CWIS Active Travel Investment Models:
Model structure and evidence base

Technical appendix 5:
Compendium of interventions

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Contents

Introduction and scope of this paper

This paper aims to provide a compendium of interventions that can be used to increase walking, cycling and walking-to-school. In particular, it aims to summarise the available evidence on their cost-effectiveness in order to feed into tables in the model that show the range of costs per unit of uplift. Inevitably, the classification of interventions into particular types is an imperfect science, not least since many are multi-stranded, or have unique features. The typology developed during the project has evolved, partly to fit the requirements of the model, and further refinements could undoubtedly be made.

This paper has drawn on data and reports from the following sources:

(a) Local authorities that delivered walking and cycling schemes as part of the Local Sustainable Transport Fund (LSTF), with evidence sought at both an 'intervention' level and area or city-wide level

(b) NGOs that have delivered walking and cycling interventions including Sustrans, Living Streets, Cycling UK, British Cycling, TABS, the Bikeability Trust, Bikeplus and Challenge for Change

(c) Transport consultancies and private organisations

(d) Academic literature

(e) Department for Transport and Transport for London sustainable travel evaluations.

The focus was on recent UK evidence. There are various categories of intervention which are not summarised here, simply because the available evidence for our study did not enable us to consider them in detail. However, they are discussed further in Technical Appendix 4: the associated 'Overview of evidence on increasing active travel', which updates the Department for Transport's previous evidence review and draws out more generic conclusions about the costs of different interventions. The references used in this paper (as indicated by superscript numbers), and a full list of acknowledgements, are also both given in Appendix 4. We are extremely grateful for the enormous amount of assistance provided by others.

Throughout this paper, the term 'trip' is used to mean a one-way journey stage. (Hence, assumptions about '2 trips' usually refer to one return journey.)

Reported 'costs per trip' in this paper are based on our own analysis, applying consistent assumptions to evidence from multiple sources, to the extent that this was possible. They are our best estimate of the investment required to generate **one additional cycle / walk /walk-to-school journey stage per year, in the year when maximum build-up of effect has been reached and before that effect starts to decay[i].**

There are numerous reasons why the estimates may not be correct. For example, some cost per trip figures may be over-estimated, because changes in walking and cycling volumes are often reported shortly after a scheme has been completed, at which date the full build-up of use may not have occurred. This is likely to be the case for cycle parking or hire schemes. For all capital schemes, costs per trip appear high, but will fall if use continues to grow over several years. With further evidence and analysis, the accuracy of the calculations given in this Appendix could gradually be improved over time.

[i] This is *not* the cost per trip calculated from the cumulative number of trips over multiple years.

A. Area-wide cycling networks (with supportive promotion)

Nature of evidence, geographical areas, populations and journey purposes

The main data analysed were taken from the 12 Large Projects funded through the Local Sustainable Transport Fund (LSTF, 2011/12-2015/16)[1]; the 6 Cycling Demonstration Towns (CDTs, 2005-2011) [2, 20]; the 12 Cycling City and Towns (CCTs, 2008-2011)[2, 20]; and initial results of the Cycle City Ambition project (CCA 2013-2018) [22]. Locations consisted of a mix of medium, large, and very large urban areas. All programmes included infrastructure measures. Associated cycling promotion activities also took place in most cases. There was also some academic literature about the outcomes of area-wide cycle networks.

Scale of activities

The CDT and CCT programmes were town or city-wide. The scale of work varied in the 12 LSTF Large Project areas, however, in total, measures included more than 10,000 cycle parking spaces (new or upgraded); more than 400km of new or improved cycle routes; bike maintenance services or classes that were taken up by over 25,000 people; and cycle training that was taken up by over 17,000 adults[1]. Other measures included school and workplace travel interventions and residential and non-residential personalised travel planning (PTP), all on a substantial scale. The eight CCA cities implemented 112km of cycle routes (across 14 schemes) in phase 1 (2013-15), with a mix of scheme types.

Costs

The 12 LSTF Large Projects invested an estimated £131 million in cycling and walking infrastructure and services between 2011/12 and 2014/15, together with £77.5 million on multi-modal behaviour change programmes. Annual spend per capita (assuming that about a third of the latter spending was related to encouraging cycling and walking) was £6[ii]. Annual expenditure per capita was £11-29 (average £17) for the CDTs, over 5.5 years; and £11-23 (average £14) for the CCTs, over 3 years. Calculations on phase 1 CCA data suggest costs per cycle route kilometre implemented ranged from £250,000 - £1.4million (depending on scheme type), averaging £700,000 per km.

Impacts

- Evaluation showed increases in cycling in all 18 CDTs/CCTs (based on data from automatic cycle counters and manual counts). For six towns with more detailed data, there was evidence that the average growth rate during the programme period was greater than the growth rate before the programme started, by between +0.5%-points and +5.9%-points per year, with a mean uplift above pre-programme trend of +2-3%-points per year (data from automatic cycle counters)[iii]. Comparison of change in cycle commuting in the 18 CDTs/CCTs with change in three comparison groups found that the prevalence of cycling to work increased in the CDTs/CCTs by between +0.69% and +1.23%, relative to the comparators (Census data, 2001 and 2011, difference-in-difference).
- For the LSTF Large Projects, there was scheme-specific evidence that the interventions had resulted in increases in cycling. This was corroborated by data from the Active People Survey (APS), which showed that the proportion of adults cycling in the previous 28 days increased from 14.1% to 14.5% during the LSTF period, while it fell from 16.0% to 15.4% in a national comparator group of local authorities over the same period.

[ii] Figures calculated using raw project data.
[iii] Figures calculated from Table 5 in reference 1.

- For the CCA cities, there was evidence from automatic cycle counters that the interventions had resulted in absolute increases in cycling, though there was considerable variation between the different schemes ranging from +3% to +131%. Data from user surveys suggested that a significant proportion (18%) were new trips that would not have occurred without the infrastructure, or which had replaced trips by other modes. There was also evidence that the new infrastructure had helped cyclists improve their levels of physical activity, and had improved perceptions of the safety and convenience of cycling
- Studies of cycle infrastructure provision in Minnesota[12], Portland[11], Denmark[16,17], the Netherlands[17], Seville[23] and Vancouver[23], and a recent major evidence review[224],all suggest that large-scale or area-wide cycling infrastructure increases cycle trips (albeit to varying extents). There is also considerable academic literature calculating the cost effectiveness of cycle infrastructure and/or modelling potential impacts[3, 4, 8, 9, 11, 15, 18]. However, variability in findings and differences in measurement and context mean that data have not been used for these cost calculations.

Costs per trip generated and time profile

Various estimates of trip costs[iv] suggest that a range of £10-£70 per cycle trip generated by the end of the programmes may be valid, with costs likely to be higher in medium-sized urban areas (compared with conurbations). Long-term evaluation of the cycling infrastructure in Darlington suggested that increases in cycling achieved between 2004 and 2009 had been maintained by 2014 (with possible further increases beginning in 2012, associated with LSTF cycling promotion activities)[21].

[iv] We generated one estimate from LSTF data, four estimates from CCT/CDT data and one estimate from CCA data.

B. Town centre walking infrastructure schemes

Nature of evidence, geographical areas, populations and journey purposes

There have been many schemes involving large-scale town centre public realm enhancements that improve conditions for pedestrians. We have information on a scheme completed in Peterborough in 2015[24]; on schemes in Redhill and Telford as part of the LSTF programme[1]; and in Darlington between 2005 and 2009, in the context of other 'Sustainable Travel Town' activities[28].

Scale of activities

Schemes usually involve the central areas of large towns and cities.

Costs

Large-scale schemes are usually multi-million pound projects with costs of £4.1 million for Redhill; £4.2 million for Peterborough; £6.5 million for Darlington; and £8.8 million for Telford.

Impacts

- In Peterborough, 24-hour pedestrian counts increased from 6,045 in 2013 (before scheme opening) to 9,330 in 2016 and 15,831 in 2017. Car traffic and accident numbers both fell.
- In Darlington, walking counts into the town centre suggested increases of 25-43% between 2004 and 2009. Since that time, there is some indication that summer walking levels have increased further, but annual walking totals have declined (by about 10%) from the 2009 peak.
- In Telford, surveys showed that, of those living within 3km of the town centre, 27% of town centre users and 46% of residents said that they were walking more for trips into town compared to a couple of years previously (net of those saying less). However, results from pedestrian counts were mixed.

Costs per trip generated and time profile

Two tentative estimates suggest that the costs are £2-4 per walk trip generated after scheme completion. However, this is based on the assumption that all trip increases into the town centre are new walking trips (rather than being due to destination switching in response to a more attractive town centre).

C: Flagship cycling and walking links

Nature of evidence, geographical areas, populations and journey purposes

'Flagship links' may include both filling in missing links (such as a bridge) or creating individual lengths of high quality pedestrian/cycle path. Data were available from a new pedestrian/cycle bridge in Reading[29] and an aggregate analysis of the 84 Connect2 projects[31]. There was also some impact data from the Cycle Superhighways and Quietways in London[30, 23]. Connect2 projects had data showing benefits for groups including over 65s, women, BME groups and those travelling to school/college. In an earlier report, Sustrans also provided some average cost and impact evidence on implementing a bridge/tunnel[32].

Scale of activities

Infrastructure had been delivered in a variety of locations (with the Connect2 projects providing more direct routes within a mile of four million people). The Sustrans Connect2 links were delivered over a 5 year period.

Costs

The Reading bridge cost £5.9 million. The Connect2 projects cost an average of £2 million each. A Sustrans evaluation report estimated that a new bridge or tunnel costs £1.4 million. No costs were obtained for the London schemes. Data for 7 of the cities receiving funding for cycling infrastructure through the Cycle City Ambition programme indicated that flagship links typically cost in the order of £1-2 million, though very extensive schemes (such as cycle superhighways) can cost > £10 million[v]. In a recent House of Commons debate, a cost of £3.5 million, including £1 million for a bridge, was quoted for a 3 mile Kenilworth to Leamington route, whilst a particularly large project – the restoration of a 1.4 mile ex-railway tunnel (linking Queensbury to Halifax) - was quoted as £16 million[vi].

Impacts

- The Reading data suggested an 11% increase in walking trips, and a 14% increase in cycle trips in year 1 (across the river, totalled across 3 bridges). The ratio of new walkers to cyclists was 3.4:1. In a survey of users, 59% agreed/strongly agreed that the bridge encouraged them to make more active travel trips.
- The Sustrans data suggested a 61% increase in cycle trips, and a 47% increase in walk trips on the new/improved routes, albeit without taking account of any trip diversion. This represented an additional 25,608 cycle trips and 122,687 walk trips per scheme p.a.. The ratio of new walkers to cyclists was 4.7:1. The iConnect study found that 38% of residents near three schemes were using them after two years (an increase from 32% in year one)[7].
- The first two London Cycle Superhighways (CS3 and CS7) were reported to experience increases in usage of 46% and 83% in their first year[23]. Of those using new cycle infrastructure in London and/or aware that there have been improvements, about a third typically report it has encouraged them to cycle a lot more, and a third that it has encouraged them to cycle a bit more, albeit that figures vary with survey.
- Proximity to a traffic-free walking/cycle route alongside the Cambridge guided busway was associated with increases in active travel for commuting[5, 6].
- In the iConnect project, after 2 years, individuals living 1km from the new infrastructure had increased their walking and cycling by 15.3 minutes/week relative to those living 2km away[7].

[v] Data received by study team.

[vi] House of Commons Hansard, vol 663, 9/7/19, 9.30am, 'Active travel' debate.

- In a study of 'Veloway 1', a new cycle route in Brisbane, linking the southern suburbs with the city centre, overall cycle counts (including both those using the new route and alternative routes) increased and those using the new route were shown to be travelling longer distances than those on alternative routes[14].

