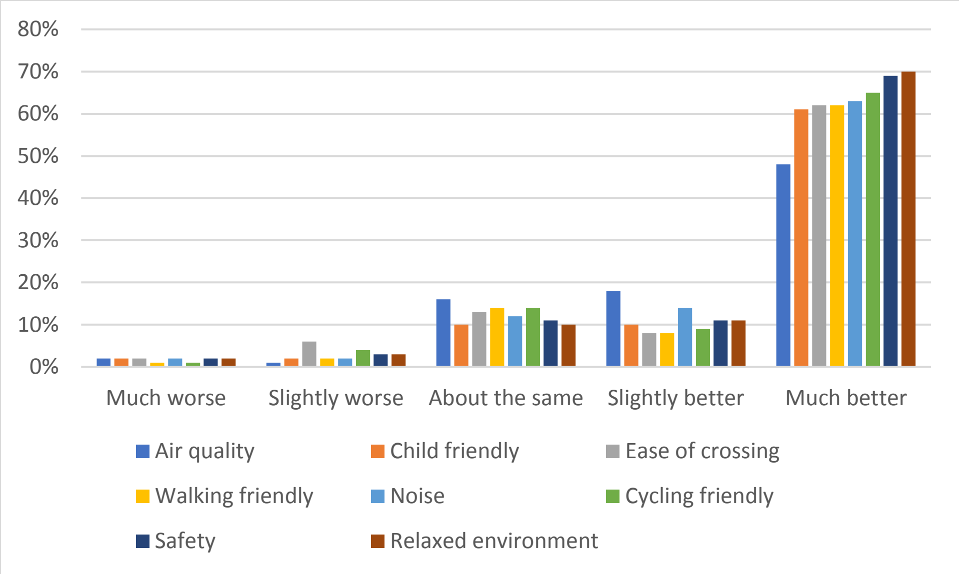

FIGURE 5: PERCEIVED CHANGES TO CHURCH STREET ENVIRONMENT

Open-ended comments were permitted for each item, and a minority commented in this way. For instance, responses in relation to 'child friendliness' included:

> "It is now safe to take my 6-year-old walking and cycling on the street".

> "The increase in pedestrians and cyclists since the closure is very noticeable and I'm much happier to let my children walk and cycle and use their scooters in Church Street".

> "It's been great for children who I've heard telling the adults with them, maybe grandparents, how it used to be with the traffic but now it's safe. When a school trip comes down the street, and they do more regularly than before, count the number of adult helpers. At one time, particularly when walking to the church they virtually had one adult to 2/3 children it was so unsafe".

4.3 Changes to Church Street: Perceived impact on personal walking and cycling frequency

Participants were asked about their levels of walking and cycling after the introduction of the scheme. Walking and cycling had similar levels of perceived change: 28% thought that they were walking more frequently through Church Street than prior to the closure, while 56% said ‘no change’ or ‘not applicable’ (e.g. because they only cycled in Church Street). For cycling, 32% believed they were cycling more frequently through Church Street, with 52% saying ‘no change’ or ‘not applicable’. This does not tell us a great deal about changes in walking and cycling, but it does support the perception of increased cycling- and walking-friendliness: many people did think they were walking or cycling more on Church Street.

4.4 Qualitative Comments

A final question in the survey asked about any final comments. Respondents commented on the intervention, on their (lack of) behaviour change and more generally walking and cycling in Isleworth and Hounslow. Most were supportive. Respondents highlighted the narrow carriageway and impracticality of two-way motor vehicular traffic:

> “Church Street is an ancient and narrow residential street, completely unsuitable for motor traffic. It was impossible for 2 vehicles to pass each other without mounting the narrow pavements. Church St is part of the London Ring orbital footpath, the Thames Path, and the National Cycle Network. As such, it should not be used as a rat-run for cars and vans. I support Hounslow Council's commitment to walking and cycling.”

