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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

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A B S T R A C T

Background: More evidence is needed on the impacts of building infrastructure for walking and cycling. A knowledge gap and an implementation gap have been mutually reinforcing. This paper reports on a longitudinal study examining the impacts of the still in progress 'mini-Hollands programme', which seeks to transform local environments for walking and cycling, in three Outer London boroughs. Compared to Inner London, Outer London has low levels of cycling and low levels of walking, and is relatively car dependent.
Methods: We conducted a longitudinal study of 1712 individuals sampled from households in mini-Holland boroughs (intervention sample) and from non mini-Holland Outer London boroughs (control sample). The intervention sample was further divided, a priori, into those living in "high-dose neighbourhoods", where substantial changes to the local walking and cycling infrastructure had been implemented, versus "low-dose neighbourhoods" where such improvements had not (yet) been made. At both baseline (2016) and one-year follow-up (2017), we administered an online survey of travel behaviour and attitudes to transport and the local environment.
Results: One year's worth of interventions was associated with an increase in active travel among those living in areas defined as 'high-dose' neighbourhoods. Specifically, those in high-dose areas were 24% more likely to have done any past-week cycling at follow-up, compared to those living in non mini-Holland areas (95% CI, 2% to 52%). The mid-point estimate for increase in active travel (walking plus cycling) time for the same group was an additional 41.0 min (95% CI 7.0, 75.0 min). Positive changes in views about local environments were recorded in intervention areas, driven by a perceived improvement in cycling-related items. Controversy related to the interventions is expressed in a growth in perceptions that 'too much' money is spent on cycling in intervention areas. However, intervention areas also saw a reduction in perceptions that 'too little' money is spent (the latter view being common both at baseline and Wave 1 in control areas).
Conclusion: Overall, the findings here suggest that programme interventions, while controversial, are having a measurable and early impact on active travel behaviour and perceptions of the local cycling environment.

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1. Introduction

Recent studies have highlighted a considerable increase in published research on walking and cycling (Pucher and Buehler, 2017; Braun et al., 2016; Feuillet et al., 2016). A related evidence base focuses on the detrimental impact of car dependent, sedentary lifestyles (Douglas et al., 2011; Panter and Ogilvie, 2017). Physical inactivity is described as a global pandemic with attributable mortality rates comparable to tobacco use (Kohl et al., 2012; Stewart et al., 2015). Many people remain insufficiently active and this trend is increasing across the world (Cohen et al., 2014).

Active travel offers a potentially transformative solution. Walking and cycling for transport can be incorporated as an incidental part of daily routine, either as a main mode of travel or as part of a public transport journey (Fairnie et al., 2016; Ogilvie, 2016). Epidemiological, social science and transport research support the economic and health benefits of physical activity. Cohort studies have shown active commuting reduces the incidence of non-communicable disease and mortality (Celis-Morales et al., 2017). If cycling levels in urban England and Wales increased to levels seen in Denmark, the associated healthcare cost savings have been estimated at £17 billion over twenty years (Jarrett et al., 2012).

Systematic and narrative reviews suggest that active travel interventions, particularly at scale, are often associated with increases in levels of walking and cycling (Ogilvie et al., 2004, 2007; Handy et al., 2005; Yang et al., 2010; Pucher et al., 2010; Saunders et al., 2013; Scheepers et al., 2014; Carlin et al., 2015). However, these reviews are limited by the lack of rigorous primary research testing whether there is a causal relationship between walking and cycling infrastructure and increased uptake (Handy et al., 2005; Pucher et al., 2010; Hull and O'Holleran, 2014; Wasfi et al., 2015; Keall et al., 2017; Song et al., 2017).

Many authors emphasise the scarcity of rigorous, individual-level research (Goodman et al., 2014; Scheepers et al., 2014; Panter et al., 2016; Foley et al., 2015; Braun et al., 2016; Sun et al., 2014; Pucher et al., 2010). Studies are typically repeat cross-sectional rather than cohort designs, or where they are longitudinal have limited follow-up (Crane et al., 2017; Panter and Ogilvie, 2017; Saunders et al., 2013). Explanations for the lack of high-quality primary research include: (i) marginalisation of active travel modes within car dependent societies (Aldred, 2012; Urry, 2004); (ii) difficulty in separating out impacts of concurrent initiatives, such as car restriction measures, media campaigns, cycle training or community-based events (Pucher and Buehler, 2012); (iii) the inherent complexity of comparing international contexts and a lack of a unified conceptual framework (Ogilvie, 2016; Saunders et al., 2013). Defining and conceptualising the population 'exposed' to an intervention is often challenging (Goodman et al., 2013; Sun et al., 2014; Ogilvie et al., 2011).

More recent research has, however, begun to address these gaps, taking advantage of the construction of new, high-quality cycle routes in traditionally low-cycling contexts. For example, the UK's iConnect consortium and the Sydney Transport and Health Study have produced papers analysing longitudinal, mixed method and quasi-experimental evidence (Song et al., 2017; Sahlqvist et al., 2013, 2015; Goodman et al., 2014; Ogilvie et al., 2011; Crane et al., 2017; Rissel et al., 2015). Other examples include research from Canada, Barcelona, and analysis of the Cambridge Guided Busway (Wasfi et al., 2015; Zahabi et al., 2016; Braun et al., 2016; Panter et al., 2011). These new studies indicate that the magnitude of any effects depends upon proximity to new infrastructure and takes time to appear (e.g. Goodman et al., 2014; Rissel et al., 2015).

2. Case study sites

The aim of this study is to examine whether and how proximity to active travel interventions is associated with changes in travel behaviour and attitudes, and change in attitudes to the local environment. This section describes the interventions studies in their broader context.

2.1. London: inner and outer

Governed by the Greater London Authority (GLA), London is divided into 33 districts: 32 boroughs and the City of London (see Fig. 1). Over the last two decades, the city has grown rapidly. The population is now 8.7 million, i.e. around 13% of the UK population. It is projected to increase to 10.5 million by 2041 (TfL, 2016).

London has pursued demand management for car travel, including the 2003 Congestion Charge and the 2017 Toxicity Charge, which both charge car drivers entering the central area (Givoni, 2012; TfL, 2017a). Alongside this London has invested in other modes, although investment in cycling grew only relatively recently (TfL 2013). These policies have been associated with a shift away from car use, mainly towards public transport. For instance, between 1993 and 2009, public transport journey stages roughly doubled (from 6.9 to 11.6 million daily) while private motorised trip stages remained stable (10.7 to 10.4 million daily).[1] However, progress in reducing car dependency is concentrated in Inner London. Between 2000 and 2015, while motor vehicle kilometres fell by 17% in Inner London, they declined by little over 5% in Outer London (TfL 2016).

Active travel rates are lower for Outer than for Inner London residents. For example, Active People Survey data from 2015/6 (Sport England, 2017) show that only 65% of Outer London residents walk three times or more per week, compared to 74% of Inner London residents. For cycling, the proportion cycling at least once per month is 17% in Inner London and 12% in Outer London; the proportion cycling at least three times a week was 8% and 3% respectively.

[1] https://data.london.gov.uk/dataset/travel-patterns-and-trends-london.

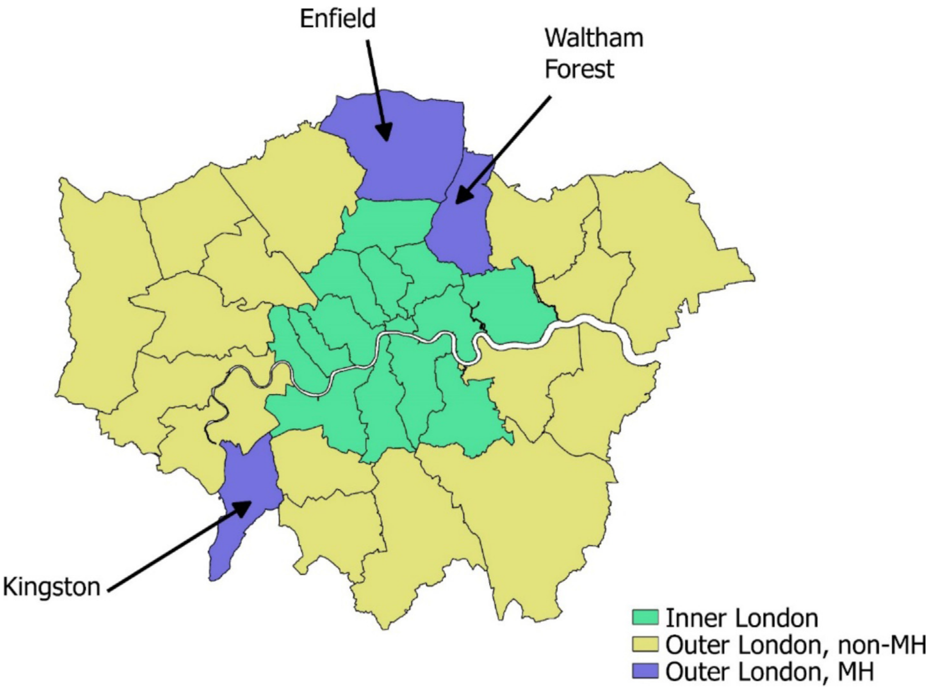

Fig. 1. Inner and Outer London, showing mini-Holland (MH) boroughs.

2.2. *The mini-Holland programme*

Enfield, Waltham Forest and Kingston are part of the £100 million 'mini-Holland' programme. The scheme was part of a commitment that the previous Mayor of London (2008–16), Boris Johnson, made to better protect vulnerable road users, learning from Dutch cycling provision (Di and Palmieri, 2016). The mini-Holland programme formed part of the Transport for London (TfL) Vision for Cycling (2013). It has now evolved to be part of the more holistic Healthy Streets approach (TfL, 2017b). The framework aims to tackle London's 'inactivity crisis' by supporting a shift from private car use to active transport modes, through creating pedestrian- and cycling-friendly street environments (TfL, 2017b). A broader theme of inclusivity is evident on programme websites – for example, 'the programme will benefit the whole community, not just people who cycle' (EWF, 2017a).

102 separate schemes have been proposed within the three boroughs, comprised of 97 infrastructure schemes and 5 'supporting measures', due all to be complete by 2021–2. The infrastructure changes include redesigned town centres, with cycle hubs at tube and rail stations; measures to reduce and calm motor traffic in residential areas; and physically protected cycle lanes along main roads. Many schemes also seek to improve walking environment and public realm quality. Around the time of the survey follow-up (May-June 2017) a third were either complete or under construction (TfL, 2017c). Only considering fully finished schemes, 20 had been completed by June 2017 (TfL, 2017d), of which 10 were completed during the first six months of 2017.