Costs per trip generated and time profile

The Connect2 schemes produced an average cost of £13 per active travel trip. The Sustrans evaluation report suggested £21 per active travel trip, as a result of installing a bridge or tunnel. One calculation for additional trips generated by the Reading Bridge suggested a cost of £18. Typically, schemes generate 3-4x as many walk trips as cycle trips. The iConnect study suggests that patronage can increase over 2 years, meaning that our estimated trip costs may be relatively high.

D. Neighbourhood traffic calming schemes (20mph zones)

Nature of evidence, geographical areas, populations and journey purposes

20mph areas can be introduced using signs only, or in combination with traffic calming. There is a considerable literature about them, however, it has traditionally focused on the safety impacts, with changes in active travel (or scheme costs) being rarely reported or systematically assessed[41]. A recent review undertaken for the Department for Transport provides new evidence, gathered across 12 case study areas, including surveys with nearly 2,000 residents on signed-only streets (and comparable control sites)[45]. Some information was also available for Kingston upon Hull[36], Portsmouth[34], Nottingham[33], Bristol[44] and Edinburgh[47, 50]. From the international literature, there was evidence showing that traffic calming was associated with higher cycling levels in Ghent (but not in four other major European urban areas) [38]. Meanwhile, schemes to improve conditions for pedestrians can include a wide range of other small-scale infrastructure and traffic management measures, such as safer crossings, new or improved footpaths (including resurfacing and managing vegetation), signing, lighting, provision of seating, improvements to subways/bridges, tidal flow or one-way systems and parking restrictions.

Scale of activities

Hull helped pioneer traffic-calmed 20mph zones in the UK. By 2002, it had 112 such zones, covering 191km (26% of its roads). There were plans (at that time) to implement a further 180 zones, to cover up to 60% of Hull's roads. Portsmouth was also an early adopter, and implemented area-wide 20mph signage on 94% of roads in the borough in 2007/8. Since then, adoption has become more widespread. For example, between 2012 and 2015, Nottingham implemented 20mph zones in 9 areas of the city. In 2012, Edinburgh undertook a 20mph pilot in part of the city, with subsequent roll-out across the city between 2015 and 2018, newly signing 80% of roads. Bristol implemented pilot 20mph zones, leading to the introduction of limits across the city between 2014 and 2015. The '20s Plenty' website lists over 60 places implementing a community-wide 20mph default[vii]. In 2016, local authorities replying to a DfT request about their use of 20mph zones indicated that they had trebled the road length covered (to nearly 4,900km; 39 respondents)[45].[viii]

There is little data available about the scale of other small-scale infrastructure measures for pedestrians. However, the implication is that they are appropriate in most settings. Transport for London has several review tools (Pedestrian Comfort Guidance; Pedestrian Environment Review System) which are used to assess the adequacy of the pedestrian environment, including footways and crossings. Living Streets also has a long-term programme of conducting community street audits.

Costs

A 2017 review of Cycle City Ambition schemes suggests a cost of £2-3,000/km for signage-only 20mph schemes, and £10-15,000/km for schemes including traffic calming[48]. Portsmouth's implementation (in 2007/8) cost approximately £1,400/km. Edinburgh's roll-out cost £2.2 million, implying a cost of £1,800 /km[ix]. Future costs of extending Hull's programme were estimated at £23,000/km (in 2002). Meanwhile, '20s Plenty' refers to a cost of £60,000/km for physical calming, although the source of

[vii] http://www.20splenty.org/20mph_places

[viii] According to DfT table RDL0201, there are 115,985km of minor urban roads in England. With an urban population of around 40 million, and assuming about 60% of roads might be suitable for treatment, this suggests (as a very broad approximation) that it might be feasible to treat about 100km of road for every 60,000 residents. This figure is also compatible with Hull data – 440km considered suitable for treatment; population 260,000.

[ix] According to DfT table RDL0202, there are 1,551km of roads in Edinburgh.

the figure is unclear[x]. Leeds has recently changed from a programme of providing 20mph zones including traffic calming, to a more rapid deployment of signage and a 'manage and monitor' approach to retrospectively provide calming where needed – with an estimated change in cost from £18,000 to £6,000 per area treated[49]. The proposed programme will cost £0.5million, and enable delivery of 90 outstanding schemes in a year (compared to previous delivery of 15 schemes per year). Additional/alternative measures to improve the pedestrian environment will range widely in cost, depending on the scale of activities implemented. For example, in a study of 30 best-practice school travel plans, the costs of infrastructure improvements and on-street safety measures ranged from £5,000 to £400,000[183]. (Sections X and AA discuss school measures in more detail.)

Impacts

Impacts on safety (or air quality or resident satisfaction) are not considered here, albeit they are often the main motivation for improving conditions for pedestrians through these schemes.

In terms of the impacts of 20 mph zones on travel choices:

- **For school travel:** In 2011, both Hull and Portsmouth had unusually high levels of primary age children walking to school (80% and 78% respectively)[xi]. Portsmouth specifically reported an increase in walking levels (for children age 5-16) from 68% to 73% between 2007 and 2009. Walking and cycling to school was also reported to increase in the Edinburgh pilot area (from 63 to 65% for walking, and 4 to 12% for cycling, albeit that residents' surveys suggested much greater increases in walking by primary children). Walking and cycling to school was also reported to increase in Bristol; whilst cycling more generally by children was reported to increase in the new review for DfT (but impacts on children's walking or school travel were not assessed).
- **For general walking and cycling:** In most surveys of 20mph zone residents, respondents say they walk or cycle more: 25% reported that they walked or cycled more in Hull (546 respondents); 7% reported more walking, 5% reported more cycling in Edinburgh (1000 residents); 9% walking more, 8% cycling more in Portsmouth (1445 respondents); 4-6% walk more, 0.5-3.5% cycle more in the 12 case study sites reviewed by DfT (1,966 and 350 respondents respectively). In Nottingham, it is reported that sustainable travel trips increased by 18% compared to 11% in control areas (with the increase primarily being walking). In Bristol, surveys carried out before and after implementation showed people walking more in their local areas, and, between 2010 and 2015, the proportion walking and cycling to work had increased (albeit in a context where many other changes had taken place too).

In terms of other evidence about the impacts of small-scale improvements to the pedestrian environment:

- For the 30 best practice travel plan schools, improvements in the safety of the school catchment were associated with increases in walking and cycling at secondary level, and with achieving high 'end levels' of walking and cycling at all schools.
- Data from a study in Canada (Wasfi et al, 2016[216]) showed that moving to a neighbourhood with a higher 'walkability' score increased the odds of walking regularly for travel by 59% compared to other types of residential move.

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[x] 20s Plenty website briefing: http://d3n8a8pro7vhmx.cloudfront.net/20splentyforus/legacy_url/60/20mphLimits_7_times_more_cost_effective_than_20mph_zones.pdf?1431367879

[xi] Based on data used for this project to generate baseline levels of walking to school at local authority district level.

- Data from Perth (McCormack et al, 2012[221]) showed that a 10km increase in pavement provision led to an increase in neighbourhood-based walking of 5.3 minutes/week/person.

Costs per trip generated and time profile

Tentative calculations for Hull, Portsmouth and Nottingham suggested a cost per additional active travel trip of £1-3. Suppose, in a town of 60,000 people, 5-10% people make an additional 2 active travel trips per week[xii]. If this is achieved by introducing 20mph limits and other small-scale measures across 100km of roads, at a cost of £200,000-1,500,000, this would imply a cost per trip of <£1 (least cost; greatest change) to £5 (greatest cost; least change). Given that the Hull evidence suggests more substantial/expensive schemes are likely to result in greater behavioural change, use of a midpoint value seems appropriate. For school travel, if 5% of primary school children start travelling actively[xiii], the range of costs would be in the order of £3-26 per primary child school trip. Overall, the evidence for impacts on walking and school travel are more convincing than for cycling.

[xii] 2 active travel trips are equivalent to one return journey.
[xiii] Calculation assumes 5% population are aged 5-10; and 39 weeks of school.

E. Cycle parking at stations

Nature of evidence, geographical areas, populations and journey purposes

Data are available from three overview studies – an evaluation of the DfT's Bike and Ride investment programme (MVA, 2011)[52]; a study for the rail industry to assess future requirements for cycle parking (TRL, 2015)[53]; and an evaluation of the DfT's Cycle-Rail Fund Round 3 allocation (2017 data)[51]. The TRL study found that 91% of cyclists at stations were commuters.

Scale of activities

The Bike and Ride programme involved cycle provision at 138 stations covering four rail franchises, comprising 2,800 cycle spaces, 1,161 secure cycle spaces, 48 cycle lockers, 310 hire bikes and 3 cycle hubs/hire. The Round 3 funding involved provision of 5,740 spaces (including lockers) at 72 stations. The TRL study included an audit of all British national rail stations, and showed that a total of 2,532 stations had 65,906 spaces.

Costs

The TRL study included averaged costs from Round 1 and 2 ATOC Cycle-Rail Working Group funding 2014, which averaged at £1,136 per space provided (across all types of cycle parking). The Round 3 funding averaged at £1,536 per space. The MVA study averaged £32,463 per station.

Impacts

- Round 3 evaluation found 40% occupation of the spaces that had been provided (i.e. 0.4 users per space)[xiv].
- The MVA study reported on a 12% increase in the number of bikes parked at 120 of the stations where facilities were provided (from 1457 to 1637 bikes). This might imply an additional 1.5 bikes per station. Passenger surveys suggested a 6% increase in rail passengers travelling by bike.
- The TRL study found that overall provision exceeded usage (by an unspecified amount), but that there were 585 stations (24%) with no cycle parking facilities at all, 23% with facilities more than 50% full, and 5% with facilities more than 90% full. It also predicted that rail growth would lead to a need for a further 80,000 spaces over 20 years.

Costs per trip generated and time profile

If each additional bike parked represents 320 trips per year (10 per week for 32 weeks), this would imply a cost per trip of between £12 and £68 per trip in the first year from the Round 3 and MVA evidence. This may represent a real variation in effectiveness, as a result of better targeting of investment in more recent years. If the TRL analysis is correct, and provision of additional cycle parking will increasingly stimulate new cycle users, the economics could be significantly better – i.e. a new cycle parking space (costing £1500) generating 320 trips per year would equate to £5 per trip in the first year. Over time, new cycle parking is less likely to be replacing existing lower-quality provision, and more likely to be catering for new users. It is possible that there will be some offsetting decline in walking.

[xiv] From the data provided, it is unclear whether these are all likely to be new users, or displaced from older parking.

F: Adult cycle training

Nature of evidence, geographical areas, populations and journey purposes

Information was available from 11 main sources (based on initiatives in Greater Manchester, West Midlands, Nottingham, Birmingham, Devon and London), including communication with 5 local authorities[54, 55, 56, 57, 58] and 6 NGO or other overview studies[59, 60, 61, 62, 63, 174]. Schemes typically attracted higher proportions of people from groups which are less likely to cycle, including women and BME groups. Most training had taken place in conurbations, although the Devon scheme had taken place in urban areas of >25,000 people.

Scale of activities

All sources provided details about the scale of schemes – in total, 32,617 people had received training via these schemes. Scheme delivery had taken place in packages lasting between 1 and 5 years. The highest level of scheme delivery per year was to 2,776 people (West Midlands).

Costs

Details about funding (and scale) were available from 8 sources. Funding was 100% revenue, usually ranging from about £40 to £70 per participant (depending on location). However, there are also several estimates suggesting that overall costs may be greater (up to £150 per participant), when including the costs of engaging potential participants, scheme management and where participants receive more than one training session.