Other comments were positive about the scheme but highlighted concerns about the wider transport network:

> “I have taken up cycling recently (apart from when running like on the day when given leaflet) and I always choose that path instead of the main road as the air quality is considerably better along the Church Street compared to the Twickenham road”.

> “I have lived in Old Isleworth for 45 years during this time I have used Church Street as a short cut when driving. I thought at first when the restriction came into force that it would be really annoying not to be able to use this cut through for my car journeys. I have since

found that it has had little impact on my journeys. The benefit to me has been great, less traffic, cleaner air etc. The only drawback has been the heavy traffic on the Twickenham road during the morning and evening rush hour which seems to have been impacted by the closure of Church Street".

Several responses demonstrated the division of opinion within the local community, even though we were only surveying people walking or cycling in the street[8]. These responses did not necessarily disagree that the changes had improved Church Street, but argued that the scheme primarily benefits Church Street residents, with negative impacts on others.

"While the tiny minority living on Church Street have benefitted, and their house prices have risen, this has been at the cost of impacting the rest of the community, who are now enduring increased noise, pollution and journey times".

4.5 Behaviour Change and Health Benefits

In this section we demonstrate the core of the evaluation method: its use to calculate health benefits due to increased active travel. As often happens in London where such interventions are introduced, Hounslow Council collected before-and-after pedestrian and cycle counts through Church Street. These were manual counts conducted on a twenty-four-hour basis across a week. The Council calculated an average weekday usage figure as follows[9]:

TABLE 1: CHANGE IN PEDESTRIAN AND CYCLE COUNTS

	Oct-15	Nov-16	Increase in Nov 16 compared to Oct 15	Proportion of Nov 16 users who are newly counted

[8] In the post-trial consultation survey, 58.4% were in favour of reopening the road to through motor traffic, compared to 40.4% who supported the permanent closure (Frost, 2017).

[9] Figures from October 2017 were later made available to the project team. These were similar to November 2016, suggesting a one-off impact of the intervention that was sustained.

Pedestrians	859	1191	39%	28%
Cyclists	504	601	19%	16%
Both	1363	1792	31%	24%

The count data shows uplift in walking and cycling of 31% combining both modes. However, not all of this will be new walk and cycle trips. The intercept survey allows us to estimate the proportion of those additional trips that are new, and hence to calculate health benefits from increased walking and/or cycling.

TABLE 2: IMPACTS OF THE SCHEME ON TRIPS

		Would have still made journey, if Church Street unfiltered			Total
		Yes	No	Not sure	
Mode	Foot	37 (74%)	4 (8%)	9 (18%)	50
	Cycle	44 (62%)	12 (17%)	15 (21%)	71
Total		81 (67%)	16 (13%)	24 (20%)	121

One-third of respondents said they would not have made their current trip, or were unsure if they would have made it, had Church Street been re-opened to motor traffic (Table 2). People were then asked about specific behaviour changes, including asking the ‘unsures’ for the most likely option, which could be ‘no change’. Table 3 presents the results of this: 13 walkers and 23 cyclists said that there would have been a change (either mode shift, change in route or destination, or the trip would not have been made without the intervention). This represents 26% of pedestrians and 32% of cyclists surveyed, or 30% of both combined. For pedestrians, the intercept survey-derived estimate of changers is similar to that derived from the count data, while cyclists seem to over-estimate their behaviour change.

TABLE 3: HOW RESPONDENTS SAID TRIPS WOULD CHANGE IF CHURCH STREET WERE OPENED TO MOTOR TRAFFIC

		Predicted change in trip				Total
		No trip	Different mode	Different route	Different destination	
Mode	Foot	0	4 (31%)	9 (69%)	0	13
	Cycle	1 (4%)	6 (26%)	15 (65%)	1 (4%)	23*
Total		1 (3%)	10 (28%)	24 (67%)	1 (3%)	36

*4 cyclists stated ‘no opinion’ or did not answer.