Enfield and Waltham Forest are neighbouring boroughs in North and East London, while Kingston is in the southwest (see Fig. 1 above). Waltham Forest and Enfield have similar demographic profiles, while Kingston has a lower level of ethnic diversity and greater affluence (see Table 1). Enfield has a lower rate of past-month cycling than the Outer London average, while Waltham Forest is somewhat higher and Kington higher still.

The mini-Holland programme is most advanced in Waltham Forest. By the end of 2017 there were 7 miles of new protected space for cycling including along part of the Lea Bridge Road, and four Village schemes with 'modal filtering' (road closures to through motor traffic: see Figs. 2 and 3; EWF, 2017b). While modal filtering schemes can in principle be low-cost and low-key, they are often controversial due to the restrictions imposed on drivers. In Waltham Forest modal filtering has evoked more hostility than cycle

Table 1
Demographic comparisons, mini-Holland boroughs.

	Waltham Forest	Enfield	Kingston	Outer London
Population, 2016 (ONS mid-year population estimates: GLA datastore, 2017)	275,800	331,400	176,100	5,598,200
% population from Black, Asian & Ethnic Minority groups, 2013 (GLA datastore, 2017)	49.9%	42.3%	30.4%	42.1%
Modelled household median income, 2012/13 (GLA datastore, 2017)	£33,080	£33,110	£43,940	£38,360
% adults living in a household with a car, 2011 (Census: ONS, 2017)	64.2%	73.8%	78.0%	73.2%
% commuters who cycle to work, 2011 (Census: ONS, 2017)	2.7%	1.4%	4.0%	2.2%
% of adults who cycle at least once per month, 2015/16 (Active People Survey: Sport England, 2017)	14.1%	8.0%	21.4%	11.7%

Fig. 2. New cycling infrastructure on Lea Bridge Road (photo: Joseph Croft, 2017).

Fig. 3. Changes in Orford Road, Walthamstow Village. This road has been closed between 10 am and 10 pm – except for buses, pedestrians, and cyclists (Photo: We Support WF Mini-Holland, 2017).

tracks, rendering it highly visible (Chandler, 2016). Other measures include over 50 side road junctions being transformed into 'continuous footways' (where the footway is continued over the road, indicating pedestrian priority) and Cycle Hubs at train stations, where cycles can be parked and/or hired at tube and train stations (EWF, 2017b).

Enfield has the largest population and geographic area, and the lowest levels of cycling. By survey follow-up (May-June 2017) relatively little infrastructure had been implemented. A flagship route along the A105 (Green Lanes) was under way, but incomplete (separate sections had been built, with the route remaining disjointed). Kingston has the highest levels of cycling of the three boroughs. However, the mini-Holland programme has been slow to progress. A physically protected cycle track along Portsmouth Road is complete and a one-way track on St Mark's Hill was finished in April 2017 (TfL, 2017c).

3. Methodology

3.1. Approach

The research project uses a longitudinal survey design to examine whether and how proximity to mini-Holland interventions is associated with changes in travel behaviour and attitudes, and change in attitudes to the local environment. Here we report on the following research questions:

(i) Is mini-Holland status associated with change in levels of cycling and in active travel more generally (primary outcomes), and in walking and car use (secondary outcomes)?
(ii) Is mini-Holland status associated with change in perceptions of local environmental quality (a secondary outcome)?
(iii) Is mini-Holland status associated with change in attitudes to investment in different transport modes, particularly cycling (a primary outcome)?

Question (i) is core to the desired impact of these schemes, specifically designed to increase cycling and more broadly active travel, preferably to replace car use. Question (ii) examines whether perceptions of the local environment improve, again a goal of these schemes and other TfL investments, and a change which might precede and/or accompany increases in active travel. Finally

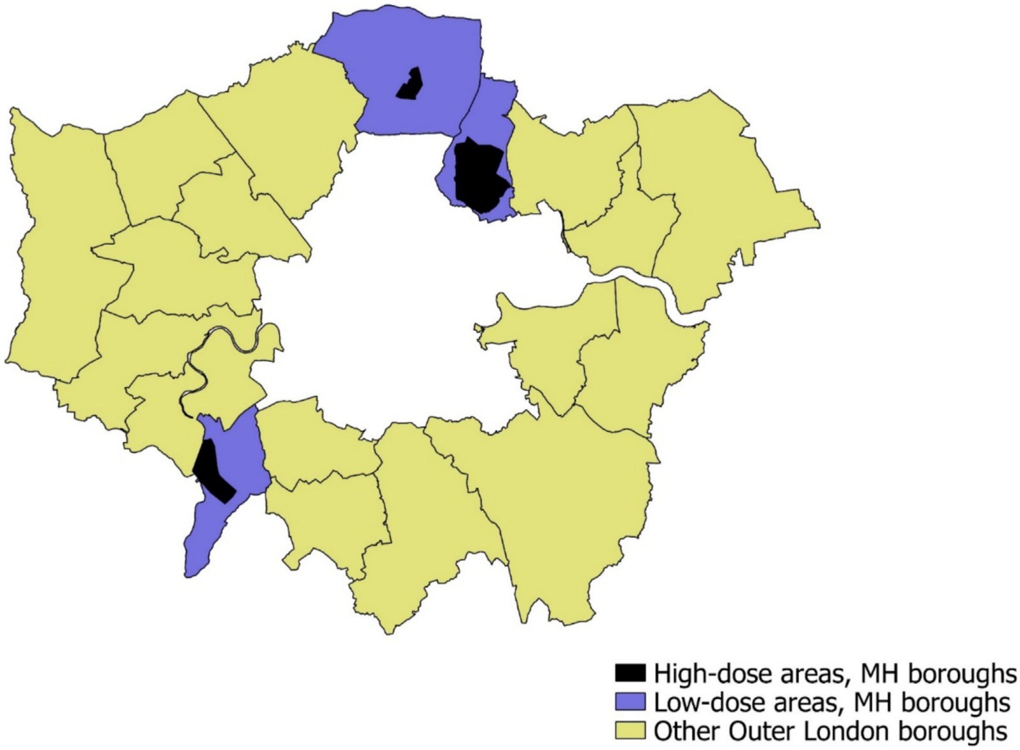

Fig. 4. High-dose, low-dose, and control areas.

question (iii) examines the impact of schemes on public views about cycling investment, a topic on which views are sometimes polarised.

3.2. Intervention group status

Defining control and intervention groups is challenging for built environment interventions (Humphreys et al., 2016). For instance, considering only those residing near a new cycle route means excluding behaviour change among those who might for instance work near the route but live elsewhere. In this study, the interventions are conceptualised as area-based, as they were by policy-makers (each sitting within, and managed by, a specific borough). Although routes form part of each package, most were not complete at one-year follow-up, with Waltham Forest (the most advanced borough) having initially implemented area-based schemes involving modal filtering. 'Exposure' to mini-Holland interventions was measured in two ways: (i) comparing mini-Holland residents to those living in other Outer London boroughs, (ii) differentiating between 'high-dose' and 'low-dose' areas within the mini-Holland boroughs themselves.

'High-dose' areas were defined by borough stakeholders at a meeting held at the TfL offices in October 2016. These stakeholders had been identified by TfL as being key officers (two or three per borough) involved in implementing interventions. They were experts who understood the nature of different interventions, when they were likely to be implemented (incorporating political realities alongside official timetables), how visible interventions might be, and the key destinations/desire lines they might serve. The stakeholders were given maps on which they were asked to mark areas where they thought residents were likely to have been affected by interventions by the time of the first survey wave (May-June 2017).[2] The lead author was present at the meeting, explained the process, and checked that the different borough representatives seemed (i) to be interpreting the question similarly and (ii) to be able to justify their choice of area. These areas were transferred to QGIS software with participants categorised based on home location.

Fig. 4 illustrates variation in size of the low and high-dose areas identified by stakeholders. The high-dose areas covered a far wider area in Waltham Forest (with 71% of study participants within it) than in Kingston (24%) or Enfield (5%). This reflects the difference in progress between the mini-Holland boroughs.

3.3. Sampling

Eligible respondents were adults aged 16 + who lived in Outer London, both in mini-Holland and non mini-Holland boroughs.

[2] By contrast, 'low-dose' refers to the remaining areas within mini-Holland boroughs awaiting interventions or where no local interventions were planned.

The survey was described as exploring travel behaviour and attitudes to local places in Outer London. It did not mention 'mini-Hollands' to avoid biasing responses owing to the programme's already controversial nature, although at baseline (May 2016) little infrastructure was in place. Control boroughs were defined as all other Outer London local authorities. Initially random household sampling was used. We sent postcards with brief details and a survey URL to addresses located within Lower Level Super Output Areas cluster sampled in intervention and control boroughs. However, the response rate was ~1%, so we also contacted people from two TfL databases (Oyster and Cyclist[3]) who had agreed to re-contact for future research. Emails sent to 106,671 people yielded a response rate of just over 2%, having screened out the ineligible (primarily people who, although registered with TfL as living in Outer London, had moved to Inner London or outside London altogether).

The baseline sample included 1519 participants in mini-Holland boroughs (615 in Waltham Forest, 490 in Kingston, 414 in Enfield) and 1916 in the rest of Outer London. Just over a third of participants came from the leaflet sample, just under a third from the Oyster database and one in five from the Cyclist database. The remaining 10% came from one of the two databases but it was not possible to identify which one. A weighting strategy was used to address a disparity of the balance of sources between control and intervention areas (see Appendix A).

Of the 3435 individuals who participated at baseline, 1722 (50.3%) participated again at Wave 1 follow-up. We excluded 10 who had moved out of or into one of the three mini-Holland boroughs, but retained individuals who remained in the same mini-Holland borough, or remained outside the mini-Holland boroughs (54 participants). The remaining 1712 participants formed our study population in subsequent analyses. This represented a follow-up rate of 49.8%, similar across the three mini-Holland boroughs (range 48–51%) and in the non mini-Holland boroughs (50%). Further survey waves are planned, with follow-up set to continue for at least another year.

3.4. Survey design

The survey was administered using Qualtrics software: https://www.qualtrics.com/uk/.[4] Informed consent was gathered via a participant information sheet forming part of the survey instrument. The baseline survey was open between May 6th and June 12th, 2016, and the first wave between May 4th and June 10th, 2017. Participants were asked about demographic and social-economic information, with questions on travel behaviour reflecting the outcomes specified above. This included a past-week travel diary where any use of different modes was recorded. The travel diary approach used is based on an online survey from another study of active commuting, which found good test-retest reliability (Shannon et al., 2006). The travel diary involved respondents recording any daily use of each mode,[5] including for recreational purposes. They were asked (in relation to each day over the past week): 'Which types of transport did you use on [date]? Please tick all that you used.' After answering these questions, those reporting any use of active modes or car/van on any given day were then asked to record daily minutes for each.

