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On the buses: a mixed-method evaluation of the impact of free bus travel for young people on the public health

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Contributions of Authors

Dr Judith Green (Reader, Sociology of Health, LSHTM) was the principal investigator. She co-ordinated the study, contributed to the study design, qualitative fieldwork and analysis, interpretation of data and writing the report.

Rebecca Steinbach (Research Fellow, Social Epidemiology, LSHTM) prepared data sets (London travel surveys, STATS19 road casualty data and Hospital Episode Statistics), conducted statistical analyses and prepared data for the economic evaluation. She contributed to the qualitative fieldwork, qualitative data analysis and the writing of the report.

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Dr Phil Edwards (Senior Lecturer, Statistics, LSHTM) contributed to the study design, prepared data sets (London travel surveys, STATS19 road casualty data and Hospital Episode Statistics) and conducted statistical analyses. He contributed to the writing of the report.

Charlotte Kelly (Senior Research Fellow, Institute for Transport Studies, University of Leeds) contributed to the economic analysis, interpretation of data and writing the report.

Dr John Nellthorp (Senior Research Fellow, Institute for Transport Studies, University of Leeds) contributed to the economic analysis, interpretation of data and writing the report.

Dr Anna Goodman (Research Fellow, Social Epidemiology, LSHTM) contributed to the qualitative data collection and analysis, interpretation of the data, and writing the report. She led the youth engagement strand of the project.

Professor Helen Roberts (Professorial Research Fellow, Medical Sociology, UCL Institute of Child Health) contributed to the study design, qualitative fieldwork, interpretation of findings, and writing of final report.

Professor Mark Petticrew (Professor, Public Health Evaluation, LSHTM) contributed to the study design, interpretation of findings, and writing of final report

Professor Paul Wilkinson (Professor, Environmental Epidemiology, LSHTM) contributed to the study design, interpretation of the data and the writing of the final report.

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Scientific Summary

Background

Despite a rising interest in transport and health among public health professionals there is a lack of robust evidence on the public health impact of transport interventions. In September 2005 London introduced a policy granting young people aged under 17 years access to free bus and tram travel. A year later this policy was extended to people aged under 18 years in education, work or training. The free bus travel intervention was part of a broader environmental strategy in London to reduce private car use, but its primary aim was to decrease 'transport exclusion', and ensure that transport costs did not deter access to goods, services, education and training opportunities for young people. We would expect that this would increase health, as transport access is linked to well-being. However, an intervention that aims to change the travel patterns of such a large segment of the population may very well have other health effects. These may include: young people walking less often or less far, and thus taking less exercise (but also reducing risk of pedestrian injury), or being more exposed to minor crime and assault as they travel further for longer distances. Free bus travel for young people might also reduce access other age groups have to transport if, for instance, the buses become too full, or older people are intimidated.

There are real challenges in evaluating the impact of large scale transport interventions in complex environments. The causal pathways by which transport interventions might affect transport mode choice and therefore health are currently poorly understood; transport interventions occur at the same time as other changes so it can be difficult to assess how far the intervention has caused any changes in health outcomes; and in complex environments there are often no obvious comparison or 'control' areas to help contextualize changes. In the absence of randomised controlled trial evidence (generally not possible with large transport interventions) there is a real need to develop robust observational methods to evaluate potential health impacts. Free bus travel provides a case study for using 'natural experiments' to develop the evidence base on transport and health, and for exploring how far existing data sets can be used to evaluate policy interventions.

Aims

This study aimed to evaluate the impact of free bus travel on public health, using a mixed method design, and to assess the economic costs and benefits of the scheme. Our specific aims were to:

- provide empirical evidence for the impact of this intervention on key health behaviours and outcomes (e.g. injuries, active travel) for young people;
- explore the effects on the determinants of health (e.g. access to education and training);
- identify the effects of increased young people's access to bus travel on older citizens;
- develop and apply methods for economic assessment; and
- contribute to the development of methods to strengthen causal inference in non-randomised designs.