Impacts

There were six sources that readily enabled an estimate of the average increase in trips per week, averaging 1.4 trips per participant per week, (0.7, 1, 1.4, 1.5, 1.6 and 1.9). Many sources broke down the increase in trips by the frequency that people were originally cycling, with varying rates for these groups. (There was one study showing a decline in walk trips, and one showing an increase.) Where participant surveys had been undertaken, 30-65% respondents reported cycling more (with some studies reporting specific increases in frequency for journeys to work, or for leisure).

Costs per trip generated and time profile

Cycling increases were assumed to apply to 32 weeks of the year. Where necessary, increases in leisure cycling were assumed to comprise 2 trips per week, and commuting to comprise 6 trips per week. Using these assumptions, it was possible to generate 8 estimates for the cost per additional cycle trip in the year after training, with 7 estimates in the range of £0.70-£1.80 (averaging £1.20), and one of around £3. Evidence from London suggested behaviour at 12 months after training was similar to that recorded after 3 months[174]. A 2016 survey of Greater Manchester's training participants 2013-15 (where half the respondents had received cycle training two years before) showed that increases in cycling had been sustained.

G. Child cycle training

Nature of evidence, geographical areas, populations and journey purposes

There was evidence from one local authority (Nottingham) and seven overview studies (which included national data, but also specific data for Hertfordshire, London and Cambridgeshire)[64, 65, 66, 67, 68, 69, 70, 71]. The overview studies included work for DfT, TABS, Cycling England, TfL and the National Foundation for Educational Research.

Scale of activities

One study reported on data for nearly 260,000 children[64] (although impact analysis was based on pupil data from one local authority area). Sample sizes for the other studies varied from 323 (with a control group of 427) to 5,528 pupils.

Costs

Four studies provided a revenue cost of £40 per pupil. The London study provided an estimate of £75 per head.

Impacts

Six of the evidence sources found that children receiving cycle training cycled more than those that did not. The Goodman et al paper[70] argues that any short-term increases in cycling after offering Bikeability in schools may not be due to that programme, but may instead reflect that those keener to cycle are also more likely to undertake training. (They found a strong effect of engaging in cycle training, but not whether children had been offered Bikeability through school[xv]). The NFER study also did not detect an increase in cycling frequency amongst children as a result of training (although this was not its primary focus).

The SDG report[65] is notable in showing higher proportions of children cycling to secondary school if their feeder schools had received Bikeability funding for a longer period. Specifically, 32 schools in Hertfordshire with Bikeability training at feeder schools for 2 years had increased the proportion of 11-15 years cycling to school by 1.3%; compared to a decline of 0.6% at 10 schools with no Bikeability training at feeder schools (between 2007 and 2010).

Of the studies showing higher levels of cycling amongst pupils receiving training, the additional proportion of trained pupils that were cycling was:

- +7% 'frequently' to school; +8% 'frequently' for leisure (TABS review[65])
- +6% cycling weekly (TfL study[66])
- +10% 'cycled in the last week' (Cycling England study[67])
- +12.7% cycling once a week or more often (Millennium Cohort study[68])
- +10% cycling 'frequently' (Nottingham[71])
- +13.5% cycling at least once a week (Goodman paper[70])
- +1.5% 'usually travels to school' by bike (Goodman paper[70])

Costs per trip generated and time profile

If it is assumed that:

- those cycling at least once a week make an average 2 return trips per week for 32 weeks (i.e. 128 extra trips per year).

[xv] 28% of the group not offered school training had, however, participated in cycle training.

- cycle training results in 5-10% more pupils cycling at this frequency, with costs of £40 per head

this would imply a cost per trip of £3 to £6. The four estimates we generated for specific schemes ranged from £1.60 to £7.00.

H. Conventional bike loans/subsidies

Nature of evidence, geographical areas, populations and journey purposes

Evidence was available from three schemes involving some form of bike loan. These included a loans scheme in the West of England (running since 2009) [72]; a five-month project in the West Midlands involving loan of a bike combined with cycle training, then sale of the bike to the participant for £50[73]; and a loan scheme (for periods ranging from 1 week to 6 months) in South Yorkshire which ran 2013 -2015, also combined with training[74]. There was also some evidence from the Sustrans' Active Travel project[174] (discussed further in the 'Community Initiatives' section). Projects were likely to disproportionately benefit lower income groups.

Scale of activities

About 220 people a year had borrowed bikes in the West of England. 232 people had been involved in the West Midlands project. 2,430 people were loaned bikes in South Yorkshire, of which 50% had also received training. 282 people were loaned bikes through the Sustrans' project.

Costs

The costs per participant were relatively high: £70-260 per person, with the variability partly depending on whether people received training and/or could subsequently purchase the bikes.

Impacts

Data about impacts was limited but comprised:

- In the West of England, respondents reported a 20% increase in cycling after the loan period[xvi].
- In the West Midlands, following the cycle training, 38% of respondents were cycling at least twice a week, 10% were cycling at least once a week and 3% were cycling at least once a month (data from a small sample of participants). Providing people undertaking cycle training with a loan bike also doubled the proportion that completed Level 2 on-road training.
- In South Yorkshire, 71% of participants committed to cycling at least once a week to work as a result of bike leasing; and 60% continued to cycle after the end of the loan period.
- In the Sustrans project, 66% of participants reported that the amount of cycling they did since taking part had increased. The proportion that did at least 10 minutes of active travel on five or more days per week increased from 37% to 55% (within the first year of participation).

One scheme operator commented on the challenge of high demand in summer and low demand in winter.

Costs per trip generated and time profile

Assuming that bikes are used for 6 trips a week for a 6 week loan period, and that 20-70% participants then make 2 trips a fortnight for 26 weeks after the loan, typical scheme costs would be £1-6. Specific estimates from the schemes we looked at were in the order of £2-5. However, there is substantial uncertainty in the calculations, not least due to lack of information about loan periods, levels of cycling during the loan periods, and levels of cycling afterwards.

[xvi] There is some ambiguity as to whether this is 20% of people, or a 20% increase in levels of cycling.

I. On-street cycle hire (of conventional bikes)

Nature of evidence, geographical areas, populations and journey purposes

Information was available in relation to on-street public bike hire schemes in Reading[78], Brighton[77], SW Lincoln[75], Liverpool[76], Nottingham[124] and London[79]. In addition, there were a number of academic papers about on-street cycle hire schemes, including a review of 75 schemes from North America, Australia and Europe (by de Chardon et al[85]), and more in-depth analyses of specific schemes. The literature indicates that larger schemes do not necessarily perform better. However, cycle infrastructure provision in the surrounding area does improve performance. (On-street cycle hire schemes using electrically-assisted bikes are discussed further in section AD. There is obvious overlap in findings, not least as some schemes offer a mix of bike types.)

Scale of activities

According to the Bikeplus website[xvii], in the UK, 26 cities and towns offer on-street cycle hire schemes, with many more in development. Nearly 25,000 bikes are shared for over 50,000 trips per day by over 650,000 unique users. Data for the schemes we evaluated (at the time of receiving data in 2018) was as follows:

Place	Year launched	No. stations	No. bikes
London	2010	750	11,500
Lincoln	2013	26	120
Liverpool	2014	100	500
Reading	2014	28	200
Nottingham	2014	28	50
Brighton	2017	52	n/a

Costs

Outside London, there were five estimates of set-up costs for the schemes, ranging from £0.5 - 2 million. However, the time of the 'set-up' phase had varied significantly, often lasting a number of years. It was common for schemes to be modified, with stations added or removed, to optimise performance. After set-up, estimated running costs (outside London) varied from one scheme operating at zero public subsidy, to schemes with running costs of up to £300,000 p.a.. In London, net public costs over 8 years were £195 million. Several schemes reported problems with vandalism.

Impacts

- Highest levels of use were in London, with 8.4 million uses p.a.. In Brighton, there had been 136,559 uses in the first 6 months. According to de Chardon et al's review, usage of shared bike schemes ranges from 0.22 to 8.4 trips per bike per day, with a median average of 1.8.
- A study of bikeshare in Quebec[80] showed that those living within 500m of a docking station were almost 3 times more likely to have cycled 10 minutes in the past week.
- In London, (based on large scale surveys), 6-9% of members of the bike hire scheme and 21% of casual users say it has prompted them to buy a bike. In addition, 14-18% of members and 78% of casual users say it has increased the amount they cycle on their own bike.
- In London, of casual users, if they had not used a hire bike, 43-44% would have used the tube; 31-36% would have used a bus; 34-38% would have walked; and 3% would have used their own bike.

[xvii] https://como.org.uk/shared-mobility/shared-bikes/what, accessed 24/7/19.

Costs per trip generated and time profile

When comparing usage in the year of maximum usage, with scheme costs to that point *including* set-up costs, costs per hire were in the order of £5-45, with several estimates of around £20 (albeit with one substantially higher estimate). However, where current hires were compared to ongoing running costs, costs per hire per year ranged from zero to £6. Costs per trip would also fall dramatically if taking account of non-hire bike trips generated, but would also need to take account of potential offsetting reductions in walking. Some schemes show growth in the first 2 years that then stabilises; others have shown increasing growth over a period of 5 years.

J. Bike refurbishment

Nature of evidence, geographical areas, populations and journey purposes

Information was available from two schemes. One scheme was operating in Greater Manchester[90], targeted at those recently gaining employment, with a cyclable commute. (At the point of application, 59% had been unemployed for more than 6 months.) The second scheme, run by Life Cycle UK[91], teaches prisoners at HMP Bristol to refurbish bikes, which are then sold on at affordable prices to people on lower incomes. (Cycle maintenance was a feature of various other initiatives – see, for example, the Big Bike Revival in section N.)

Scale of activities

By January 2016, in Manchester, 308 people had received a reconditioned bike. (The scheme began in 2014 – those involved feel that distributing about 300 bikes a year is feasible, but limited by the number of appropriate applicants.) In Bristol, in 2016/17, 546 bikes were refurbished, and 80 were subsequently sold at a subsidised rate.

Costs

Scheme costs were in the order of £110,000-£160,000, equivalent to £280-£360 per bike distributed.

Impacts

Data from Manchester (based on a sample of only 63 participants) indicated that 62% were cycling much more, 22% were cycling more, and 81% were using the bike to cycle to and from work.

Costs per trip generated and time profile

Tentative calculations suggest costs may be in the order of £1-5 per trip in the year participants receive the bike, depending on assumptions made about the frequency of bike use and how many bike purchasers would have otherwise bought a bike anyway.

K. Bike purchase via salary sacrifice

Nature of evidence, geographical areas, populations and journey purposes

Since 1999, employees have been able to purchase a bike and cycle equipment to use for work (and other purposes), via an employer scheme, with tax benefits. Some changes were made to the rules in 2010. Schemes were usually limited in value to £1000, although, since June 2019, this restriction will no longer apply. An evaluation of the scheme by the Institute of Employment Studies (2016) [92] was commissioned by the Cycle to Work Alliance, a policy coalition comprising Cyclescheme, Cycle Solutions, Evans Cycles and Halfords.

Scale of activities

There are a wide variety of schemes running in the UK, often via independent companies, and including most of the main cycle retailers. In 2014, more than 183,000 employees participated in the Cycle to work scheme via the Cycle to Work Alliance, an 11.6 per cent increase on the numbers taking part in 2013, and there had been 1.1 million successful applications since 2007[30].

Costs

Cyclescheme currently provides the following estimates of tax savings to individuals/employers (and therefore public costs) in the first year[xviii].

Cost of bike	£250	£500	£750
Basic rate tax payer saving	80	160	240
Higher rate tax payer saving	105	210	315
Employer saving	35	69	104
Total	£105-140	£229-279	£344-419

Impacts

From a survey that the Cycle to Work Alliance conducted in 2015 (n=13,000)[30], 66% of users were reported to increase the amount they were cycling including 9% (of all respondents) who were previously non-cyclists. Respondents cycled on average 30.4 miles a week on their way to and from work, after having joined the scheme, up by 18.0 miles from 12.4 miles before joining the scheme. (However, IES note that there may have been some survey bias in that keener cyclists might have been more likely to respond.)