The survey section on 'attitudes to local area and transport' incorporated 15 statements about the participants' local area which covered similar domains to those in a TfL/GLA 'Healthy Streets' survey (see Appendix B). Participants were asked to rate how strongly they agreed with each (responses 'strongly disagree', 'tend to disagree', 'neither agree nor disagree', 'tend to agree', 'strongly agree'). We scored each question from -2 to $+2$, with $+2$ being the most favourable response.

Following the baseline survey, exploratory factor analysis was used to study how these 15 items clustered into common dimensions, and hence to create useful composite variables. The analysis showed two distinct clusters involving 14 of the 15 questions. A "general area perceptions" cluster involved 14 items, while a "cycling perceptions" cluster involved the four statements that related specifically to cycling. To facilitate comparisons between cycling-related and other items, we calculated an average of the 10 non-cycling items that formed part of the general composite measure.

3.5. Statistical analysis

We initially present descriptive statistics for our planned primary and secondary outcome variables. We then present regression analyses examining whether there is evidence that the mini-Holland and non mini-Holland groups differ in their behaviour, perceptions and attitudes at Wave 1. We also present three-way contrasts in which the mini-Holland group is split by local authority, or by the low-dose and the high-dose areas.

In all regression analyses we adjust for the corresponding measure at baseline, e.g. when the outcome is whether the participant did any past-week cycling at Wave 1 we adjust for whether that participant did any past-week cycling at baseline. We entered continuous baseline measures of past-week travel as linear terms, alongside quadratic terms if these were statistically significant. We included these quadratic terms to improve model fit, and therefore increase precision; our study findings are similar in analyses that did not include these quadratic terms.

After conducting minimally-adjusted analyses, we adjusted for other demographic and socio-economic characteristics. Specifically, these are: gender (male/female), age (years), ethnicity (white/black or minority ethnic), disability status (Yes/No), household type, employment status, and presence of cars or vans in the household. We used Poisson regression with robust standard

[3] People registered as customers either of TfL's Oyster (public transport smart card) or cycling services.

[4] A telephone option was offered at baseline, however, few people used this (41 completions) and the majority of these said they were happy to complete the survey online in future waves.

[5] Comprising car or van (driver or passenger); public transport; walking or running (5 min or more); pedal cycle; motorcycle, moped, or scooter; and taxi, black cab or minicab.

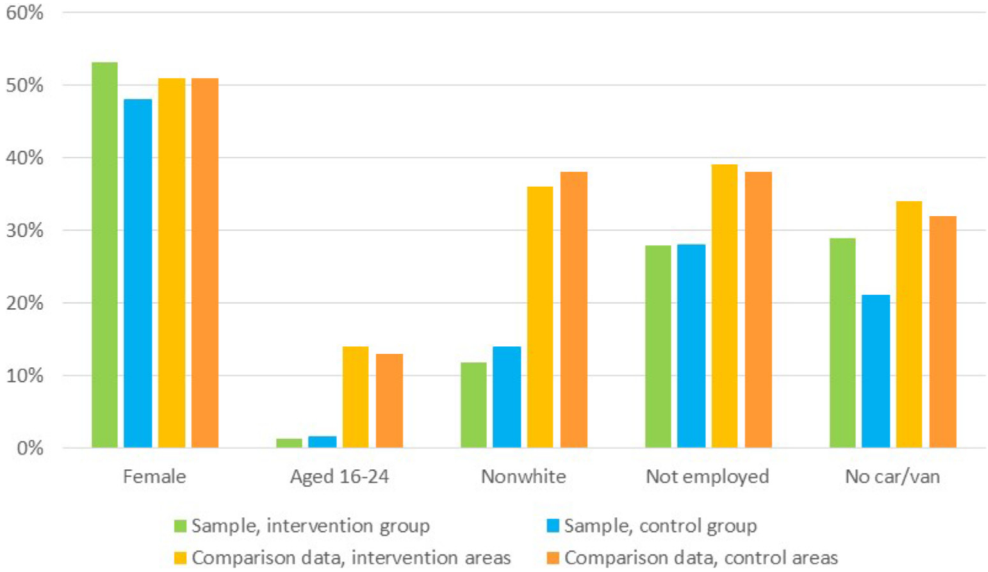

Fig. 5. Comparison of demographic and socio-economic characteristics between the study sample and the background population, stratified by mini-Holland status. Sources for comparison data: ONS midyear population data mid-2015, for age and gender. Census 2011 for ethnicity, employment status and car ownership. See Appendix Table 6 for a more detailed table that presents each of the 3 mini-Holland boroughs separately.

errors for binary outcomes (Zou, 2004), choosing this in preference to logistic regression because many of our binary outcomes are common. We used the same approach for unordered categorical variables, comparing different categories to the reference category. We used linear regression for continuous outcomes. We verified in a sensitivity analyses that our findings were similar after excluding outliers, defined as individuals reporting more than 1500 min of past-week use of the mode in question (range 2–11 individuals).

A small proportion of individuals had missing data on one or more demographic and socio-economic covariates (range 0–3.3%) or on whether the participant had cycled, walked or used a car in the past week (range 0.5–1.0% missing data). We imputed this using multiple imputation by chained equations (25 imputations). When conducting analyses with past-week travel time as the outcome, we excluded the 78 participants who reported uncertainty on the time they had spent walking, cycling or driving.

4. Results

4.1. Demographic and socio-economic characteristics

Table 6 in Appendix C shows the demographic and socio-economic characteristics of our participants, and compares them to the background population of Outer London. This is summarised in Fig. 5. The sample was well-balanced with respect to gender but, compared to the background population, there was a notable underrepresentation of 16–24-year-olds, non-white individuals and individuals not in employment. The study sample were somewhat more likely to have a car or van in household, and to have cycled in the past week or month.

Encouragingly, the nature and magnitude of demographic skewing seemed similar in the mini-Holland and non mini-Holland groups (Appendix D, Table 7). This suggests that comparisons between groups may be robust despite the samples not being fully representative of the local population.

We found more marked demographic and socio-economic differences between the ‘low-dose’ and ‘high-dose’ mini-Holland areas (Appendix D, Table 8). As previously discussed, those living in high-dose areas were far more likely to be from Waltham Forest and far less likely to be from Enfield. They were also more likely than those in the low-dose areas to be: female (58% versus 49% in the low-dose areas); younger (42% aged under 45 versus 30%); single adults (44% versus 31%); in full-time employment (65% versus 53%); and without any household car or van (43% versus 20%). To some extent this may reflect the targeting of early interventions towards areas perceived as more demographically receptive to cycling and walking interventions.

4.2. Active travel uptake

4.2.1. Predictors of past-week cycling

For past-week cycling, there was a trend towards higher cycling levels at Wave 1 in the mini-Holland group than the non mini-Holland group, after adjusting for cycling level at baseline (Table 2). This effect was, however, not statistically significant to $p < 0.05$ for any cycling in the past week ($p = 0.07$) nor for past-week minutes of cycling ($p = 0.32$). Stratifying the mini-Holland group by borough indicated that Waltham Forest and Kingston were driving these effects (Appendix E, Table 9).

Somewhat stronger evidence of between-group differences for cycling came when separating participants living in high-dose and

Table 2
Predictors of Wave 1 past-week cycling, walking and active travel.

	% doing any cycling in the past week (N = 1712)		Minutes of cycling in the past week (N = 1634)		% doing any walking in the past week (N = 1712)		Minutes of walking in the past week (N = 1634)		% doing any active travel in the past week (N = 1712)		Minutes of active travel in the past week (N = 1634)	
	%	Adjusted rate ratio (95% CI)	Mean (SD)	Adjusted regression coefficient (95% CI)	%	Adjusted rate ratio (95% CI)	Mean (SD)	Adjusted regression coefficient (95% CI)	%	Adjusted rate ratio (95% CI)	Mean (SD)	Adjusted regression coefficient (95% CI)
Non mini-Holland	15.2%	1	29.9 (103.0)	0	82.9%	1	203.1 (217.5)	0	85.3%	1	233.0 (235.4)	0
Mini-Holland	18.4%	1.16 (0.99, 1.36)†	40.8 (139.4)	4.1 (−4.0, 12.2)	87.6%	1.03 (0.98, 1.07)	240.9 (229.6)	19.0 (−1.8, 39.8)†	90.0%	1.03 (0.99, 1.07)	281.7 (263.1)	23.0 (1.0, 44.9)*
Non mini-Holland	15.2%	1	29.9 (103.0)	0	82.9%	1	203.1 (217.5)	0	85.3%	1	233.0 (235.4)	0
Low-dose mini-Holland	15.9%	1.10 (0.90, 1.34)	34.0 (135.7)	1.4 (−8.5, 11.2)	87.0%	1.03 (0.98, 1.08)	222.6 (203.6)	11.4 (−11.5, 34.4)	89.2%	1.03 (0.98, 1.07)	256.5 (238.7)	12.5 (−12.1, 37.1)
High-dose mini-Holland	22.4%	1.24 (1.02, 1.52)*	51.9 (144.6)	8.9 (−3.1, 20.8)	88.6%	1.02 (0.97, 1.08)	270.4 (264.6)	32.0 (−0.1, 64.1)†	91.2%	1.03 (0.98, 1.08)	322.3 (294.7)	41.0 (7.0, 75.0)*

†$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, for difference from the non mini-Holland group. Analyses adjusted for the baseline measure of the outcome in question, plus gender, age, ethnicity, disability, household type, employment type and number of cars in the household. The results were very similar in minimally adjusted analyses that adjusted only for the baseline measure of the outcome in question: see Appendix E, Tables 9–11. These appendix tables also show analyses separating the three mini-Holland borough.

low-dose areas. With respect to doing any past-week cycling the rate ratio for the high-dose group, as compared to the non mini-Holland group, was 1.24 (95% CI 1.02, 1.52, $p = 0.04$). Past-week minutes of cycling showed the same pattern, although the difference was not significant.

4.2.2. Predictors of past-week walking and active travel

Results for past-week walking and active travel were similar to each other, which is unsurprising as walking made up most of all active travel reported. There was generally little or no evidence of differences by mini-Holland status in the proportion of individuals doing "any walking" or "any active travel" in the past week (see Table 2). These behaviours were already very common at baseline (88% for walking and 90% for active travel), giving little scope to increase.