Here our interest is in new users or those switching mode. We assumed that changes in route or destination would balance out in terms of change in physical activity[10].

- Four pedestrians would have switched from a different mode (8% of all pedestrians, and 31% of 'changing' pedestrians)
- Seven cyclists would have switched from a different mode or (in one case) made a new trip (10% of all cyclists, or 30% of 'changing' cyclists stating the type of change)
- Of ten people reporting a mode shift, six said this would have been from the car; one said car or public transport, one said public transport, one reported a mode shift from walking to cycling, and one did not state the alternative mode.

[10] It seemed possible that some trips might get longer (people detouring to use Church Street) and others might get shorter (people feeling able to use a more direct route incorporating Church Street).

Health Economic Benefit

There are two possible ways of combining the count and intercept data to estimate new walking and cycling trips due to the intervention. The first would use data from the intercept survey on 'new users' as a percentage of all surveyed, then apply this to all users counted in November 2016. The second would use the proportion of 'behaviour changers' in the intercept survey who said they were making entirely new trips, then applying this ratio to the number of **additional** users counted in November 2016, compared to October 2015. We chose the second as being more accurate given the tendency of the intercepted cyclists to overstate their likelihood of behaviour change. The second set of assumptions places more weight on the count data, using the intercept data to identify additionally counted users as making truly new trips, or not.

TABLE 4: CALCULATIONS OF HOW MANY ADDITIONALLY COUNTED USERS ARE REALLY 'NEW', BASED ON INTERCEPT SURVEY DATA

	November 2016	October 2015	Additional users in October 2015	Percent of additional users who are truly 'new'	Truly new trips
Pedestrians	1191	859	332	30.8	102
Cyclists	601	504	97	30.4	29

Using the DfT WebTAG appraisal framework[11] we calculated the health economic benefit from an increase of 102 daily walk trips and 29 daily cycle trips. Default options were used,

[11] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/639108/active-mode-health-benefits-worksheet.xlsx

with the start year (appraisal and intervention date) changed to 2016 and a twenty-year appraisal period. The health benefit was calculated as £530,171. Given the small sample size, uncertainty will be high. However, the estimated benefit is fifty times higher than the cost of the physical infrastructure, approximately £10,000[12].

4.6 Other Impacts of the Scheme

While this paper focuses on the impacts on walking and cycling in Church Street, Hounslow Council monitored wider scheme impacts. Some displacement of motor traffic took place, largely onto Twickenham Road, with a traffic increase of 19% (+120 vehicles from 2014) in the weekday pm peak hour. Overall average bus journey times (the Council suggests this is also a proxy for broader changes in motorised journey times) showed little change across four routes, with small reductions or increases in journey time depending on the route (Frost, 2017; SDG 2017). Disaggregated by time of day, direction, and route, some changes became more significant. The largest was bus 267 Southbound during the afternoon PM peak, which saw an increase in journey time of 162 seconds, or 27%: in other words, mean journey time for those passengers increased from 10 minutes to 12 minutes 42 seconds. Air pollution monitoring showed, perhaps surprisingly (and counter to public perceptions) a reduction in NO_2 levels on Twickenham Road larger than the borough average (Frost, 2017).

5. Discussion

5.1 Summary of findings

[12] The full scheme cost was increased by costs in consultation and reporting stemming partly from the controversy generated. Such costs were not fully quantified but included for instance senior officer time preparing and reviewing documents and attending consultation events.

The example given highlights how count data and intercept data can be combined to estimate the health economic benefit of an active travel intervention, and to gain additional data on perceptions and views of the scheme. The intercept survey results suggest that the scheme – costing around £10,000 for the physical intervention, plus monitoring and consultation costs – had positive impacts on walking and cycling in Church Street. For all eight 'perception' indicators, most users said that the street was now 'much better'. The results highlight negative impacts of motor traffic previously experienced by people walking and cycling and a relatively positive co-existence of walking and cycling, even with both having increased.