Costs per trip generated and time profile

The available evidence suggests that an increase of 6 trips per week (assuming an average distance of 3 miles) may be appropriate, perhaps for 32 weeks of the year. If so, this would imply trip costs of £0.50-2.

[xviii] Data calculated from the table given in this weblink, accessed 21/7/19: https://www.cyclescheme.co.uk/help/faqs/employer-faqs#3

L: Electrically-assisted bikes (grants to individuals)

Nature of evidence, geographical areas, populations and journey purposes

Data were available about the costs and effects of state grants to individuals to purchase e-bikes from France (2017)[102], Jersey (2016) [118], Sweden (2018) [105] and Guernsey (2018) [119], and from sub-national grant schemes in Oslo (2016)[100], various locations in Austria (2009-12) [105,112,103] and 36 locations in France (2010-16)[101]. The issue has recently been reviewed for the Bicycle Association[105]. Corroboratory information was available from a range of locations, including surveys of e-bike owners and projects encouraging people to trial e-bikes. Evidence suggests that, compared to the usual profile of cyclists, women, older age groups and people with health problems are more likely to take up the subsidies.

Scale of activities

There have been national grant programmes for individuals who wish to purchase e-bikes in many countries including France, Germany, Austria, Italy, the Netherlands, Spain and Sweden[105]. There have also been grants offered at regional and city level in many countries. Reports of grant funds being exhausted fairly quickly are common (less than 12 months in Jersey, less than a month in Guernsey, three weeks in Oslo, 24 hours in Berlin[xix]). In both France and Sweden, an observable uplift on national e-bike sales has been attributed to their national grant schemes, whilst uplift in Austria has been attributed to various local incentive programmes[105,99].

Costs

Grants typically provide 25% of the value of the e-bike, with maximum values ranging from €200 for France to about €950 in Sweden, (€500 for Oslo, £300 in Jersey, £375 in Guernsey, €250 for many of the French schemes). The scale of funding allocated also varies, from £100,000 in Guernsey to over €38 million in Sweden and €50m in France (£150,000 in Jersey, €0.5m in Oslo). The reported number of bikes purchased includes 366 in Guernsey, 550 in Jersey, 2540 in Vienna and >150,000 in France.

Impacts

Impacts from grant schemes are reported as follows:

- Comparing a sample of 669 new e-bike owners (with 2,230 other cyclists, of whom 993 wanted to buy an e-bike), results suggested that new e-bike owners' average cycle trip length was 4.7km, compared to 2.3km, and they cycled an additional 12-18km per week. (Oslo)
- After 3 months, new e-bike owners had cycled an average of 275 miles, riding 2-4 days per week, with 60% replacing motor vehicles as their primary mode of transport. (Guernsey)
- Two surveys (of 128 grant recipients in Sep 2016 and 217 recipients in April 2017) suggested 58-63% of grant recipients replaced travel by car/van/scooter/motorbike. From the smaller survey, it was also reported that 19% replaced a conventional bike. 75% used the e-bike for work, and 96% used it for leisure, averaging about 2 days/week for each purpose. (Jersey)
- In a survey of 22,163 beneficiaries, 55% of new owners used the e-bike for work and 84% used it for leisure. 61% of e-bike trips replaced cars whilst 21% replaced conventional bikes. (France)
- In a survey of 346 e-bike grant recipients, on average, respondents had increased their cycling distance from 200 to 1,400km p.a., saving 660km by car, with an average trip length of 7.6km, compared to 3.4km for French cycle commuters (French sub-national schemes)
- In a survey of 196 people receiving e-bike grants in Vorarlberg in 2009, 52% of new e-bike trips were reported to replace conventional bike trips, whilst 35% were previously done as a car driver. Substantial and long-term changes in behaviour were reported for 21% of purchasers. (Austria)

[xix] https://usingrenewables.blogspot.com/2018/07/berlins-e-cargo-bike-subsidy-exhausted.html

- In a survey of 1,398 people receiving subsidies for e-bikes between 2009-11, average cycle distance was reported as 794km, with reductions in car use reported by 37% of respondents for work, 40% for shopping and 40% for leisure trips. (Austria)
- About half of the use of e-bikes generated through the national programme was estimated to substitute for car use. (Sweden)

Many of the findings reported here are backed up from other sources. For example, there are often reports of e-bikers making longer journeys than traditional cyclists (9.8km compared to 6.3km from a survey of commuters in the Netherlands; 11.4km compared to 7.1km from a German survey)[98]. Equally impacts on car use are commonly reported, albeit that the scale of impacts varies. Examples include:

- A 72% reduction in the travelling distance previously undertaken by car by 321 e-bike purchasers in Sweden (c. 2014)[116]
- In a sample of 3,897 recently made trips by 1,796 e-bike owners in North America (2017 data), 46% would previously have been made by car[106]
- In a 2017 survey of 93 e-bike owners in Vermont, the mean annual mileage cycled was 1440 miles, replacing 760 car miles (i.e. 53% of the cycle distance) [110]
- In a trial involving 80 employees who were loaned an e-bike for 6-8 week periods in Brighton, 43% reported driving less, and, averaged across the sample, car mileage reduced by 20%[xx].[98]

In addition to reports about the impacts on regular trip making, (and a considerable literature on the health benefits), there are also reports of reduced car ownership from e-bike purchase[101, 112], that trying out an e-bike (either on a trial or by trying one owned by a friend or relative) can lead to purchase[98,103,108,114,117,121] and perceptions that cycling is safer using an e-bike[104,106].

Costs per trip generated and time profile

In terms of cost per trip, a typical subsidy might be £250. On average, users might then use bikes for 4-6 (one-way) trips per week, with 50-70% replacing journeys not previously made by bike. If cycling for most weeks of the year, this would imply costs of £1-3 per trip. The cost estimates we generated for individual schemes were within this range (with schemes with higher subsidy levels and/or fewer commuters tending to be at the higher end). In some cases, there were some reductions in walking trips reported.

[xx] It should be noted that Brighton has relatively low levels of car ownership, and only 37 participants reported driving a car at least once a week prior to taking part in the trial.

M. Secure cycle parking (with additional facilities)

Nature of evidence, geographical areas, populations and journey purposes

There was evidence from local authority schemes in Nottingham[122] (14 locations), Greater Manchester[48,124] (7 locations, 713 spaces in 2015; 15 locations, 1,206 spaces in 2017), Swindon[125] (2 locations, 180 spaces) and Grimsby, North East Lincolnshire[123] (1 location). Some Manchester hubs include showers and changing; the Grimsby hub includes bike repair, bike hire and other facilities. Some facilities have been provided in these towns from 2010 (Swindon), 2011 (Nottingham), 2012 (Manchester) and 2014 (Grimsby), with locations added over time.

Scale of activities

The number of *unique registered users* was reported to be 560 (Swindon, 2018 data), 730 (Greater Manchester, early 2016) and 1,246 (Nottingham, 2013-15). In terms of *use*, in Grimsby, in 2017, there were 2,952 uses per year (up from 1,520 in 2014) with the majority reported to be occasional or one-off users. In Manchester, in 2015, there were 1,500 uses per month (up from 233 in 2012). In Nottingham, in 2014/15, there were 914 average uses per month. This implies 50-300 uses per location per month.

Costs

Costs ranged from £100,000-£700,000 per location, partly depending on the facilities provided, with the majority of funding required being capital. The Grimsby centre is now run as a community interest company and no longer requires financial input from the authority.

Impacts

In terms of impact data:

- In a 2015 survey in Nottingham, 75% would have travelled by other modes (including 16% who would have walked).
- In Manchester, from a 2015 survey, 51% reported cycling more. 32% would have cycled anyway; 14% would have walked. After dropping their bike, 59% were walking for up to 5 minutes, and 14% were walking for over 5 minutes. Usage was falling by 20-50% in winter months. Meanwhile, the overall number of bikes parked in the centre of Manchester had increased between 2011 and 2015, also indicating the hub was not a displacement facility. 64% of hub users reported using it for commuting.
- In Grimsby, many people said they never cycled before due to lack of cycle parking. People were using it for journeys 'into town', and cycling levels in the wider area are growing.

Costs per trip generated and time profile

Some indicative calculations from estimates of usage levels in the first three years (assuming walk trip substitution is offset by walk trips to the destination, but that 25% of users might have cycled anyway) suggests costs per trip of perhaps £20-70 (excluding additional bike hire trips), but with some higher estimates. Manchester and Grimsby both show a significant increase in use over time, suggesting that costs per trip will reduce substantially over time, given that most of the cost is the initial capital.

N. Mass cycle rides/festivals/events

Nature of evidence, geographical areas, populations and journey purposes

Data were available from 5 sources. Leicester[127] and Bournemouth[126] had both held a number of mass cycle rides (Ride social, Skyride, Breeze) and a cycling festival. In Bournemouth, this included 50 rides in 2015/16. In Leicester, it included 700 rides between 2011 and 2015, and a 1-2 week festival each year. Transport for London[128] had organised various activities, including a fun day aimed at families (Freecycle); and a ride for committed cyclists (RideLondon-Surrey). There was also some evidence from led rides as part of Sustrans' Active Travel project[174] (discussed further in section U, 'Community-based interventions'). The Big Bike Revival[130] runs cycling events aimed at people who own bikes but don't use them, which includes activities such as led rides and bike maintenance. Evidence from Leicester suggested 42% of their ride participants were women; evidence from Bournemouth suggested only 31% were. About 40% of Big Bike Revival participants came from the three lowest deciles of deprivation.

Scale of activities

Bournemouth's festival had attracted 400 cyclists. Its rides had attracted 350 participants. Leicester's rides had attracted 6,801 participants. London's Freecycle event attracted 70,000 people and 25,824 people participated in RideLondon-Surrey. 475 people took part in guided rides as part of the Sustrans' Active Travel project. In 2017, Bike Bike Revival report that they reached over 52,000 people, running 1,448 events, resulting in 12,770 people cycling more regularly.

Costs

Cost information was very limited. The cost of organising an annual rides programme outside London was in the order of £5,000-15,000 p.a..

Impacts

29% of those attending events in Bournemouth classified themselves as new or occasional cyclists; 34% did so in Leicester (including 38% of those participating in the Skyride). In Leicester, 58% of new or occasional cyclists reported that they would increase cycling as a result. 37% were frequent cyclists, of whom 39% reported a desire to start cycling to work (i.e. 14% of the total participants).

For FreeCycle, 25% of survey respondents felt that their level of cycling had increased (vs 1% who felt it had decreased) when contacted shortly after the event. Of these respondents, 73% had been cycling more for leisure and 10% had been cycling more to work/college/school. For RideLondon-Surrey, 52% of survey respondents felt that their level of cycling had increased (vs 0% who felt it had decreased) after the event. 30-34% of spectators (in Surrey and London respectively) said that they thought attending the event would make them cycle more in future.

In the Sustrans' Active Travel project, 53% reported that the amount they cycled had increased since taking part in a guided cycle ride, and the proportion reporting that they cycled once a week increased from 48% to 74%.

24% of Big Bike Revival participants were reported to be cycling more after participating in events, including 57% of non-regular cyclists (i.e. those cycling fortnightly or less).

Costs per trip generated and time profile

As well as the trips generated by the events themselves, additional trips may be generated by new/occasional cyclists cycling more, and frequent cyclists being more inclined to cycle for work. Some tentative calculations suggest the costs may be in the order of £1-3 per new active travel trip, although there is substantial uncertainty in the calculations.