There was, however, some evidence that the *duration* of past-week walking and active travel was higher in Wave 1 in the mini-Holland group relative to the non mini-Holland group. This was observed in the binary comparison between mini-Holland and non mini-Holland areas ($p = 0.07$ for walking, $p = 0.04$ for active travel). The difference was particularly large in Kingston, but a positive trend was also observed in Waltham Forest and Enfield (see Appendix E, Tables 10 and 11).

Once again, the clearest evidence of differences in past-week walking/active travel time was seen when comparing participants living in low-dose and high-dose areas. While there was no evidence of differences between the mini-Holland low-dose group and the non mini-Holland group, there was evidence of increased walking and active travel in the mini-Holland high-dose group. The regression coefficient for past-week active travel minutes for the high-dose group, as compared to the non mini-Holland group, was 41.0 (95% CI 7.0, 75.0, $p = 0.02$), i.e. a point estimate of 41 extra minutes of walking or cycling per participant per week, with a confidence interval ranging from +7 to +75 min. Between baseline and Wave 1, past-week minutes of active travel decreased somewhat in the non mini-Holland (−7.5) and mini-Holland low-dose groups (−16.1), whereas they increased in the high-dose group (+26.8 min).

In absolute terms the increase in past-week time spent walking was greater than the increase in cycling (e.g. +32 min walking versus +9 min cycling in the mini-Holland high-dose areas). Relative to the amount of walking and cycling at baseline, however, these increases are slightly larger for cycling (+13% in walking and +18% in cycling in the mini-Holland high-dose area).

4.2.3. Predictors of past-week car use

For past-week car use, there was a non-significant trend for those living in mini-Holland boroughs to be less likely to report any past-week car use than those living in non mini-Holland areas ($p = 0.10$; see Appendix E Table 12). This trend was observed in all three mini-Holland boroughs, and the point estimate was somewhat stronger in the high-dose mini-Holland group than in the low-dose mini-Holland group although the differences were again not significant. Time spent driving in a car in the past week showed no consistent pattern in the results, and no evidence of a difference in any contrast (all $p > 0.4$).

4.2.4. Testing for differential impacts by demographic and socio-economic characteristics

We used tests for interaction to examine whether the effect of living in a mini-Holland borough varied according to participant characteristics. To maximise power, we decided to test for interactions after defining mini-Holland status as a binary variable, specifically being in the high-dose group versus being in the low-dose or non mini-Holland groups combined. The seven characteristics we examined were gender (male/female), age (defined in two ways, as a binary variable < 45 vs 45+, and as a continuous variable), ethnicity (white/non-white), disability (yes/no), employment (full-time/other), and car ownership (any/none). We did this for our two primary outcomes, past-week cycling time and past-week active travel time. In none of these 14 analyses performed was there evidence for an interaction (all $p > 0.1$, and most $p > 0.4$). Given the low statistical power, however, these null findings should be treated more as "absence of evidence" rather than "evidence of absence".

4.3. Perceptions of the local environment

4.3.1. Change in attitudes towards local environment supportiveness for cycling

As illustrated in Fig. 6, all four cycling-related 'local environment' items showed a positive change in the mini-Holland boroughs, as opposed to a mixture of 2 positive and 2 negative changes in the non mini-Holland boroughs. For all four items, the mini-Holland boroughs showed a more positive change than the non mini-Holland boroughs (all $p < 0.001$ for difference). The largest absolute difference was for the item on whether there were "lanes, paths or routes for cycling".

Likewise, when combining these items into a single score, there was very strong evidence that a more favourable change in attitudes towards local cycling provision occurred in the mini-Holland areas compared to the non mini-Holland areas, both in terms of raw scores and after adjusting for attitudes at baseline and participant characteristics ($p < 0.001$, see Table 3). This was true to a similar extent in all three mini-Holland boroughs, while the effect in the high-dose mini-Holland areas was stronger. The effect size (regression coefficient/standard deviation) for the change in views on cycling environments in mini-Holland compared to non mini-Holland areas was 0.28, and for high-dose versus non mini-Holland areas 0.35. To give a specific example of what these kinds of differences mean, a relative improvement of 0.2 in a given item could be achieved by – for instance – 5% of the population changing their position from 'disagreeing' to 'agreeing' with the item, other views remaining on balance the same.

4.3.2. Change in attitudes towards local environment supportiveness for non-cycling items, and overall

There was little difference by mini-Holland status in changes in attitudes for the 10 non-cycling items (see Appendix E, Fig. 8). Instead in both the mini-Holland and the non mini-Holland boroughs non-cycling items showed a small trend towards average

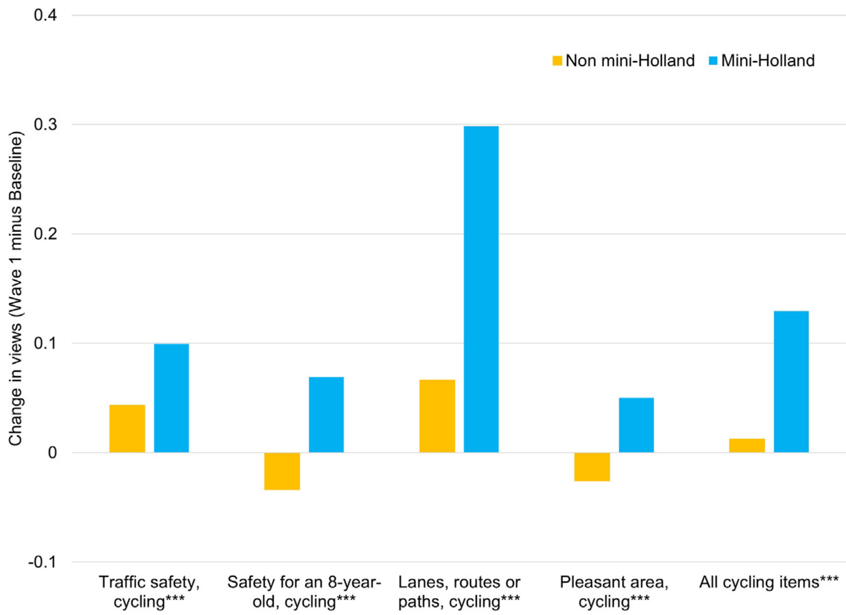

Fig. 6. Changes in attitudes to local environment cycling items between Baseline and Wave 1 (N = 1712). $^{***}p < 0.001$.

Table 3
Predictors of local environment perception scores at Wave 1 (N = 1712).

	Cycling perception score (4 items)		Non-cycling perception score (10 items)		General local environment perception score (14 items)	
	Mean score (SD)	Adjusted regression coefficients (95% CI)	Mean score (SD)	Adjusted regression coefficients (95% CI)	Mean score (SD)	Adjusted regression coefficients (95% CI)
Non mini-Holland	−0.43 (0.76)	0	0.23 (0.56)	0	0.04 (0.52)	0
Mini-Holland	−0.06 (0.78)	0.22 (0.16, 0.28)***	0.23 (0.56)	0.02 (−0.03, 0.06)	0.14 (0.54)	0.07 (0.03, 0.11)***
Non mini-Holland	−0.43 (0.76)	0	0.23 (0.56)	0	0.04 (0.52)	0
Low-dose mini-Holland	−0.14 (0.77)	0.19 (0.12, 0.26)***	0.28 (0.53)	0.04 (−0.01, 0.08)	0.16 (0.52)	0.08 (0.03, 0.12)**
High-dose mini-Holland	0.06 (0.78)	0.27 (0.19, 0.36)***	0.15 (0.58)	−0.02 (−0.08, 0.04)	0.12 (0.57)	0.06 (0.00, 0.11)*

$^{*}p < 0.05$, $^{**}p < 0.01$, $p < 0.001$for difference from the non mini-Holland group. All analyses adjust for the baseline measure of the outcome in question, plus gender, age, ethnicity, disability, household type, employment type and number of cars in the household. See Appendix E, Table 13 for an additional tabulation that separates the three mini-Holland boroughs.

response becoming less favourable, with no significant difference between the two for 9 of the 10 items.[6]

This lack of any difference for most individual items held for the composite of all 10 non-cycling items, which showed no evidence of a difference according to mini-Holland status as a binary variable, or when stratifying between low-dose and high-dose mini-Holland areas (all $p > 0.1$, Table 3).

The combination of a marked favourable shifts in the four cycling items, plus no significant differences in changes in the non-cycling items, meant that overall there was evidence of a positive change in the sum of the 14 items covering perceptions of the local environment in the mini-Holland as opposed to the non mini-Holland areas (see Table 3).

4.4. Views about levels of support for investment in cycling

At baseline, there were already notable differences between the intervention and control group in views about investment in cycling, and these widened at follow-up (see Fig. 7 below). In the control group, over half of those expressing an opinion (i.e. excluding don't knows) said that there was insufficient investment in cycling, with most of the rest saying this was 'about right'. In mini-Holland boroughs, more mixed views reflected the widespread awareness and controversy surrounding proposed interventions, even though at baseline little had been implemented, particularly outside Waltham Forest.

[6] The only exception is that there was significant evidence of a difference for the item “My local area has enough places to stop and rest outdoors”, driven by a far more marked decrease in the proportion of favourable answers in the non mini-Holland boroughs: see Appendix E.

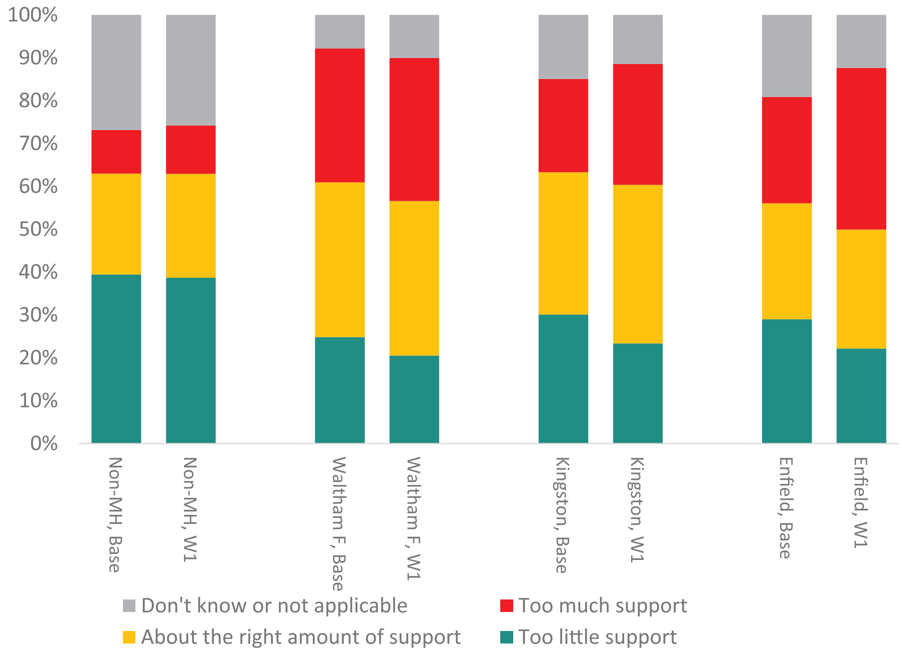

Fig. 7. Attitudes of participants towards TfL/local area support for cycling investment, at Baseline and Wave 1, stratifying by mini-Holland borough (N = 1712).