Count data had shown an uplift of 39% in people walking through the street, and 19% more people cycling. Data from the intercept survey suggested that of those additional users, only around 30% would have been making entirely new trips (mode shift or new trip). These figures were used to calculate the likely uplift in trips due to the scheme and estimate an associated health economic benefit due to increased physical activity of approximately £500,000 (based on the approved DfT calculation method, and a 20-year appraisal period).

5.2 Strengths and limitations

The study example reported here is small-scale with consequently high uncertainty around the extent of behaviour change. The study focused only on current users of the scheme and did not speak to users discouraged by the scheme. While it seems unlikely that pedestrians and cyclists – the users studied here – would have been affected in this way, we cannot be certain. Church Street is only one road and respondents pointed to potentially adverse effects in other parts of the borough, due to diversion of motor traffic, not investigated here.

Positively the study contributes to an under-researched area, highlighting potentially large benefits in journey quality for people walking and cycling due to removal of motor traffic, and also potentially an increase in walking and cycling uptake. The approach represents a step forward from current UK scheme monitoring practice which often solely uses count data as a measure of change in uptake. It demonstrates a low-cost way of evaluating small-scale interventions where more robust (and expensive) methods, such as longitudinal household surveys, are unfeasible and unlikely to be implemented. Further studies are recommended with larger sample sizes to examine and more accurately quantify such benefits. If many schemes are evaluated in this way and data shared, an evidence base can be created allowing analysis of scheme and area characteristics affecting uptake of walking and cycling, which could be used in scheme appraisals in future.

5.3 Meaning of the study

Reductions in the priority given to the car remain controversial and challenging (Marqués et al 2015), as in this case. This study suggests that removing through motor traffic can improve perceived safety and ease of crossing, alongside other indicators of walking- and cycling-friendliness. In any individual case this would be balanced against other potential impacts. One limitation of this scheme was that as only one street was filtered, other local residential streets may have been negatively affected.

The study further suggests that mode shift may occur not only in response to the (perceived) absence of danger, but more positively, in response to environments being attractive and welcoming (Wang et al, 2016). Church Street is inherently attractive, leading to the River Thames and lined with a mix of mostly historic terraced housing. With removal of most motor vehicles, the high-quality environment became more visible. Further research might compare the results of improving such inherently attractive environments with the impacts of motor traffic reduction in less historic and beautiful settings; or explore impacts of measures directly targeting streetscape attractiveness, such as tree planting.

Alongside a substantial decline in motorised traffic Church Street saw a rise in the number of people walking and cycling. The study found little evidence of conflict between walking and cycling, with 80% of respondents saying they felt safety had improved. Even some respondents critical of the closure of Church Street made comments such as:

> 'Of course the street is more relaxed, safer, easier to cross, quieter, more cycle friendly, more walking friendly and more child friendly when you remove vehicle traffic, so would any street including Twickenham Road or even the M1.'

5.4 Conclusions

This small-scale study has found a range of benefits – in journey ambience and, potentially, mode shift and resultant health gain – that might be obtained from removing through motor traffic from residential streets used as motor traffic cut-throughs. More research is needed, but the results provide tentative support for authorities considering such strategies. Future research could compare benefits realised in different contexts, for instance, streets with different levels of visual attractiveness, within areas that are generally more or less welcoming to pedestrians and cyclists, in neighbourhoods with differing current active travel rates, or schemes that also introduce elements such as greening alongside those that do not. Such low-cost studies could easily be incorporated within municipal plans for monitoring and evaluation of similar, relatively small-scale changes, helping to build up a knowledge base about which kinds of changes are most likely to induce new walking and cycling trips.

References

Aldred, R., Elliott, B., Woodcock, J. and Goodman, A. (2016). Cycling provision separated from motor traffic: a systematic review exploring whether stated preferences vary by gender and age. Transport Reviews, 37(1), pp.29-55.