O. Cycle inclusion schemes

Nature of evidence, geographical areas, populations and journey purposes

Evidence was available from four small-scale schemes: a cycling hub in Chesterfield with a fleet of 16 adapted trikes and quads for people who may struggle with a 2-wheel bike (offering taster sessions, rides etc.) [131]; a 'Bikes for all' programme in Glasgow to provide free bike-share memberships and associated cycling support for those on low incomes or with other particular needs[133]; a 'Cycling for all' programme of Sunday events in Nottingham to encourage everyone to cycle by providing cycle training and bike maintenance[132] and a Cycle 4 Health programme in West Yorkshire, involving a 12 week programme of cycling support, targeted at those with poor mental and physical health[129].

Scale of activities

At the time of our contact, the Chesterfield hub was engaging with around 80 users, on 400 rides, in a year. The Glasgow scheme ran a pilot with 69 people, over 8 weeks, and was planning to expand. In 2018 it generated 4,711 trips by 238 participants. In Nottingham, between 2013-15, 951 people attended events; 610 took part in training; 270 were given information/advice; and over 915 hours of inclusive cycle training were delivered. In West Yorkshire's Cycle 4 Health programme, there had been 270 attendees in 2016/17 (12 month period), of whom 90% reported not doing any cycling activity at the start of the programme.

Costs

Costs for schemes ranged from £10-60,000p.a.. Costs per participant were relatively high, partly reflecting the high level of support/special assistance required. In Chesterfield, there were also some high up-front capital costs, due to the specialised nature of the bikes.

Impacts

Approximately 5-10 participants in the Chesterfield scheme progress to independent cycling each year. Participants in Glasgow made an average of 5 trips in the 8-week trial. More recent data suggests that 4,711 bike trips were made in 2018 as a result of the scheme, from 238 'sign-ups', presumably implying about 20 new bike trips per person. In Nottingham, the number of participants increased by 44% in the second year, but there were no data about impacts on subsequent cycling behaviour. At the end of the programme, 63% of participants reported that they cycled at least once a week, and six weeks after participation, 68% of participants in West Yorkshire's Cycling4Health events reported that they had maintained or increased their cycling, with participants reported to be averaging over 2 hours of cycling per week.

Costs per trip generated and time profile

Some tentative calculations suggest the costs may be in the order of £4-50 per new active travel trip, although there is substantial uncertainty in the calculations, and some costs are due to purchasing specialist equipment.

P. Led walks

Nature of evidence, geographical areas, populations and journey purposes

Information was available from local authorities about led walk programmes in York[135] and Shropshire[134], and as part of the Sustrans Active Travel project (discussed further in section U, 'Community-based interventions'). National data was also available about the Walking for Health initiative run by the Ramblers Association from its website, and from a 2006 evaluation[137] of its predecessor, the Walking the Way to Health (WHI) initiative (run by the Countryside Agency and the British Heart Foundation). Led walks are typically aimed at older age groups and attract more women. The York scheme included a GP referral element, for those where walks would provide a health benefit. In 2016/17, of those participating in the national Walking for Health scheme, 69% were female, 59% were over 65, 11% had a long-term illness, health problem or disability and 8% were from the 20% most deprived areas[138].

Scale of activities

In 2016/17, via Walking for Health, 1,800 walks were organised each week, with an average attendance of 14 participants. At least 82,000 participants attended one or more walks, recording a total of 1.2 million walk attendances[138]. In Shropshire, the programme had run for 6 years, annually attracting 1,600-1,800 unique participants, and 30,000 walk attendances. In York, annual attendance (averaged over two years) was around 2,500 participants, with an increasing proportion of new participants each year. In the Sustrans project, 800 people had taken part in guided walks.

Costs

Through Walking for Health, in 2016/17, there were 404 active schemes, many involving substantial volunteer input. 63% were run by a paid co-ordinator, with the remainder having access to paid staff support. The average budget for schemes was about £9,000 for those with paid co-ordinators and £3,000 for schemes with volunteer coordinators[139]. Costs for the local authority schemes (which are likely to have included some volunteer input) were in the order of £20-30,000 for an individual town - with one local authority reporting that the higher end of the range enabled tailoring and targeting of schemes to 'harder-to-reach/more-to-gain' groups.

Impacts

The 2006 evaluation sampled 750 participants of led walks. Nearly three-quarters said that they did more walking generally since getting involved in led walks. The researchers were not able to show overall gains in physical activity, but did show that those remaining on the led walks programme after 12 months were more active than those who ended participation at 3 months. By 12 months, 50-75% of original survey respondents were still attending led walks at least once a fortnight.

In the Sustrans' project, 53% of those participating in led walks reported that they had increased the amount they walked since taking part, and the proportion walking for 15 minutes at least several times a week increased from 73% to 85%.

The York scheme was successful in attracting new people each year. The Walking for Health review reports that it had attracted an increasing share of people from low income groups, with health problems and from BME groups. The 2006 evaluation commented on the need to have a core of people to initially launch and maintain schemes.

Costs per trip generated and time profile

Making no assumption about increases in walking aside from the participation in the led walks, but assuming that each led walk is equivalent to new 2 walk trips (given that walks often involve a tea break), generated cost estimates of £2-7 per walk trip. However, allowing for potential increases in

walking by participants at other times (say, 2 extra trips every week for 50% of participants[xxi]) would reduce the costs per walk trip substantially, to less than £1 in some cases.

[xxi] Note that calculations assume increases per unique participant, not per walk attendee.

Q. Walking promotion

Nature of evidence, geographical areas, populations and journey purposes

Information was available from 'Beat the Streets' projects in Reading[140] and Thurrock[141] (where participants touch smart cards on electronic scanners positioned around the project area in return for points); pedometer programmes in Doncaster[1] and Peterborough[142]; other active travel promotion programmes in Sheffield[1], Peterborough[142] and Leicester[143]; and Living Streets initiatives, including the 2008-2012 'Walking Works' project with employers[144] and 'Walk to Work' week[145]. There was also academic literature, including a review of 26 studies of using pedometers to encourage walking (Bravata et al 2007[147]); a study of the effects of distributing Doorstep Walks packs in Salisbury (Vernon et al 2002[148]); and a study of distributing information packs through three workplaces in Glasgow (Mutrie et al 2002[149]). Most projects had a health component, with GP referrals included in 3 schemes.

Scale of activities

Scheme sizes in individual locations varied, from about 1,600 participants in Sheffield to 24,000 in Reading. With the Living Streets 'Walking Works' project, over 33,000 people signed pledges (to reach individual walking targets) between 2009 and 2011.

Costs

For local authority schemes with funding details, spending was in the order of £80-130,000 per year. Costs per participant were very variable, depending on the type of support provided.

Impacts

- In the Beat the Streets schemes, participants said it helped them to walk /cycle more (78% walk, Reading 2014 pilot; 73% walk 32% cycle, Reading 2016 scheme; 85% walk 29% cycle, Thurrock).
- In Reading, 3 months after the 2014 pilot, 53% participants said they continued to walk more.
- In Thurrock, on average, people said they did 30 mins of physical activity on 3.6 days per week at the beginning and 4.1 days per week at the end of Beat the Streets.
- In Sheffield, 3 months after the programme end, 76% of participants continued to walk locally; 62% of individuals were walking more than they did when they first joined the programme and individuals reported an average increase of 81 minutes per week of local walking.
- In Peterborough, engagement led to about 9,000 attendances on leisure and Nordic walks.
- In Leicester, 6 months after a 12 week programme, 50% of participants had increased walking.
- For the Walking Works project, the proportion of those signing pledges who were walking some/all of their journey on 5+days / week increased from 38 to 44%.
- In a September follow-up survey of participants in the 2011 June 'Walk to Work' week, the proportion who walked *to* work 5 days a week increased from 27% to 49%, and *from* work from 26% to 45%. Increases in the frequency of walking for other journeys were also reported.
- The review of pedometer programmes found that, on average, pedometer users increased their steps per day by 2,000-2,500. Having a goal of 10,000 steps was associated with higher effects.
- With the Salisbury walking packs, one in six people reported that they continued to use the resource 18 months after initial participation.
- With the 'Walk in to work out' initiative in Glasgow, 25% of participants (initially chosen because they were not active commuters) were regularly actively commuting after 12 months (and were twice as likely to do so as control group participants at 6 months).

Costs per trip generated and time profile

Tentative cost estimates ranged from £0.10 to £5 per additional active travel trip, and were more likely to be at the lower end of scale.

R. Household Personalised Travel Planning

Nature of evidence, geographical areas, populations and journey purposes

Data on household PTP was available from a wide variety of schemes, including overview reports from ITP (including 10 schemes)[160] and Sustrans (13 schemes) [152], the previous evaluation of the Sustainable Travel Towns (13 phases of work)[161], and specific reports for various schemes in Hertfordshire (x3)[150,151], Nottinghamshire (x3)[157,158,159], Leicestershire[156], Loughborough[155], West Midlands[154] and Manchester[153].

Scale of activities

Early schemes, as evaluated for the 2007 ITP study, ranged in size from 350-10,000 households. One finding from that work was that there were economies of scale from undertaking larger projects. More recent schemes have typically targeted 10-20,000 households (in one phase). Participation rates by targeted households range from 20-60%, averaging 40-45%.

Costs

Typical costs are £30-40 per targeted household, and £60-90 per participating household.

Impacts

Scheme results vary quite significantly, and are reported according to a variety of metrics (increase in trips per person per year, % increase in trips by different modes, %-point increases in trips by different modes). There were about 25 schemes where it was possible to calculate an increase in active travel trips per year, per targeted household[xxii]. The 9 phases of work in the Sustainable Travel Towns (with comparable data, including adjustment for control group changes) showed an average increase of 37 active travel trips per household targeted. The average across all 25 schemes with comparable data was 36 additional active travel trips per household targeted. Schemes have typically been more successful at promoting walking than cycling (with, on average, 20-25% of the newly generated active travel trips typically being cycling).

Costs per trip generated and time profile

The costs per active travel trip typically ranged from £0.40 to £7.00. For 5 schemes in the ITP study, the average was calculated as £1.50. For the 9 phases of work with comparable data undertaken as part of the Sustainable Travel Towns project, the cost was estimated as £1.90 per active travel trip (or £1.10, if excluding the highest value from a first phase of work). For 9 additional schemes with relevant and comparable data, the cost was £2.30 per active trip. There were a few outlying higher costs - in those cases, the authorities subsequently changed to more cost-effective solutions. This highlights that achieving the impacts for the costs described here relies on learning from best practice. Feeder walk trip stages to and from public transport would probably be additional to those reported in the calculations above in most cases, which would lead to lower costs per trip stage[xxiii].

[xxii] Assuming 2.4 people per household in all calculations.

[xxiii] Although, via travel diaries, PTP surveys often do capture trip stages, rather than just trips, our understanding is that analysis is often based on 'main mode'. This was the case for the analysis conducted for the Sustainable Travel Towns evalution[161].

S: Workplace PTP

Nature of evidence, geographical areas, populations and journey purposes

Information was available from five local authorities (with one scheme also subject to previous evaluation by Sustrans[32]). Workplace PTP had taken place in the following five locations: South East Derby[162]; Devon[163] (Exeter, Barnstaple and Newton Abbey); East Sussex[164]; Lowestoft (Suffolk)[165]; and Manchester[153]. All schemes had focused on urban areas (albeit of differing sizes).