At Wave 1, the differences seen at baseline widened, with a decrease in the proportion of individuals in the mini-Holland group saying there was "too little" support for investment in cycling (from 28% to 20%), and an increase in the proportion saying that there was "too much" support for investment in cycling (from 27% to 33%). These differences were highly significant (all $p < 0.01$, most $p < 0.001$). The magnitude of the effect was similar between low-dose and high-dose mini-Holland areas (Appendix E, Table 14). The increase among people saying "too much" is invested in cycling was largest in Enfield, both in absolute terms (from 25% at baseline to 38% in Wave 1) and after adjusting for participant characteristics (Appendix E, Table 14).

5 Discussion

5.1. Summary of results

Firstly, Mini-Holland status (particularly being in the high-dose area) was associated with increased use of active travel at Wave 1, including an increased likelihood of any participation in past-week cycling. One-year findings show as yet no evidence of change in car use. Secondly, mini-Holland status (particularly being in the high-dose area) was associated with increasingly positive perception of the local cycling environment, and therefore a more positive overall perception of the local environment. Finally, mini-Holland status was associated with increased likelihood of saying that too much money is being spent on cycling, and decreased likelihood of saying too little is spent.

Increased active travel and improved perceptions of the local environment represent encouraging results for planners. They suggest that coordinated planning of high quality infrastructural interventions can increase active travel levels even before schemes are fully complete, and even in relatively car-dominated city contexts. However, findings related to views on cycling investment confirm that such interventions may – as here – be controversial, particularly where walking and/or cycling are stigmatised (Aldred, 2013).

5.2. Strengths and weaknesses of the study

This is one of relatively few longitudinal studies examining change over time as interventions happen. Focusing on suburban Outer London, the study examines places more typical of the urban UK than are higher-profile Inner London locations or Cambridge, home of another recent longitudinal study (Panter et al., 2016). Given the evidence gaps, particularly in relation to low-cycling contexts, these are key strengths. This study is ongoing for at least a further year so can report on what happens as more interventions are implemented.

However, there are weaknesses. Study power was relatively low, particularly for one of our primary outcomes, past-week cycling. Response rate was extremely low, and our sample does not fully represent the demographics of control or intervention areas (although the nature and the magnitude of the selection bias seems to be operating similarly between our intervention and control groups). The sample is made up of a combination of respondents to a household leaflet, and respondents from two TfL customer databases. This type of convenience sampling is common in evaluation studies of transport interventions (e.g. Crane et al., 2017; Panter et al., 2016), which tend to assume changes in a non-typical sample provide some proxy indication of changes in the wider population. However, a more representative sample would provide more confidence that changes here are generalisable.

5.3. Meaning of the study and implications for policy and future research

The consistent results build confidence in the findings; where statistical significance is not reached the effect is generally in the expected direction. Similarly, the larger effects (in terms of travel behaviour change, and views about the cycling environment) in high-dose mini-Holland areas than in low-dose mini-Holland areas indicates that in places where borough stakeholders expected change to happen based on intervention timescales, there was indeed stronger evidence of change. This ‘dose response’ effect adds confidence to our ability to attribute a causal role to the mini-Holland intervention. The exception is the change in attitudes towards cycling spending in the mini-Holland boroughs, seen just as strongly in the low-dose areas as in the high-dose areas. In other words, the benefits of the intervention were specific to people living near to new infrastructure, whereas the controversy around the schemes was observed across a wider area.

Prior to the roll-out of the scheme, the potential for negative impacts on users of other modes was widely discussed (e.g. Mead 2015; Hill 2015). We found no evidence of this. For instance, there was no evidence that time spent in cars was increasing (due to congestion), nor that walking environments were becoming less attractive due to the introduction of cycle lanes. On the contrary, it is encouraging that the increase in active travel was composed both of more walking, and more cycling - this perhaps reflects the refocusing of the mini-Holland programme to focus on walking as well as cycling along with an early focus on traffic reduction in residential areas in Waltham Forest. It is encouraging that there was no evidence that the impact of the mini-Holland programme was unequally distributed across demographic or socio-economic groups (although statistical power to detect such differences was low).

Goodman et al. (2014) found being one kilometre closer (in terms of shortest route network distance) to new walking and cycling infrastructure was associated with an increase in active travel of 15.3 min per week. Our findings are not directly comparable because Goodman et al. studied route-based interventions, while we have used an area-based measure. Our increase of 41.0 min per week (for people living in the high-dose areas) is apparent at one-year follow-up, while Goodman et al. (2014) only found evidence of change after two years.

The findings suggest that large-scale interventions with ambitious area-based components can lead to uptake in active travel, even over only a year, with the programmes only partly implemented. Outer London had not previously seen the substantial mode shift observed in Inner London, thus this suggests that even in less apparently promising locations, investment can drive uplift in walking and cycling. Area-based interventions incorporating cycle routes and neighbourhood traffic reduction may be particularly good at encouraging active travel more broadly, compared to cycle routes alone. They may also be easier to evaluate because they are intended to have an area-level effect, contributing to a greater chance of identifying travel behaviour change if such takes place.

The mini-Holland interventions have, however, been controversial, generating 'backlash'. This has been most notoriously the case in Waltham Forest with vocal protests, particularly early on (Patient, 2017; Hill, 2015; Hill, 2017). However, Waltham Forest seems to be driving the growth in active travel and improved perceptions of the cycling environment found here. While backlash did not represent a majority of participants in mini-Holland boroughs (neither did it translate into voting behaviour in London's May 2018 council elections) it highlights an ongoing need for political leadership in England to successfully implement such interventions (Aldred et al., 2017).

Future research should consider obtaining a larger and more representative random sample of individuals or households, for instance by interviewing participants in person, and following-up in person, as is done for the National Travel Survey. This would be much more expensive and beyond this project’s relatively small budget, but would help evidence the extent to which changes are likely to be common across wider populations. Future research could also usefully incorporate a qualitative longitudinal component, to examine in more detail how and why views and behaviour may be changing.

6 Conclusion

In conclusion, our findings indicate that the partially-implemented London mini-Hollands programme has been effective in increasing active travel and improving perceptions of the local environment. The study confirms the controversial nature of the programme, and indicates that the controversy does not seem to be mitigated by slower implementation, as it extends to ‘low dose’ areas that have not yet seen schemes implemented locally. Potentially the data provided here and elsewhere may help in this regard, providing evidence that ambitious active travel interventions can lead to early impacts in terms of both walking and cycling.

Acknowledgements

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A. Weighting

The mini-Holland and non mini-Holland groups differed in terms of the proportion of participants coming from different sampling sources (Household leaflet survey, Oyster database, Cyclist database, and Unknown database). The disproportionality of the sampling sources was adjusted in two stages – via group weighting and individual-level weighting. Group level weights were applied to the non mini-Holland group to equalise the relative contribution of different sources (Table 4, column A). In the Unknown sample, a mixture of individuals from the Oyster and Cyclist databases, the share of individuals from the Oyster database was higher in the mini-Holland group than the non mini-Holland group. To take account of this, we further assigned individual weights for the unknown group, separately for cyclists and non-cyclists (Table 4, column B).

At Wave 1 the follow-up rate was 42% in the household leaflet sample, 52% in the Oyster database sample, 62% in the Cyclist database sample, and 37% in the 'Unknown' sample (Table 4). These differences in follow-up rates persisted largely unchanged, and remained highly significant, after adjusting for participant characteristics. We therefore further updated our weights to take account of the differences in follow-up rates across these different sources. We did this as follows:

$$\text{Wave 1 weight} = \text{Baseline weight} * \frac{\text{Overall Wave 1 follow-up rate}}{\text{Wave 1 follow-up rate for source in question}}$$

For example, in the household leaflet sample the follow-up rate was 42%, as opposed to 50% for the sample as a whole. We therefore multiplied the baseline weight by 50%/42% = 1.19 (Table 4, column C).

The baseline group-level weight, baseline individual-level weight and Wave 1 weights were then multiplied together to create a final weight, as summarised in Table 4.

Table 4
Summary of calculation of weights.

	Column % of participants at baseline		% followed-up at Wave 1	Group-level baseline weight(A)		Individual-level weight(B)		Wave 1 wt(C)	Final weight(A*B*C)	
	Non mini-Holland	Mini-Holland	Non mini-Holland + mini-Holland	Non mini-Holland	Mini-Holland	Non mini-Holland	Mini-Holland	Non mini-Holland + mini-Holland	Non mini-Holland	Mini-Holland
Household leaflet	31.1%	37.6%	41.9%	1.21	1.00	1.00	1.00	1.19	1.44	1.19
Oyster database	19.9%	32.5%	52.3%	1.63	1.00	1.00	1.00	0.95	1.55	0.95
Cyclist database	36.4%	19.6%	62.1%	0.54	1.00	1.00	1.00	0.80	0.43	0.80
Unknown (Oyster or Cyclist database)	12.6%	10.3%	36.8%	0.82	1.00	0.76 cyclists 1.05 non-cyclists	1.00	1.35	0.84 cyclists 1.18 non-cyclists	1.35

B. Components of cycling and general area quality measures

See Table 5.

Table 5
Wording of the 15 statements presented to participants, and whether responses to each is included in our summary measures of perceptions of local environments.

Statement	Reverse coded?	Included in 'local environment, general' score	Included in 'local environment, cycling' score	Included in 'local environment, non-cycling' score
Cycling is unsafe because of the traffic	Yes	✓	✓	✗
My local area is safe for an 8-year-old child to cycle		✓	✓	✗
There are special lanes, routes or paths for cycling		✓	✓	✗
My local area is pleasant for cycling		✓	✓	✗
Walking is unsafe because of the traffic	Yes	✓	✗	✓
My local area safe an 8-year-old child to walk alone		✓	✗	✓
My local area is pleasant for walking		✓	✗	✓
There are good quality pavements for walking		✓	✗	✓
There are enough safe places to cross roads		✓	✗	✓
My local area has enough places to stop and rest outdoors		✓	✗	✓
The area has enough shade or shelter from the weather		✓	✗	✓
There are places to walk to, such as shops, restaurants, leisure facilities		✓	✗	✓
The area is unsafe because of the level of crime or antisocial behaviour	Yes	✓	✗	✓
Air pollution caused by motor traffic is a problem in my area	Yes	✓	✗	✓
I regularly stop and talk with people in my local area		✗	✗	✗

C. Sample representativeness

See Table 6.