Aldred, R., Croft, J. and Goodman, A. (2018) Impacts of an active travel intervention with a cycling focus in a suburban context: One-year findings from an evaluation of London's in-progress mini-Hollands programme, Transportation Research Part A: Policy and Practice

Banister, D., (2005) Unsustainable Transport: City Transport in the New Century. Routledge. London.

Bradley, M. (1988). Realism and adaptation in designing hypothetical travel choice concepts. Journal of Transport Economics and Policy, 22 (1), 121–137.

Beukers, E., Bertolini, L. and Te Brömmelstroet, M. (2012) Why Cost Benefit Analysis is perceived as a problematic tool for assessment of transport plans: A process perspective, Transportation Research Part A: Policy and Practice, 46(1), pp. 68-78

Brookfield, K. (2017). Residents' Preferences for Walkable Neighbourhoods. Journal of Urban Design, 22 (1), 44-58.

Buck, D., Buehler, R., Happ, P., Rawls, B., Chung, P., & Borecki, N. (2013). Are bikeshare users different from regular cyclists? Transportation Research Record: Journal of the Transportation Research Board, 2387(1), 112–119.

Bunn, F., Collier, T., Frost, C. et al (2003) Traffic calming for the prevention of road traffic injuries: systematic review and meta-analysis, Injury Prevention 9, pp. 200-204.

Christie, N. (2018) Why we need to view road safety through a public health lens? Transport Reviews. 38:2, 139-141.

Cohen, J., Boniface, S. and Watkins, S. (2014). Health implications of transport planning, development and operations. Journal of Transport & Health, 1(1), pp.63-72.

DfT (2018) British Social Attitudes Survey 2017: Public attitudes towards transport, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/724855/british-social-attitudes-survey-2017.pdf

Domarchi, C., Tudela, A. and González, S. (2008) Effect of attitudes, habit and affective appraisal on mode choice: an application to university workers, Transportation 35(5), pp. 585-599

Doorley, R., Pakrashi, V. and Ghosh, B. (2015) Quantifying the Health Impacts of Active Travel: Assessment of Methodologies, Transport Reviews 35(5), pp. 559-582

Douglas, M.J., Watkins, S.J., Gorman, D.R. and Higgins, M. (2011), Are cars the new tobacco?, Journal of Public Health, 33(2), pp. 160–169

Elvik, R. (2001) Area-wide urban traffic calming schemes: a meta-analysis of safety effects, Accident Analysis and Prevention, 33(3), pp. 327-336

Foley, L., Panter, J., Heinen, E., Prins, R. and Ogilvie, D. (2015) Changes in active commuting and changes in physical activity in adults: a cohort study, International Journal of Behavioral Nutrition and Physical Activity 12, p.161

Forsyth, A. (2010) "Measuring Walking and Cycling Using the PABS (Pedestrian and Bicycling Survey) Approach: A Low-Cost Survey Method for Local Communities" Mineta Transportation Institute Publications

Frost, M (2017) Church Street, Isleworth: Trial Road Closure. Available from: https://democraticservices.hounslow.gov.uk/documents/b23646/Church%20Street%20Isle worth%20-%20Presentation%20slides%20Thursday%2023-Mar-2017%2019.30%20Isleworth%20and%20Brentford%20.pdf?T=9, accessed 22nd July 2018

Gomersall, S.R., Maher, C., English, C., Rowlands, A.V., Dollman, J., Norton, K. and Olds, T. (2016) Testing the activitystat hypothesis: a randomised controlled trial, BMC Public Health 16:900

Goodwin, P., Hallett, S., Kenny, F. and Stokes, G. (2012; 1991) Transport: The New Realism. Transport Studies Unit, University of Oxford. Working Paper N° 1062

Karlsson, C. (2018) Healthy Streets for All? A Multi-Method Assessment of Pedestrians' Experiences of Uxbridge Road in Ealing Broadway, London, University of Westminster: MSc Dissertation.