Scale of activities

Three schemes had been delivered over two years; one in one year; and, for one, the timescale was unspecified. In total, 11,802 people had received personalised information about non-car travel options. In most cases, schemes initially targeted a much wider number of workplaces/employees, compared to those receiving the more personalised engagement. For example, one programme, targeting 141 workplaces, representing 164,000 employees, led to 1-1 engagement with 7,798 employees. (This was an eight-phase programme.) Evidence from the other schemes suggests 1-1 engagement with 500-1000 people per year (or phase) is plausible (possibly with additional 'lighter touch' support for a similar number of people). The Derby interviewee commented on the benefits of providing activities at scale. There was no evidence suggesting that any schemes had explicitly targeted employees living close to work – however, clearly, focusing on these people would enhance the possibility of switching to active travel.

Costs

Costs of running the schemes comprised revenue funding ranging from about £50,000 to £500,000. Estimates of the cost per participant receiving 1-1 engagement comprised £47, £56, £92 and £95.

Impacts

Percentage-point increases in walking or cycling by those intensively engaged were as follows:

- Derby – 3% increase in cycling (sustained after 3 months)
- East Sussex - +4% cycling, +4% walking (for those living less than 5km from work who comprised 27% of participants)
- Devon - +14% cycling, +1% walking
- Lowestoft - +6% cycling, +2% walking

Costs per trip generated and time profile

If the assumed increase in trips is 3 days a week (x2 way), multiplied by 32 weeks for cycling, and 47 weeks for walking (i.e. 192 for cycling, and 282 for walking), this suggests about £3 and £16 per *active travel* trip generated per year. Note that additional feeder walk trips to and from public transport would probably be generated.

Meanwhile, more specific estimates for three of the schemes suggested costs of £4-27 per *cycle* trip generated.

T. Workplace travel challenges

Nature of evidence, geographical areas, populations and journey purposes

Information about sustainable travel challenges (where people log their journeys) was available from commuter challenges run in Bournemouth in 2013 and 2017[166,167]; in Derby in 2014[168]; in 6 areas of the South East (2010-11)[169]; and via Love to Ride[170] (with data from challenges run in Sep 16, Mar 17 and Sep 17). The Bournemouth 2013 and Derby challenges were for all modes; the others were cycling challenges. They were all aimed at commuters.

Scale of activities

Over 30,000 people were involved in the challenges described. Typically, each challenge had involved 50-100 workplaces. Typically, 5-20 people became involved per workplace.

Costs

Cost estimates, per participant, ranged from £13 to £47, with an average of £31. Schemes were typically run on budgets of £15-40,000 p.a..

Impacts

All schemes reported an increase in cycling. In addition, the 2013 Bournemouth scheme reported an increase in walking. Headline findings were:

- In Bournemouth (2013), 2 months after the challenge, participants reported increased cycling averaging 0.9 days/week and walking 1.3 days/week.
- In Bournemouth (2017), 3 months after the challenge, 10% of those travelling by car at baseline had switched to cycling to work; 41% of non-cyclists at baseline were cycling at least once a week and various categories of cyclists reported cycling more often.
- In Derby, 6 months after the challenge, increases in cycling were reported, including an increase in the proportion cycling at least once a week from 63% to 69%.
- The South East initiative reported that 14% of participants were new cyclists.
- Love to Ride reported that 46% of participants became more frequent cyclists (than previously) during the intervention.

Costs per trip generated and time profile

Converting from evaluation evidence to trip estimates was problematic, but suggested costs might equate to approximately £0.30-£5.00 per trip in the first year of impact.

U. Community-based interventions (multi-stranded approaches)

Nature of evidence, geographical areas, populations and journey purposes

Information was available from four initiatives: a programme of five community hubs in Nottingham[171] providing services including household PTP, jobseeker PTP, led walks/rides and cycle training operating over 2-3 years (between 2012 and 2016); 'Ucycle'[172], a programme of bike hire, events, cycle training and facility improvements delivered at two universities, three FE Colleges and two hospitals in Nottingham (between 2009 and 2015); Bike North Birmingham (2012-15)[173], a programme including activities at schools, workplaces, stations and local community sites, together with infrastructure upgrades; and 10 'Active Travel' projects run by Sustrans between 2008-11[174], in 10 different parts of the country, involving a mix of initiatives aimed at promoting walking and/or cycling locally (such as organised walks/rides; training; bike loans; workplace events; personalised travel/fitness plans etc). The Sustrans projects included a focus on older and more inactive groups; Nottingham's community hubs included a focus on job seekers.

Scale of activities

With the Nottingham community hubs, 11,970 residents received PTP; 9,725 jobseekers received PTP; 4,237 people took part in led walks, 1,516 people took part in led rides, and 1,775 people received cycle training. With Ucycle, there were 1,189 beneficiaries of bike loans and 18,963 beneficiaries of infrastructure and events. With Bike North Birmingham, direct engagement included 9,427 school pupils; 4,873 employees; 396 people via stations and 1,685 people through the wider community. There were also 9 cycle routes (27km) that would have benefitted many people. With the Sustrans projects, 80,561 people were involved. This implies direct involvement with 6-8,000 participants per area during the projects (albeit that this may include some double counting of participants involved through more than one activity).

Costs

Costs were in the order of £300,000 to £2 million per area over 3 years (with the higher end of the range including infrastructure improvements).

Impacts

- In Nottingham, through the PTP projects, cycling mode share increased from 10% to 13%, and walking from 28% to 31%. The cycle training was estimated to lead to an additional 1.9 cycling trips per week.
- With Ucycle, at the institutions involved, cycling mode share increased from 4.7% to 8.3% and walking increased from 11.8% to 16.5% during the project period.
- In Birmingham, trips on the 9 routes increased by 31% (from 142,350 trips to 185,785). The proportion of children usually cycling to school increased from 3% to 10%; and 14% employees increased their cycling to work. There were also reported increases in leisure cycling and cycling to the station. Overall the programme was estimated to increase cycle trips in the areas by 17%.
- In the Active Travel project, in a 2011 survey of 377 respondents that took part in cycling activities and 356 that took part in walking activities, the proportion reporting that they cycled at least once a week increased from 48% to 75%, and the proportion reporting walking at least once a week from 88% to 95%.

Costs per trip generated and time profile

Some tentative estimates of the costs per active travel trip (generated per year, by the end of the project) were in the order of £<1-8 per trip, although the data did not readily lend itself to such calculations. It is plausible that packaged interventions may be very good value for money, but equally that costs per trip could be higher in less receptive locations.

V. Workplace travel initiatives

Nature of evidence, geographical areas, populations and journey purposes

Specific workplace travel initiatives, including workplace PTP, walking promotion programmes run through workplaces, and workplace involvement as part of community engagement programmes are covered in other sections. Meanwhile, workplace travel plans, where employers put in place a package of measures to change the travel of their staff, sometimes involving grants from the local authority, have a long history. For this study, we have evidence from a 7-year grant programme in the West of England (where employers also provide matched funding) [175]. There is also evidence from previous Department for Transport research, including Making Travel Plans Work[176], Smarter Choices[182], Sustainable Travel Towns[161] and Evaluation of the Local Sustainable Travel Fund[1].

Scale of activities

Over 90% of LSTF projects included activities to help people travel to work more sustainably, with 6,600 workplaces estimated to have been involved. By the end of the Sustainable Travel Towns programmes, in all three towns, there had been engagement with employers representing about 30% of employees. In the West of England, 138 businesses had received grants between 2011 and 2018.

Costs

In the 2004 Smarter Choices report, seven local authorities provided cost details about their workplace travel activities. Costs per employee targeted ranged from £0.70 to £5. There were two travel grant programmes, one offering grants of up to £5,000, and one offering grants of up to £20,000. In the Sustainable Travel Towns, the cost per employee in engaged organisations was between £9 and £14 over the five-year programme, or approximately £2 to £3 per year. By 2008, the towns were working with approximately 25-50 organisations, with spending of £60-80,000 p.a..

Impacts

- From a study of 20 good practice travel plans conducted in 2002, for those with before and after data, walking had increased by 1.2%-points and cycling had increased by 0.75%-points.
- In a study of 26 organisations from 7 local authorities (Smarter Choices review), the weighted average reduction in cars per 100 staff was 18%.
- In Peterborough, there were 19 employers engaged in the travel planning programme with before and after data by 2008. Active travel increased at 12 of these. Overall, there was a 3.5% reduction in cars per 100 staff (weighted by employee numbers).
- In the West of England, surveys conducted in 2016 and 2017 suggested a stable cycle and walk mode share at all businesses, whilst those that had received grants saw a 0.7%-point increase in cycling, and 1.2%-point increase in walking.
- Data from 93 workplaces in Large Project LSTF areas showed a fall in car driver mode share of 2.7%-points. Data from Small Projects showed a fall in car driver mode share of 0.9%-points. Evidence from the Strategic Employment Sites LSTF Case Study found a fall in car driver mode share of 1.7%-points, more than offset by an increase in bus mode share of 2.6%-points. LSTF interventions tended to be 'light-touch' and to lack reinforcing measures such as parking restraint.

Costs per trip generated and time profile

Evidence from the good practice travel plans and the West of England suggests that well-implemented travel plans in appropriate locations and with suitable reinforcing measures (such as parking restraint) can increase active travel by 1-3%-points. If expenditure is assumed to be £9-14 per employee (as in the Sustainable Travel Towns), the cost per active travel trip is in the order of £1-£3. Costs would be

higher when working with employers in locations where it is harder to achieve change, or if there are no reinforcing measures to discourage car use.

Note that additional feeder walk trips to and from public transport would probably be generated.

W. School travel initiatives (walking/cycling promotion)

Nature of evidence, geographical areas, populations and journey purposes

Walking and cycling promotion can form part of a broader approach to school travel, delivered under the umbrella of a school travel plan and potentially in conjunction with pedestrian/cycle training, infrastructure measures and/or traffic restraint. However, there are also stand-alone programmes. Evidence for our study was available from schools receiving Sustrans' Bike It initiatives in Nottingham[179] and South Yorkshire[180], which encourage children to cycle. We also had data from various phases of Living Streets' work to promote walking in schools, including data from a 2010-12 'Walk Once a Week' (WoW) initiative[220]; from WoW work in Hackney (2009-11) [187]; from 15 local authorities participating in their 2012-15 Walk to School Outreach programme[181]; and from 5 authorities participating in their 2018-19 Walk to School Outreach programme[185,186]. Darlington has worked on school travel since 2004, and data were available from its 'Mega Motion' active travel promotion programme offered to primary schools (which includes pedestrian, cycle and scooter training) [177] and a stand-alone Year 6 transition programme[178].

Scale of activities

Sustrans' Bike It initiative involves a staff member providing direct support to schools over several years, and operates in a number of local authorities. In Nottingham, the Bike It officer had engaged with 7,570 pupils over 2 years. In South Yorkshire, Bike It officers had engaged with 24 schools in Doncaster (including intensive work with 5) in 1 year and 50 schools in Sheffield (intensive work with 13) over 2 years. The Hackney initiative involved work with 30 schools. By 2012, Living Streets WoW initiative had involved 1,800 schools. During their 2012-15 programme, Living Streets worked with 182 secondary schools and 854 primary schools across 15 local authority areas, reaching around 400,000 children (including phases of intensive intervention and ongoing support). In their 2018/19 9-month programme, they worked with 275 schools, and 77,275 children, (including 133 new schools), which comprised approximately 10% of primary schools in the 5 local authority areas. Between 2012 and 2015, Darlington's Mega Motion programme involved 21 schools (8,119 pupils) and its Year 6 transition programme involved all 27 schools with year 6 students (1,200 pupils).

Costs

Estimates for the cost per school vary from £500 to about £10,000 depending on the nature of the programme. If only considering schools receiving intensive engagement, or that are new to a programme, costs will tend to be at the higher end. However, most programmes involve a mix of more intensive engagement with some schools, and more diffuse and/or 'maintenance' style activities with a much greater number, which leads to the far lower costs. Meanwhile, 'stand-alone' initiatives, such as transition training, are relatively cheap – perhaps requiring delivery of a 2-hour session per school, and resource packs averaging £5-10 per pupil.