Table 6
Comparison of selected demographic and socio-economic characteristics of study participants with comparison datasets, to assess sample representativeness (N = 1712).

		Waltham Forest		Kingston		Enfield		Mini-Holland group (combined)*		Non mini-Holland group	
		Study sample	Comparison data	Study sample	Comparison data	Study sample	Comparison data	Study sample	Comparison data	Study sample	Comparison data
Gender†	Male	47%	50%	50%	49%	45%	48%	48%	50%	52%	49%
	Female	53%	50%	50%	51%	55%	52%	53%	51%	48%	51%
Age (years)†	16–24	2%	14%	2%	15%	0%	14%	1%	14%	2%	13%
	25–34	13%	25%	6%	20%	13%	20%	11%	22%	12%	21%
	35–44	28%	21%	19%	20%	18%	18%	22%	20%	19%	19%
	45–54	23%	17%	28%	16%	24%	18%	25%	17%	23%	17%
	55–64	24%	11%	28%	12%	30%	12%	27%	12%	30%	12%
	65+	11%	13%	18%	16%	14%	17%	14%	15%	14%	16%
Ethnicity‡	White	88%	56%	90%	76%	87%	64%	89%	65%	86%	62%
	Non-white	12%	44%	10%	24%	13%	36%	12%	36%	14%	38%
Employment status (age 16–74)‡	Employed	75%	60%	72%	64%	68%	59%	73%	62%	72%	62%
	Not employed	25%	40%	28%	36%	32%	41%	28%	39%	28%	38%
Number of cars/vans in household‡	0	40%	42%	20%	25%	21%	32%	29%	34%	21%	32%
	1	49%	42%	52%	47%	45%	43%	49%	44%	49%	44%
	2+	11%	16%	28%	28%	34%	24%	23%	22%	30%	24%

* Comparison data for the mini-Holland group created by taking a weighted average of the 3 mini-Holland boroughs, weighting by the relative sample size in each.
† Source: ONS midyear population data, mid-2015.
‡ Source: Census 2011.

D. Differences in participant characteristics by intervention group status

See Tables 7 and 8.

Table 7
Demographic and socio-economic characteristics of participants in Wave 1 follow-up, comparing the mini-Holland and non mini-Holland groups (N = 1712).

		Mini-Holland group(N = 750)		Non mini-Holland group (N = 962)		p-value for difference†
		N	Weighted %	N	Weighted %	
Gender	Male	358	47.5%	533	52.5%	0.002
	Female	385	52.5%	426	47.5%	
Age (years)	16–24	10	1.4%	12	1.6%	0.89 /
	25–34	80	10.8%	117	12.1%	0.73
	35–44	168	22.3%	206	19.2%	
	45–54	186	25.0%	239	23.1%	
	55–64	201	26.7%	271	30.2%	
	65+	95	13.8%	112	13.8%	
Ethnicity	White	639	88.2%	816	86.3%	0.48
	Non-white	83	11.8%	118	13.8%	
Disability	No	660	88.7%	846	86.6%	0.68
	Yes	82	11.3%	112	13.4%	

(continued on next page)

Table 7 (*continued*)

		Mini-Holland group(N = 750)		Non mini-Holland group (N = 962)		p-value for difference[†]
		N	Weighted %	N	Weighted %	
Household type	A couple without children	241	31.9%	307	31.6%	0.03
	Single adult living alone	179	23.9%	196	21.6%	
	Single adult living with other adults	69	9.0%	87	9.7%	
	A couple with children	230	31.0%	309	30.4%	
	Single adult living with children	19	2.6%	22	2.5%	
	Other	12	1.6%	41	4.2%	
Employment status	Full-time employed	440	57.4%	587	58.2%	0.35
	Part-time employed	111	15.0%	125	14.2%	
	Not in paid employment: retired	135	19.0%	154	17.8%	
	Not in paid employment: other	64	8.6%	96	9.9%	
Number of cars or vans in household	0	217	28.7%	196	20.8%	< 0.001/
	1	366	48.8%	498	49.3%	< 0.001
	2+	167	22.5%	277	30.0%	

[†]p-values calculated using Chi-squared tests for association, with Chi-squared tests for trend additionally reported for ordered categorical variables.

Table 8
Demographic and socio-economic characteristics in Wave 1 follow-up, comparing mini-Holland participants in high-dose and low-dose areas (N = 750).

		'Low-dose' group (N = 460)		'High-dose' group (N = 290)		p-value for difference[†]
		N	Weighted %	N	Weighted %	
Source of participants	Household Leaflet	150	37.6%	93	37.8%	n/a
	Oyster database	158	31.7%	102	33.3%	
	Cyclist database	109	18.4%	80	22.0%	
	Unknown (Oyster or Cyclist database)	43	12.3%	15	7.0%	
Borough	Waltham Forest	90	19.8%	224	78.1%	< 0.001
	Kingston	180	38.7%	57	19.0%	
	Enfield	190	41.5%	9	3.0%	
Gender	Male	236	51.1%	122	41.6%	0.01
	Female	219	48.9%	166	58.4%	
Age (years)	16–24	5	1.1%	5	1.9%	< 0.001/
	25–34	46	10.4%	34	11.4%	< 0.001
	35–44	85	18.6%	83	28.3%	
	45–54	113	24.4%	73	26.0%	
	55–64	130	27.9%	71	24.8%	
	65+	75	17.6%	20	7.6%	
Ethnicity	White	400	87.9%	260	90.1%	0.48
	Non-white	53	12.1%	29	9.9%	
Disability	No	396	87.8%	255	90.2%	0.42
	Yes	53	12.3%	28	9.8%	
Household type	A couple without children	156	33.5%	85	29.4%	0.01
	Single adult living alone	96	21.0%	83	28.5%	
	Single adult living with other adults	35	7.4%	34	11.5%	
	A couple with children	156	34.2%	74	25.7%	
	Single adult living with children	9	2.1%	10	3.5%	
	Other	8	1.8%	4	1.4%	
Employment status	Full-time employed	248	52.8%	192	64.8%	0.006
	Part-time employed	73	15.8%	38	13.8%	
	Not in paid employment: retired	97	22.2%	38	13.9%	
	Not in paid employment: other	42	9.2%	22	8.6%	

(*continued on next page*)

Table 8 (*continued*)

		'Low-dose' group (N = 460)		'High-dose' group (N = 290)		p-value for difference[†]
		N	Weighted %	N	Weighted %	
Number of cars or vans in household	0	91	20.0%	126	42.9%	< 0.001/
	1	226	48.6%	140	49.0%	< 0.001
	2+	143	31.4%	24	8.1%	

[†]p-values calculated using Chi-squared tests for association, with Chi-squared tests for trend additionally reported for ordered categorical variables.

E. Additional tabulation of results

See Fig. 8 and Tables 9–14.

Fig. 8. Changes in attitudes to local environment non-cycling items between Baseline and Wave 1 (N = 1712). $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table 9
Predictors of Wave 1 cycling.

	% doing any cycling in the past week (N = 1712)			Minutes of cycling in the past week (N = 1634)		
	%	Minimally-adjusted rate ratio (95% CI)	Additionally-adjusted rate ratio (95% CI)	Mean (SD)	Minimally-adjusted regression coefficient (95% CI)	Additionally-adjusted regression coefficient (95% CI)
Non mini-Holland	15.2%	1	1	29.9 (103.0)	0	0
Mini-Holland	18.4%	1.17 (1.00, 1.38)†	1.16 (0.99, 1.36)†	40.8 (139.4)	4.4 (−3.7, 12.5)	4.1 (−4.0, 12.2)
Non mini-Holland	15.2%	1	1	29.9 (103.0)	0	0
Waltham Forest	20.5%	1.20 (1.00, 1.45)†	1.19 (0.98, 1.45)†	50.1 (137.7)	7.2 (−3.8, 18.2)	6.1 (−5.3, 17.5)
Kingston	20.3%	1.24 (0.99, 1.55)†	1.25 (0.99, 1.58)†	42.2 (139.9)	5.1 (−7.2, 17.5)	4.9 (−7.5, 17.3)
Enfield	12.7%	0.99 (0.72, 1.36)	0.97 (0.71, 1.33)	24.8 (140.1)	−0.9 (−16.8, 15.1)	0.3 (−16.2, 16.9)
Non mini-Holland	15.2%	1	1	29.9 (103.0)	0	0
Low-dose mini-Holland	15.9%	1.10 (0.91, 1.33)	1.10 (0.90, 1.34)	34.0 (135.7)	0.9 (−9.0, 10.8)	1.4 (−8.5, 11.2)
High-dose mini-Holland	22.4%	1.25 (1.03, 1.53)*	1.24 (1.02, 1.52)*	51.9 (144.6)	10.1 (−1.6, 21.7)†	8.9 (−3.1, 20.8)

†$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, for difference from the non mini-Holland group. Minimally adjusted analyses adjust only for the baseline measure of the outcome in question. Additionally-adjusted analyses also adjust for gender, age, ethnicity, disability, household type, employment type and number of cars in the household.

Table 10
Predictors of Wave 1 walking.

	% doing any walking in the past week (N = 1712)			Minutes of walking in the past week (N = 1634)		
	%	Minimally-adjusted rate ratio (95% CI)	Additionally-adjusted rate ratio (95% CI)	Mean (SD)	Minimally-adjusted regression coefficient (95% CI)	Additionally-adjusted regression coefficient (95% CI)
Non mini-Holland	82.9%	1	1	203.1 (217.5)	0	0
Mini-Holland	87.6%	1.03 (0.99, 1.08)	1.03 (0.98, 1.07)	240.9 (229.6)	24.8 (3.7, 45.9)*	19.0 (−1.8, 39.8)†
Non mini-Holland	82.9%	1	1	203.1 (217.5)	0	0
Waltham Forest	87.2%	1.02 (0.97, 1.08)	1.00 (0.95, 1.05)	245.0 (224.0)	24.6 (−2.9, 52.2)†	12.4 (−15.4, 40.1)
Kingston	89.3%	1.05 (1.00, 1.11)†	1.06 (1.00, 1.12)*	258.3 (250.6)	31.7 (−2.1, 65.4)†	33.3 (0.2, 66.4)*
Enfield	86.1%	1.03 (0.96, 1.10)	1.02 (0.96, 1.09)	213.9 (209.9)	17.2 (−13.9, 48.3)	12.3 (−18.7, 43.3)
Non mini-Holland	82.9%	1	1	203.1 (217.5)	0	0
Low-dose mini-Holland	87.0%	1.03 (0.98, 1.08)	1.03 (0.98, 1.08)	222.6 (203.6)	12.1 (−10.9, 35.1)	11.4 (−11.5, 34.4)
High-dose mini-Holland	88.6%	1.04 (0.99, 1.10)	1.02 (0.97, 1.08)	270.4 (264.6)	45.4 (13.5, 77.3)**	32.0 (−0.1, 64.1)†

See footnote to Table 9

Table 11
Predictors of Wave 1 active travel (cycling or walking).