Ma, L. and Dill, J. (2015) Does The Installation of Bicycle Boulevards Improve Residents' Perceptions of The Bicycling and Walking Environment? A Panel Study, Journal of Transport & Health, 2(2), p.S24

Marqués, R., Hernández-Herrador, V., Calvo-Salazar, M. and García-Cebrián, J.A. (2015) How infrastructure can promote cycling in cities: Lessons from Seville, Research in Transportation Economics 53, pp. 31-44

Melia, S. (2012) Filtered and unfiltered permeability: The European and Anglo-Saxon approaches. Project, 4. pp. 6-9.

Melia, S. (2016) The EVIDENCE project: Measure no.4 – Access restrictions. World Transport Policy and Practice, 22 (1/2). pp. 39-46. ISSN 1352-7614 Available from: http://eprints.uwe.ac.uk/28968

Melia, S. and Shergold, I. (2016) Pedestrianisation and politics: Evidence gaps and a case study of Brighton’s Old Town. In: Universities Transport Study Group, Bristol, January 2016. Available from: http://eprints.uwe.ac.uk/27971

Mueller, N., Rojas-Rueda, D., Cole-Hunter, T., de Nazelle, A., Dons, E., Gerike, R., Götschi, T., Int Panis, L., Kahlmeier, S. and Nieuwenhuijsen, M. (2015) Health impact assessment of active transportation: A systematic review, Preventive Medicine 76, pp. 103-114

Nieuwenhuijsen, M. J, & Khreis,. H., (2016) Car free cities: Pathway to healthy urban living. Environmental International. Vol 94. 251 – 262.

Özdemir, D. and Selçuk, I. (2017) From pedestrianisation to commercial gentrification: The case of Kadıköy in Istanbul, Cities 65, pp. 10-23

Sanders, R. L., (2014) Perceived traffic risk for cyclists: The impact of near-miss and collision experiences. Accident analysis and collision experinces. Vol 75. 2015. 26 – 34.

Schepers, P., Twisk, D., Fishman, E., Fyhri, A. and Jensen, A. (2017) The Dutch road to a high level of cycling safety, Safety Science, 92, pp. 264-273

SDG (2017) Church Street Trial closure impact. Available from: https://www.hounslow.gov.uk/downloads/file/463/traffic_monitoring

Shaheen, S., Zhang, H., Martin, E. and Guzman, S. (2011) Hangzhou Public Bicycle: Understanding Early Adoption and Behavioral Response to Bikesharing in Hangzhou, China, Transportation Research Record, No. 2247, pp. 34-41.

Skov-Petersen. H., Jacobsen, J.B., Vedel, S.E., Nielsen, T.A.S. and Rask, S. (2017) Effects of upgrading to cycle highways - An analysis of demand induction, use patterns and satisfaction before and after, Journal of Transport Geography 64, pp.203-210

Sheller, M. and Urry, J. (2000) The City and the Car. International Journal of Urban and Regional Research, 24, pp. 737 - 757

Stappers, N.E.H., Van Kann, D.H.H., Ettema, D., De Vries, N.K., and Kremers, S.P.J (2018) The effect of infrastructural changes in the built environment on physical activity, active transportation and sedentary behavior – A systematic review, Health & Place 53, pp. 135-149

Urry, J 2004 The system of automobility. Theory, Culture & Society 21, 4-5, 25 - 39

TfL (2017). Guide to the Healthy Streets Indicators. Available at: https://tfl.gov.uk/cdn/static/cms/documents/guide-to-the-healthy-streets-indicators.pdf

TfL (2017a). Healthy Streets for London. Available at: http://content.tfl.gov.uk/healthy-streets-for-london.pdf

Wang, Y., Chau, C.K., Ng, W.Y. and Leung, T.M. (2016) A review on the effects of physical built environment attributes on enhancing walking and cycling activity levels within residential neighborhoods, Cities, 50, pp. 1-15