Impacts

Evidence on impacts was as follows:

- Results from Bike It initiatives included[xxiv]: a 7%-point increase in the active travel mode share in Nottingham; a 3%-point increase in the active travel mode share for how pupils said they 'usually' travelled in Sheffield (over 4 years) and a 6%-point increase for Doncaster (over 2 years). The proportion reporting that they regularly cycled or scooted/skated (at least once a week) increased,

[xxiv] Increases in scooting/skating or park-and-stride excluded in Nottingham, but included in Sheffield and Doncaster.

with %-point increases of +20% cycling (Doncaster), +5% scooting/skating (Doncaster), +9% cycling (Sheffield), +11% scooting/skating (Sheffield), albeit with some offsetting reductions in the proportions reporting regularly walking (-4%-points Doncaster and -2%-points Sheffield).

- In an evaluation of Living Streets Walking Once a Week scheme, between 2010 and 2012, the proportion of children walking to school was reported to have increased from 43% to 54% in 2012 (n=20,000 p.a.), albeit that it is unclear whether this is only on the nominated walking day.
- The Living Streets 2012-15 initiative reported an average modal shift at primary schools of 13% (local authority results ranging from 8-17%), and 6% at secondaries.
- An average increase of 17%-points walking all or part of the way was reported for Local Sustainable Transport Fund projects by Living Streets.
- The Living Streets 2018-19 Outreach programme reported a 22% increase in the number of walking trips being made to/from schools, including sustained levels of walking at schools that were primarily engaged in an earlier phase of the programme.
- Data from Hackney suggested the proportion of students walking to school increased by 12% at WoW schools, compared to 7% at non-WoW schools (i.e. a difference of 5%-points).
- Darlington's active travel mode share at primaries rose from 56% in 2004, to around 60% by 2006/7, and has since stayed at that level, albeit dipping back in some years when school travel work has been less well funded. Cycle mode share has been about 6-7% since 2008/9. The active travel share at secondary schools (all years) has not been maintained over time, although a relatively high cycling mode share (7-8%) was achieved in 2016/17 and 17/18.

Costs per trip generated and time profile

Estimates of costs per trip (excluding the costs of travel training which form part of the Darlington approach) were mostly £1 or less (with some as low as 10 pence). Initiatives clearly need regular renewal, not least due to pupil turnover. An evaluation of the Living Streets initiative showed a slightly higher impact in the first year of engagement (+16%-points above baseline) compared with the second (+11 %-points above baseline), which was partially attributed to 'novelty value'. An evaluation of the Living Streets 2012-15 initiative found that schools receiving intensive support in 2013 (followed by standard support in subsequent years) had maintained their increased walking share after three years, and this was also the case in the 2018/19 evaluation. Surveys in the Bike It schools in Doncaster showed a slight decline between years 2 and 4 of engagement (+25% versus +21% regularly using active travel modes, compared to baseline).

X. Links to schools

Nature of evidence, geographical areas, populations and journey purposes

Between 2004 and 2005, Sustrans' Links to Schools project[188] created 147 links connecting over 300 schools to their communities, as well as enabling leisure and commuting trips by local people. A summary report provides monitoring information for 15 case study sites, located in a variety of area types, serving both primary and secondary schools. (Counts took place either immediately after scheme completion, and/or up to six months later.) As well as usage by school children, projects also reported more general usage, including increases in use by those with disabilities, over 60s, households without access to a car and, in some cases, BME groups.

Scale of activities

Sustrans reported that up to 200,000 children were potentially able to benefit from the improvements.

Costs

The project cost a total of £26.3 million (with £10 million provided by the Department for Transport). This implies an average cost per link of £179,000.

Impacts

Reported usage across the 15 case studies totalled nearly 3 million trips p.a. – with average trips per link of about 190,000. Together, thirteen of these case studies accounted for about 12.5% of the DfT grant money. Using the usage figures for those thirteen, and assuming that uplift was in proportion to spending, this would imply that across all 147 links, usage might have increased by over 18 million trips, or about 124,000 trips per link. Sustrans reported that about a third of these journeys replaced a car trip.

Total walk/cycle trips to school by children recorded in the 15 case studies were in the order of 950,000 – i.e. about a third of all trips observed on the links. For the 9 cases where the *increase* in the number of children travelling actively to school was reported, approximately 40% of the active travel school trips were reported to be new trips. (It is unclear whether an adjustment for those diverting from alternative routes was always made, although it is reasonably similar to the overall proportion of trips estimated to replace a car journey). The extent of new schoolchildren trips also varied depending on the link (from an increase of 6% of existing school trips to a 9-fold increase or more). In many cases, children were also reported to account for a substantial number of other trips on the links. (It was not possible to disaggregate impacts by primary and secondary children – whilst 7 case studies did only serve one or the other, variation in results for each category was in line with variation for case studies serving a mixture of school types.)

Costs per trip generated and time profile

For all active travel trips on the links, in the first year of use, the average cost was less than £1 in the case studies, or about £1.40 for all links. However, a proportion of these trips will have diverted from other routes. Assuming a third of these trips are by school children, and 30-40% of these are newly generated, this would imply a cost of around £11-15 per new active travel to school trip generated in the first year.

Y. Bus route enhancements

Nature of evidence, geographical areas, populations and journey purposes

From two large-scale research studies for the DfT[1, 189], there was evidence about the impact of enhancements to services on six bus routes, including two commuter routes in Greater Bristol; two 'job connector' services in South Yorkshire (one from Barnsley to the outskirts; one connecting Barnsley and Doncaster); and two services in East Kent (aimed at all journey purposes, between Canterbury and its surrounding smaller towns). Improvements included new or more frequent services, real time information, on-street bus priority and/or service measures. In all cases, the improvements to services were significant (implying that more 'diluted' improvements over an area-wide network might not achieve the same degree of efficacy).

Scale of activities

The six bus routes varied in length (as indicated by their geographical reach). Patronage increases were in the order of at least 200,000 extra passengers per route (and in some cases substantially more than this).

Costs

For the six bus services, local authority expenditure to improve the services included both capital and revenue, and ranged from £455,000 to £1.4 million.

Impacts

For four of the services, on-bus surveys provided evidence on what proportion of passengers would previously have driven (which was over 60% in three cases). Each additional bus trip is assumed to generate two walk trip stages (at either end).

Costs per trip generated and time profile

To estimate a cost per walking trip generated, additional walk stages were assumed to occur where the newly generated bus trip had transferred from car. Where on-bus survey evidence was not available, a conservative figure of 25% was used (to represent a low transfer rate or that some of the walk trips generated would be relatively short).

For the six bus routes, costs per annual walk stage generated were in the order of £2-5. In all cases, routes then became commercially viable, suggesting that more frequent services and other improvements can lead to patronage uplift which justifies the provision of ongoing commercial services, such that effects are long term.

Z. Concessionary fares

Nature of evidence, geographical areas, populations and journey purposes

Evidence was available from Department for Transport statistics on concessionary fares[198]; from confidential operator information about the uplift effect and reimbursement received for older people's concessionary fares in East Kent (supplied as part of a large-scale DfT research study[189]), and from various academic papers evaluating the effects of concessionary fare schemes[190, 191, 192, 193, 194, 195, 196, 197].

Scale of activities

From 2001, in England[xxv], statutory concessions were put in place for local bus journeys by older[xxvi] and disabled people, including free local travel from 2006, which was then extended, in 2008, to include free local bus travel between 09.30 and 23.00 for older and disabled people anywhere in England (the English National Concessionary Travel Scheme, ENCTS). Almost all of the 89 Travel Concession Authorities (TCAs) outside London also offer some discretionary travel concessions (and have done in the past). The most commonly offered discretionary concessions are extensions to the statutory time period (70 TCAs in 2018/19), support for companions to disabled people and concessions on community transport. Reductions for young people are offered by 18 of the 89 TCAs outside London, and by at least one commercial bus operator in 71 TCAs outside London.

In 2017/18, 884 million concessionary bus journeys were made in England, and 70% of eligible older people were estimated to hold an older person's concessionary pass.

Over time, in London, both the number and share of concessionary bus journeys has been increasing. Outside London, bus use has been falling over the last ten years. Although concessionary journey levels were initially sustained (meaning they became a higher share of all journeys), after changes to the Bus Operators Service Grant in 2012 and associated reductions in services, they began reducing. They currently comprise about a third of all bus journeys in England (both in and out of London)[xxvii].

Costs[198]

In 2017/18, local authorities spent £1.12 billion on providing travel concessions in England. 79% was spent on the ENCTS, whilst 21% was spent on discretionary concessions, including youth and non-bus concessions such as trams, ferries, national rail and Park-and-Ride schemes. (In England outside London, the proportions were 87% and 13%.). Reimbursement to bus operators for a concessionary trip was £1 per trip (ranging from 80p per trip in London to £1.02 in metropolitan areas and £1.14 in non-metropolitan areas) - these values have increased substantially over time. A small amount of funding is also spent on scheme administration.

Impacts

Literature evidence on the impacts of free fares for older people includes:

- Analysis of 16,991 English NTS records from 2005-8 showed that older people with a free bus pass were significantly (4 times) more likely to travel actively, and to walk at least 3x times a week, regardless of socio-economic status compared with non-pass holders. A 2018 study, using NTS data from 33,344 participants eligible for a bus pass 2006–2014, drew similar conclusions for all ethnic groups, and additionally showed that black people are more likely to own a bus pass, and gain a higher proportion of active travel via bus journeys compared to other ethnic groups[190, 196].

[xxv] The timing of concessions in other parts of the UK was different.
[xxvi] The initial age limit was 60. Since April 2010, eligibility has been tied to the State Pension age for women.
[xxvii] Data taken from bus data tables BUS0105 and BUS0108.

- Analysis of data on 4,650 bus-pass–eligible people suggested that those holding a bus pass were more likely to undertake moderate or vigorous physical activity, and that women holding a bus pass were likely to have faster gait speed, lower BMI and smaller waist circumference. Pass holders were more likely to be female[197].
- A 2007 survey of 769 people renewing a concessionary pass with Salisbury District Council (including both residents of Salisbury and surrounding small urban and rural areas) found that new pass holders (48%) were making 0.86 bus trips per week, whilst those who had held a half-fare pass before 2006 (52% sample) were making 1.17 bus trips a week, a 17% increase from their pre-2006 usage[191].
- In a 2002 survey of 134 people in Edinburgh, 65% of respondents indicated that they made extra bus journeys as a result of the improved concessionary fare. For these new journeys, 44% replaced walking, 23% car, 27% were new journeys and the remaining 6% 'other modes'[192].
- Analysis of Scottish concessionary data suggested that changing from an (average) 55% bus fare concession to 100% could increase demand by 25-80% in the medium term by recipients, but that growing car ownership amongst the older age group will dampen the effect in the future[193].
- A 2014 review of various data sources and studies on concessionary fares found that 54% of pass holders reported using the bus more, and that at least 20% of concessionary bus trips were likely to be replacing car trips[194].

Looking at National Travel Survey data[xxviii], the number of trip stages per person per year (by all ages) on local buses (outside London) was 47 in 2004-5 and 2009-10 (averaging two years of data in each case). Meanwhile, for 60-69 year-olds, the value went from 45 to 60, and for those aged 70+, it went from 61 to 69. This implies that about 20-45% of trips by these age groups may have been newly generated (assuming that their bus use would otherwise have declined in line with that of other age groups).