	% doing any cycling or walking in the past week (N = 1712)			Minutes of cycling or walking in the past week (N = 1634)		
	%	Minimally-adjusted rate ratio (95% CI)	Additionally-adjusted rate ratio (95% CI)	Mean (SD)	Minimally-adjusted regression coefficient (95% CI)	Additionally-adjusted regression coefficient (95% CI)
Non mini-Holland	85.3%	1	1	233.0 (235.4)	0	0
Mini-Holland	90.0%	1.03 (0.99, 1.07)†	1.03 (0.99, 1.07)	281.7 (263.1)	28.3 (6.1, 50.1)*	23.0 (1.0, 44.9)*
Non mini-Holland	85.3%	1	1	233.0 (235.4)	0	0
Waltham Forest	89.2%	1.02 (0.97, 1.07)	1.00 (0.96, 1.05)	295.1 (258.3)	31.9 (2.2, 61.6)*	19.5 (−10.5, 49.5)
Kingston	92.9%	1.06 (1.01, 1.11)*	1.06 (1.02, 1.12)**	300.5 (277.5)	33.2 (−2.2, 68.6)†	34.9 (−0.1, 69.8)†
Enfield	87.7%	1.02 (0.96, 1.08)	1.02 (0.96, 1.08)	238.7 (248.6)	17.2 (−16.6, 51.1)	14.5 (−19.7, 48.7)
Non mini-Holland	85.3%	1	1	233.0 (235.4)	0	0
Low-dose mini-Holland	89.2%	1.03 (0.98, 1.07)	1.03 (0.98, 1.07)	256.5 (238.7)	12.3 (−12.1, 36.7)	12.5 (−12.1, 37.1)
High-dose mini-Holland	91.2%	1.04 (1.00, 1.09)†	1.03 (0.98, 1.08)	322.3 (294.7)	54.4 (20.5, 88.2)***	41.0 (7.0, 75.0)*

See footnote to Table 9.

Table 12
Predictors of Wave 1 car use.

	% doing any car use in the past week (N = 1712)			Minutes of car use in the past week(N = 1634)		
	%	Minimally-adjusted rate ratio (95% CI)	Additionally-adjusted rate ratio (95% CI)	Mean (SD)	Minimally-adjusted regression coefficient (95% CI)	Additionally-adjusted regression coefficient (95% CI)
Non mini-Holland	78.5%	1	1	159.7 (199.7)	0	0
Mini-Holland	70.1%	0.94 (0.90, 0.99)*	0.96 (0.92, 1.01)	141.4 (181.5)	−3.1 (−20.0, 13.8)	1.9 (−14.6, 18.4)
Non mini-Holland	78.5%	1	1	159.7 (199.7)	0	0
Waltham Forest	60.1%	0.89 (0.82, 0.96)**	0.95 (0.88, 1.02)	110.8 (155.9)	−19.3 (−38.7, 0.0)†	−3.1 (−21.9, 15.8)
Kingston	76.3%	0.97 (0.90, 1.04)	0.97 (0.91, 1.04)	160.0 (192.1)	6.7 (−16.9, 30.3)	3.8 (−19.3, 27.0)
Enfield	70.3%	0.98 (0.93, 1.04)	0.97 (0.91, 1.03)	167.5 (198.5)	10.5 (−19.0, 39.9)	6.9 (−22.0, 35.9)
Non mini-Holland	78.5%	1	1	159.7 (199.7)	0	0
Low-dose mini-Holland	77.9%	0.98 (0.93, 1.03)	0.97 (0.93, 1.02)	161.8 (182.9)	7.5 (−12.1, 27.2)	3.5 (−15.5, 22.4)
High-dose mini-Holland	57.3%	0.86 (0.79, 0.94)**	0.94 (0.86, 1.02)	108.6 (174.3)	−20.5 (−41.7, 0.7)†	−0.8 (−22.2, 20.5)

See footnote to Table 9.

Table 13
Predictors of local environment scores at Wave 1 (N = 1712).

	Cycling perception score (4 items)		Non-cycling perception score (10 items)		General local environment perception score (14 items)	
	Mean score (SD)	Regression coefficients (95% CI)	Mean score (SD)	Regression coefficients (95% CI)	Mean score (SD)	Regression coefficients (95% CI)
Non mini-Holland	−0.43 (0.76)	0	0.23 (0.56)	0	0.04 (0.52)	0
Mini-Holland	−0.06 (0.78)	0.22 (0.16, 0.28)***	0.23 (0.56)	0.02 (−0.03, 0.06)	0.14 (0.54)	0.07 (0.03, 0.11)***
Non mini-Holland	−0.43 (0.76)	0	0.23 (0.56)	0	0.04 (0.52)	0
Waltham Forest	−0.01 (0.78)	0.23 (0.15, 0.32)***	0.13 (0.57)	−0.01 (−0.07, 0.05)	0.09 (0.56)	0.06 (−0.01, 0.11)†
Kingston	0.03 (0.77)	0.22 (0.14, 0.31)***	0.41 (0.51)	0.09 (0.03, 0.15)**	0.30 (0.51)	0.12 (0.07, 0.18)***
Enfield	−0.26 (0.75)	0.19 (0.10, 0.29)***	0.18 (0.53)	−0.03 (−0.10, 0.03)	0.05 (0.49)	0.03 (−0.03, 0.09)
Non mini-Holland	−0.43 (0.76)	0	0.23 (0.56)	0	0.04 (0.52)	0
Low-dose mini-Holland	−0.14 (0.77)	0.19 (0.12, 0.26)***	0.28 (0.53)	0.04 (−0.01, 0.08)	0.16 (0.52)	0.08 (0.03, 0.12)**
High-dose mini-Holland	0.06 (0.78)	0.27 (0.19, 0.36)***	0.15 (0.58)	−0.02 (−0.08, 0.04)	0.12 (0.57)	0.06 (0.00, 0.11)*

†p < 0.10, *p < 0.05, **p < 0.01, for difference from the non mini-Holland group. All analyses adjust for the baseline measure of the outcome in question, plus gender, age, ethnicity, disability, household type, employment type and number of cars in the household.

Table 14
Attitudes of participants towards TfL/local area support for investment in cycling at Wave 1: adjusted multinomial regression model (N = 1712).

	'Too little support' versus 'about the right amount'	'Too much support' versus 'about the right amount'
Non mini-Holland	1	1
Mini-Holland	0.71 (0.62, 0.80)***	1.37 (1.14, 1.63)**
Non mini-Holland	1	1
Waltham Forest	0.68 (0.56, 0.83)****	1.35 (1.10, 1.66)**
Kingston	0.70 (0.58, 0.85)***	1.22 (0.98, 1.52)†
Enfield	0.74 (0.60, 0.92)**	1.56 (1.27, 1.91)***
Non mini-Holland	1	1
Low-dose mini-Holland	0.76 (0.66, 0.87)***	1.37 (1.14, 1.64)**
High-dose mini-Holland	0.60 (0.47, 0.75)***	1.36 (1.11, 1.68)**

*p < 0.05, **p < 0.01, ***p < 0.001, for difference from the non mini-Holland group. All analyses adjust for baseline attitudes in the level of support for cycling, plus gender, age, ethnicity, disability, household type, employment type and number of cars in the household.

References

Aldred, R., 2012. Governing transport from welfare state to hollow state: The case of cycling in the UK. Transp. Policy 23, 95–102.
Aldred, R., 2013. Incompetent or too competent? Negotiating everyday cycling identities in a motor dominated society. Mobilities 8 (2), 252–271.
Aldred, R., Watson, T., Lovelace, R., Woodcock, J., 2017. Barriers to investing in cycling: Stakeholder views from England. Transport. Res. Part A: Policy Pract. http://dx.doi.org/10.1016/j.tra.2017.11.003. (in press, corrected proof).
Braun, L.M., Rodriguez, D., Cole-Hunter, T., Ambros, A., 2016. Short-term planning and policy interventions to promote cycling in urban centers: findings from a commute mode choice analysis in Barcelona, Spain. Transport. Res. Part A 89, 164–183.
Carlin, A., Murphy, M., Gallagher, A., 2015. Do interventions to increase walking work? A systematic review of interventions in children and adolescents. Sports Med. 46 (4), 515–530.
Celis-Morales, C., Lyall, D., Welsh, P., Anderson, J., Steell, L., Guo, Y., Maldonado, R., Mackay, D., Pell, J., Sattar, N., Gill, J., 2017. Association between active commuting and incident cardiovascular disease, cancer, and mortality: prospective cohort study. BMJ 357, j1456.
Chandler, M., 2016. Drivers call for reversal of mini-Holland scheme run by 'cycling Taliban'. Evening Standard. < https://www.standard.co.uk/news/transport/drivers-call-for-reversal-of-miniholland-scheme-run-by-cycling-taliban-a3268536.html > (accessed 3 April 2018).
Cohen, J., Boniface, S., Watkins, S., 2014. Health implications of transport planning, development and operations. J. Transp. Health 1 (1), 63–72.
Crane, M., Rissel, C., Standen, C., Ellison, A., Ellison, R., Wen, L.M., Greaves, S., 2017. Longitudinal evaluation of travel and health outcomes in relation to new bicycle infrastructure, Sydney, Australia. J. Transp. Health 6, 386–395.
Di, G., Palmieri, S., 2016. Cycling in a megacity: the case of London. In: Urban Planning, Public Space and Mobility, first ed. pp. 129–150.
Douglas, M., Watkins, S., Gorman, D., Higgins, M., 2011. Are cars the new tobacco? J. Pub. Health 33 (2), 160–169.
EWF, 2017a. Enjoy Waltham Forest. < http://www.enjoywalthamforest.co.uk > (accessed 22 October 2017).
EWF, 2017b. Enjoy Waltham Forest Walking and Cycling Account. < https://www.enjoywalthamforest.co.uk/wp-content/uploads/2015/01/Walking-Cycling-Account-2017.pdf > (accessed 22 October 2017).
Fairnie, G., Wilby, D., Saunders, L., 2016. Active travel in London: the role of travel survey data in describing population physical activity. J. Transp. Health. http://dx.doi.org/10.1016/j.jth.2016.02.003.
Feuillet, T., Salze, P., Hélène, C., Menai, M., Enaux, C., Perchoux, C., Franck, H., Kesse-Guyot, E., Serge, H., Simon, C., Weber, C., Oppert, J., 2016. Built environment in local relation with walking: why here and not there? J. Transp. Health 3, 500–512.
Foley, L., Panter, J., Heinen, E., Prins, R., Ogilvie, D., 2015. Changes in active commuting and changes in physical activity in adults: a cohort study. Int. J. Behav. Nutr. Phys. Activity 12, 161.
Givoni, M., 2012. Re-assesing the results of the London congestion charging scheme. Urban Stud. 49 (5), 1089–1105.
GLA datastore, 2017. London Borough Profiles and Atlas. < https://data.london.gov.uk/dataset/london-borough-profiles > (accessed 12 November 2017).
Goodman, A., Sahlqvist, S., Ogilvie, D., 2013. Who uses new walking and cycling infrastructure and how? Longitudinal results from the UK iConnect study. Prev. Med. 57 (5), 518–524.

Goodman, A., Sahlqvist, S., Ogilvie, D., 2014. New walking and cycling routes and increased physical activity: one-and 2-year findings from the UK iConnect Study. Am. J. Pub. Health 104 (9), 38–46.
Handy, S., Cao, X., Mokhtarian, P., 2005. Correlation or causality between the built environment and travel behavior? Evidence from Northern California. Transport. Res. Part D: Transp. Environ. 10 (6), 427–444.
Hill, D., 2015. Waltham Forest 'mini-Holland' row: politics, protests and house prices. The Guardian. < https://www.theguardian.com/uknews/davehillblog/2015/nov/07/waltham-forest-mini-holland-row-politicsprotests-and-house-prices > (accessed 3 November 2017).
Hill, D., 2017. The long war of mini-Holland in Enfield. The Guardian. < https://www.theguardian.com/uk-news/davehillblog/2017/jan/17/thelong-war-of-mini-holland-in-enfield > (accessed 3 October 2017).
Hull, A., O'Holleran, C., 2014. Bicycle infrastructure: can good design encourage cycling? Urban Plan. Transp. Res. 2 (1), 369–406.
Humphreys, D., Panter, J., Sahlqvist, S., Goodman, A., Ogilvie, D., 2016. Changing the environment to improve population health: a framework for considering exposure in natural experimental studies. J. Epidemiol. Commun. Health 70 (9), 941–946.
Jarrett, J., Woodcock, J., Griffith, U.K., Chalabi, Z., Edwards, P., Roberts, I., Haines, A., 2012. Effect of increasing active travel in urban England and Wales on costs to the National Health Service. Lancet 379 (9832), 2198–2205.
Keall, M., Chapman, R., Howden-Chapman, P., Witten, K., Abrahamse, W., Woodward, A., 2017. Increasing active travel: results of a quasi-experimental study of an intervention to encourage walking and cycling. Epidemiol. Commun. Health 69 (12), 1184–1190.
Kohl, H., Craig, C., Lambert, E., Inoue, S., Alkandari, J.R., Leetongin, G., Kahlmeier, S., 2012. The pandemic of physical inactivity: global action for public health. Lancet 380 (9838), 294–305 21.
Mead, N., 2015. Bike lane blues: why don't businesses want a £30m cycle-friendly upgrade?. The Guardian. < https://www.theguardian.com/cities/2015/oct/05/bike-lane-blues-london-local-businesses-cycle-enfield-green-lanes > (accessed 26 October 2017).
Ogilvie, D., 2016. Physical activity for public health: in pursuit of rigorous evaluation in the real world. Charles Perkins Centre. < https://www.youtube.com/watch?v=CosVe5_r3Vw, University of Sydney > (accessed 25 October 2017).
Ogilvie, D., Cummins, S., Petticrew, M., White, M., Jones, A., Wheeler, K., 2011. Assessing the evaluability of complex public health interventions: five questions for researchers, funders, and policymakers. Milbank Q. 89 (2), 206–225.
Ogilvie, D., Egan, M., Hamilton, V., Petticrew, M., 2004. Promoting walking and cycling as an alternative to using cars: systematic review. Br. Med. J. 329 (7469), 763–766.
Ogilvie, D., Foster, C., Rothnie, H., Cavill, N., Hamilton, V., Fitzsimons, C., Mutrie, N., 2007. Interventions to promote walking: systematic review. BMJ 334 (7605) 1204-1204.
ONS., 2017. 2011 Census. < https://www.ons.gov.uk/census/2011census > (accessed 1 November 2017).
Panter, J., Griffin, S., Jones, A., Mackett, R., Ogilvie, D., 2011. Correlates of time spent walking and cycling to and from work: baseline results from the Commuting and Health in Cambridge study. Int. J. Behav. Nutr. Phys. Activity 8, 124.
Panter, J., Heinen, E., Mackett, R., Ogilvie, D., 2016. Impact of new transport infrastructure on walking, cycling, and physical activity. Am. J. Prev. Med. 50 (2), 45–53.
Panter, J., Ogilvie, D., 2017. Can environmental improvement change the population distribution of walking? On behalf of the iConnect consortium. J. Epidemiol. Community Health 71, 528–535.
Patient, D., 2017. Protests at grand opening of Mini Holland scheme to feature in documentary. East London and West Essex Guardian Series. < http://www.guardianseries.co.uk/news/14305046.Protests_at_grand_opening_of_Mini_Holland_scheme_to_feature_in_documentary/ > (accessed 28 October 2017).
Pucher, J., Buehler, R., 2012. City Cycling. The MIT Press, London.
Pucher, J., Buehler, R., 2017. Cycling towards a more sustainable transport future. Transp. Rev. 37 (6), 689–694.
Pucher, J., Dill, J., Handy, S., 2010. Infrastructure, programs, and policies to increase bicycling: an international review. Prev. Med. 50, 106–125.
Rissel, C., Greaves, S., Wen, L.M., Crane, M., Standen, C., 2015. Use of and short-term impacts of new cycling infrastructure in inner-Sydney, Australia: a quasi-experimental design. Int. J. Behav. Nutr. Phys. Activity 12 (1), 129.
Sahlqvist, S., Goodman, A., Cooper, A., Ogilvie, D., 2013. Change in active travel and changes in recreational and total physical activity in adults: longitudinal findings from the iConnect study. Int. J. Behav. Nutr. Phys. Activity 10, 28.
Sahlqvist, S., Goodman, A., Jones, T., Powell, J., Song, Y., Ogilvie, D., 2015. Mechanisms underpinning use of new walking and cycling infrastructure in different contexts: mixed-method analysis. Int. J. Behav. Nutr. Phys. Activity 12 (1), 24.
Saunders, L., Green, J., Petticrew, M., Steinbach, R., Roberts, H., 2013. What are the health benefits of active travel? A systematic review of trials and cohort studies. PLoS One 8 (8), e69912. http://dx.doi.org/10.1371/journal.pone.0069912.
Scheepers, C., Wendel-Vos, G., Den Broeder, J., Van Kempen, E., Van Wesemael, P., Schuit, A., 2014. Shifting from car to active transport: a systematic review of the effectiveness of interventions. Transport. Res. Part A: Policy Pract. 70, 264–280.
Shannon, T., Giles-Corti, B., Pikora, T., Bulsara, M., Shilton, T., Bull, F., 2006. Active commuting in a university setting: assessing commuting habits and potential for modal change. Transp. Policy 13, 240–253.
Song, Y., Preston, J., Ogilvie, D., 2017. New walking and cycling infrastructure and modal shift in the UK: A quasi-experimental panel study. iConnect consortium. Transport. Res. Part A Policy Pract. 95, 320–333.
Sport England 2017. Active People Survey. < https://www.sportengland.org/research/about-our-research/active-people-survey/ > (accessed 2 November 2017).
Stewart, G., Anokye, N.K., Pokhrel, S., 2015. What interventions increase commuter cycling? A systematic review. BMJ Open 5, 8.
Sun, G., Oreskovic, N., Lin, H., 2014. How do changes to the built environment influence walking behaviors? A longitudinal study within a university campus in Hong Kong. Int. J. Health Geogr. 13 (1), 28.
TfL, 2013. Cycling Vision Portfolio. < http://content.tfl.gov.uk/glamayors- cycle-vision-2013.pdf > (accessed on 12 October 2017).
TfL., 2016. Travel in London: Report 9. < http://content.tfl.gov.uk/travel-in-london-report-9.pdf > (accessed on 20 October 2017).
TfL, 2017. T-charge. < https://tfl.gov.uk/modes/driving/emissions-surcharge > (accessed 25 October 2017).
TfL, 2017a. Healthy Streets. < http://content.tfl.gov.uk/healthy-streets-for-london.pdf > (accessed 25 October 2017).
TfL, 2017b. Mini-Hollands. < https://tfl.gov.uk/travel-information/improvements-and-projects/cycle-mini-hollands > (accessed 19 October 2017).
TfL, 2017c. Programmes and Investment Committee 13 October 2017. Investment Programme Report – Quarter 1, 2017/18, < https://tfl.gov.uk/cdn/static/cms/documents/pic-20171013-agenda-item05-investment-programme-q1.pdf > (accessed 3 April 2018).
Urry, J., 2004. The 'system' of Automobility. Theory, Culture and Society, vol. 21(4/5), 25–39.
Wasfi, R., Dasgupta, K., Eluru, N., Ross, N., 2015. Exposure to walkable neighbourhoods in urban areas increases utilitarian walking: longitudinal study of Canadians. J. Transp. Health 3 (4), 440–447.
We Support Waltham Forest Mini-Holland, 2017. We Support Mini Holland in Waltham Forest. < https://wesupportmh.wordpress.com/gallery/ > (accessed 15 November 2017).
Yang, L., Sahlqvist, S., McMinn, A., Griffin, S., Ogilvie, D., 2010. Interventions to promote cycling: systematic review. BMJ 341, c5293.
Zahabi, S.A., Chang, A., Miranda-Moreno, L., Patterson, Z., 2016. Exploring the link between the neighborhood typologies, bicycle infrastructure and commuting cycling over time and the potential impact on commuter GHG emissions. Transport. Res. Part D. Transp. Environ. 47, 89–103.
Zou, G., 2004. A modified Poisson regression approach to prospective studies with binary data. Am. J. Epidemiol. 159 (7), 702–706.