Costs per trip generated and time profile

Based on various sources, and assuming that the effects of increasing the provision of free bus travel for other age groups would be similar to the effects observed for older people, we estimate that the cost per additional annual walk trip is about £2. This is equivalent to assuming that about 30% of concessionary bus trips represent new journeys, generating 2 walk stages each, but that 25% of these might previously have been made on foot[xxix] or generate walk stages which are too short to count. Costs for this initiative would recur annually. Understanding the longevity of effects is complex. There is evidence that the longer-elasticities of responses to changes in bus fares can be considerably greater than shorter-term effects[222], however changes to bus markets and car ownership will also affect trends.

[xxviii] Table NTS0604

[xxix] Although the Edinburgh figure is 44%, this is from a small sample, and seems likely to be influenced by Edinburgh's dense urban structure.

AA. School streets closures / parking restraint

Nature of evidence, geographical areas, populations and journey purposes

'School streets' initiatives are where roads around schools are closed to general traffic at the beginning and end of the school day, using Road Traffic Orders, often in conjunction with small-scale supportive measures for other modes. In a related approach, Public Space Protection Orders can be used to stop *parking* around schools at the start/end of the school day. Data about costs and impacts were available from 1 school in Camden[199], 5 schools in Hackney[201], 3 schools in Solihull[200] and 6 schools in Edinburgh[202]. These schools are all primaries; initiatives date from Autumn 2015 onwards.

Scale of activities

In the four authorities for which we had data, 33 schools either have, or are scheduled to have, schemes (4 in Camden; 17 in Hackney; 3 in Solihull; and 9 in Edinburgh). There are also reports of schemes in Reading[199], East Lothian[199], 8 in Islington (plus three in consultation)[xxx] and consultation on 9 sites (13 schools) in Croydon[xxxi]. In Havering, 4 schools have time-related parking restrictions[xxxii]. Sustrans is working on the topic, including a one-day closure of streets outside 43 schools in March 2019 to raise awareness of this measure[xxxiii].

Costs

Per school, quoted costs ranged from £9,000 to £50,000. Different authorities had used different approaches – with cost items including folding bollards; (flashing) signs; automatic number plate recognition (ANPR) cameras; introduction of 20mph zones; traffic surveys; local consultation; and designation of the traffic orders. Outside London, camera use is not permitted, so police enforcement is necessary, which was felt to be a problem given the strain on police resources. The authority using ANPR cameras reported average costs of £40,000 per school whilst the other authorities reported costs in the order of £10-20,000 per school, although fines recouped from camera use provided some offsetting revenue.

Impacts

- At the school in Camden (scheme implemented July 2016), car use (including park-and-stride) fell from 15% in 2015 to 8% (2017) and 9% (2018), whilst active travel went from 44% (2015) to 53% (2017) and 61% (2018). An improvement in air quality was also measured.
- At the three schools in Solihull (schemes implemented Sep 2017; monitoring 4-6 months later, corresponding with very cold weather), car/car-share reduced by -14, -16 and -23 %-points. Meanwhile, active travel increased by +15 (+9), +18 (-5) and +23 (+8) %-points. (Numbers in brackets indicate the changes in active travel *excluding* park-and-stride.)
- At the six schools in Edinburgh (schemes implemented Sep/Oct 2015; comparison of June 2015 and 2016 data), on average, the proportion of children driven reduced by 6%-points, and the proportion travelling actively increased by 5%-points (including +3%-points park-and-stride). However, results for individual schools were variable, with one school where car use did not reduce. Traffic volumes and vehicle speeds (measured on the streets and in the surrounding areas) reduced overall during restriction times, NOx levels reduced and perceptions of safety

[xxx] https://www.islington.gov.uk/energy-and-pollution/pollution/air-quality/air-quality-projects/school-street-consultations
[xxxi] https://getinvolved.croydon.gov.uk/project/567
[xxxii] https://www.havering.gov.uk/school-pspo
[xxxiii] https://www.sustrans.org.uk/SustransSchoolStreets

immediately outside the schools increased. Parent and resident support for schemes increased post-implementation (albeit with some mixed views from residents on peripheral streets).

- At the five schools in Hackney, active travel (excluding park-and-stride) increased at four schools (by +1, +4, +5 and +9 %-points), with cycling increasing at all schools, and walking at two. However, car use only reduced at two (-3 and -8 %-points). At one school, the share of car use increased, which was attributed to an increase (and potential change in composition) of the intake. Schemes were implemented from June 2017; monitoring based on 4 surveys (2 before, 2 after), each spaced 6-12 months apart.

Costs per trip generated and time profile

Average costs per active travel trip generated were in the order of £1-3/trip in the first year (excluding Hackney data, and treating park-and-stride as a 0.5 walk trip). Effects appear to be relatively immediate, and sustained over several years (albeit that the data to draw this conclusion is limited).

(In Hackney, for the four schools where active travel increased, the apparent average cost per active travel trip generated was about £4 - partly due to the purchase of ANPR cameras - although in practice this cost was offset by revenue from fines. Many of the trips generated were cycling trips, in some cases substituting for walking trips.)

AC. School travel plans

Nature of evidence, geographical areas, populations and journey purposes

Work on school travel dates back to the early 2000s, with a major Government initiative in 2003 to provide funding for school travel advisers and school travel plans. Evidence for our study was available from a DfT-funded review (2005) of 30 best practice school travel plans (and their 23 associated local authorities' school travel work) [183]; an Atkins review of the Government's initiative undertaken in 2010[184]; information from DfT reports on smarter choices[182] and Sustainable Travel Towns[161]; and from Darlington (which has worked on school travel since 2004) [177, 178]. Both of the early reviews found that higher increases in walking occurred in urban areas. Secondary schools have traditionally been harder to engage with than primaries, particularly about walking. The 2010 study also found regional differences – with higher increases in walking at schools in London and the South East.

Scale of activities

By 2009, nationally, 81% of schools (primary and secondary) were reported to have a 'travel plan'. In recent years, Modeshift STARS (and TfL STARS) have developed as an accreditation scheme for schools, to provide a more meaningful, graded assessment of how far each school supports sustainable travel.

Costs

The costs of school travel schemes depend on the nature of the schemes. School travel plans originally developed as 'safe routes to school' schemes, and included infrastructure measures in the surrounding catchment. Spending on the best-practice primary school travel plans reviewed in 2005 averaged £28,000 per primary and £67,000 per secondary, with some including infrastructure measures (most commonly safer crossings and new, shared pedestrian and cycle paths). A review of 23 local authorities promoting travel plans at that time concluded that each member of staff was typically working intensively with 8 schools (range 2-17) and less intensively with a further 6 schools (range up to 32) each year, with potential staff costs of £20-30,000 p.a.. The costs of providing particular initiatives are discussed further elsewhere.

Impacts

Evidence on impacts was as follows:

- In the 2005 review[xxxiv], the weighted average change across the 28 'best practice' schools with information about change (representing 17,800 pupils) was that walking increased by 14% (+4.1 %-points), cycling increased by 26% (+2.1%-points), and car use reduced by 23% (-9.1 %-points). Changes at some individual schools were considerably greater than this.
- The 2010 review of the Travelling to School initiative found that, nationally, at primary schools, walk mode share increased by 1.5%-points (with 61% of schools reporting an increase in walking) and car mode share decreased by 1.6%-points between 2006/07 and 2008/09. At secondary schools, walk mode share fell by 0.3%-points and this was offset by a similar increase (0.3%-points) in cycling. The review found relatively small differences in pre/post change between schools with travel plans, and those without, but baseline data only became available after 3 years of the initiative, and schools 'with travel plans' were very variable in terms of actual activities. Six 'best practice' primary schools showed increases in walking of between 9 and 24%-points.
- In Smarter Choices, data from 8 local authorities with programme-wide data, and 80 schools with good quality travel plans, suggested that a local authority programme might typically achieve car

[xxxiv] Scooting and 0.25% of park-and-stride trips counted as walking in this study.

use reductions at 60-90% of engaged schools, and reductions of 20%+ at 15-40% of schools – thereby achieving an average reduction in car use of 8-15% across all engaged schools, much of which would be switching to active travel. (If applied to a car mode share of about 40%, this would be equivalent to a change of 3-6%-points *at engaged schools*.)

- Data from Peterborough and Worcester (from their Sustainable Travel Towns work) showed increases in active travel of 4-7%-points (depending on survey dates and methods used), mainly due to increases in walking in Peterborough and both walking and cycling in Worcester.
- Darlington's active travel mode share at primaries rose from 56% in 2004, to around 60% by 2006/7, and has since stayed at that level, albeit dipping back in some years when school travel work has been less well funded. Cycle mode share has been about 6-7% since 2008/9. The active travel share at secondary schools (all years) has not been maintained over time, although a relatively high cycling mode share (7-8%) was achieved in 2016/17 and 17/18.

Costs per trip generated and time profile

Individual estimates of the cost of achieving change via school travel plans are highly variable. If assuming an increase in active travel of 3-6%-points at a primary school of 300 pupils, and a cost of £30,000, costs per trip would be in the order of £4-9. Given that costs are likely to include some infrastructure changes, costs per trip should reduce significantly over time. However, sustained volunteer input from members of the school community over a number of years would probably be additionally needed. The 2005 review found that the 'good practice' schools had all been working on school travel for at least two years (with 40% working on it for more than 4 years).

AD: Shared e-bike schemes

Nature of evidence, geographical areas, populations and journey purposes

The main evidence was from 11 shared electric bike schemes, run as a DfT pilot project by Bikeplus[93]. These took place in a variety of locations (Bristol; Cambridge/Norwich; Eastbourne; Exeter; Oxfordshire & East England; Hebden Bridge, West Yorkshire; Isle of Wight; New Forest; Oxford; Plymouth and Rotherham). They included provision of e-bikes for tourist areas, as part of a car club, to link to a local station, for short-term loan via workplaces, as part of a city centre bike hire scheme etc.. There was also some evidence from ebikes Derby[120]. In the pilot schemes, it was reported that 49% of trips made were for business or commuting. 45% were by women and 18% were by people not in employment, education or training

Scale of activities

In 10 months (Jan-Oct 2016), as part of the shared e-bike project, 188 e-bikes were provided, tried by 2,667 people, and used for 11,702 journeys. The Derby scheme launched in June 2018 with 200 bikes at 30 docking stations (although vandalism has meant the scheme has been closed). Prior to closure, it had attracted nearly 7,000 users. There are larger European schemes. In Madrid, Bicimad[xxxv] has been operating since 2014, with over 2,000 electrically-assisted bikes from 165 docking stations. In Berlin, Uber launched an e-bike sharing service in May with 1,000 e-bikes[xxxvi].

Costs

The public sector costs of the shared e-bike pilot schemes ranged from £17,000 to £89,000, partly depending on funding model, averaging at £2,700 per e-bike provided (including set-up costs). The Derby scheme suggests similar costs per bike provided.

Impacts

For the UK shared e-bike scheme, the number of hires generated per bike (in 10 months) varied considerably, from 3 to 300. 81% of users were not previously making their journey by bike and there was survey data suggesting that some people had gone on to buy either an electric or a conventional bike. The Derby scheme was generating approximately 4,000 rentals a month, and the scheme operator noted that usage over the winter had remained relatively constant, rather than dropping away. Although a different type of initiative, it is worth noting that other programmes, encouraging people to 'try out' an e-bike, also report on subsequent purchases or increases in conventional cycling[98, 104, 114, 117, 121].

Costs per trip generated and time profile

Tentative calculations suggest that scheme costs may be in the order of £12-22 in the first year, but would drop to £2-3 per trip if making assumptions about other additional cycle trips resulting from personal bike/e-bike purchase. Costs should also reduce over time, given that there is a major start-up capital cost – although vandalism problems will obviously affect that.

[xxxv] https://www.introducingmadrid.com/electric-city-bikes; https://en.wikipedia.org/wiki/BiciMAD
[xxxvi] https://www.electrive.com/2019/05/09/uber-launches-jump-pedelecs-in-berlin/