Methods

To assess these health effects of free bus travel we drew on three main sources of data: qualitative data, quantitative data and literature reviews.

Qualitative data:

We interviewed 119 young people and 47 older citizens from a range of backgrounds to find out how they experience transport, and the ways in which they feel that access and use influences their health and wellbeing. We spoke to participants in focus groups (66 young people, 18 older citizens) and individual or paired interviews (53 young people, 29 older citizens). Participants were largely selected from four areas of London, chosen to represent two outer London boroughs (Havering and Sutton) and two inner London (Islington and Hammersmith & Fulham) with a range of transport availability.

Questions focussed on generating stories by asking about: modes of travel to and from main daytime destination, and in the evenings and at weekends; experiences, benefits and disadvantages of different transport modes; and experiences of interactions with others when travelling.

Transcripts and notes were analysed qualitatively, drawing on techniques from the constant comparative method, including detailed open coding of early segments of data, close attention to comparisons within the data (for instance in comparing young people's accounts in stories and in addressing direct questions) and context (e.g. in comparing accounts in focus groups and interviews).

Quantitative data:

We used a number of different routine data sources to measure as robustly as possible the overall impact of free bus travel for young people on the transport patterns of young people, the transport patterns of older citizens, and the incidence of road traffic injuries and assaults in young people.

We estimated changes in travel patterns using the London Area Transport Survey (2001) and London Travel Demand Survey (2005-2008): These surveys sampled 30,000 households in 2001 and 8,000 households annually since 2005 across London. In every sampled household each person aged over 5 years is asked to complete a one day travel diary to record the start, interchanges (e.g. change from bus to train), and end of every journey made on that day.

We estimated changes in road traffic injuries using the STATS19 data (2001-2009), the official dataset of death and personal injuries from road traffic collisions that occur on the public highway in the UK.

We estimated changes in the incidence of assaults using Hospital Episode Statistics (HES) (2001-2009). We identified hospital admissions due to assaults (intentional causes of injury ICD-10 codes X85-Y09).

Our analysis compared the pre-post intervention changes in outcomes (travel patterns, injuries, assaults) in a population affected by free bus travel (young people aged 12-17 years) to the change seen in a population not affected by the intervention, adults aged 25-59 years.

Literature reviews:

We drew on the transport studies literature on evaluating the costs and benefits of transport strategies to examine the costs and benefits of this policy, from the perspectives of the economy, environment and society. We conducted a systematic review of prospective studies of the health benefits of active travel.

Results

What effect has the scheme had on use of bus travel by young people in London?

In the context of rising levels of bus use in London, there was no quantitative evidence that the scheme itself had increased the number of journeys with the bus as the primary mode, or the number of kilometres travelled by bus by young people compared with adults. However, these had gone up overall for both groups, and the number of short journeys travelled by bus had risen. The qualitative data provided some evidence that, because the scheme was both cost free to young people at the point of use and universal, it contributed to bus travel becoming the 'default' mode for many journeys and buses becoming a key site of social activity for young people.

What impact has the scheme had on active travel?

Although the number of journeys with walking as a main mode decreased, there was little evidence that overall levels of active transport had reduced, in part because bus travel entails some walking, and the scheme had generated additional journeys. Few journeys are made by bicycle in London, and compared with adults (for whom cycling rates had gone up), young people were cycling less after the introduction of free travel. Young people's accounts suggested that cycling was not, in general, considered a candidate transport mode, but we do not know whether this has changed since the introduction of free travel. On balance, then, it is difficult to attribute changes in cycling to the introduction of free bus travel, although reasonable to suggest that free bus travel for all would militate against other attempts to increase cycling rates.

Has the scheme fostered sustainable transport?

The quantitative data indicated that journeys by car declined in both adults and children, but it is difficult to attribute these changes to the scheme rather than other interventions over the same period. Qualitative evidence suggested that in outer London in particular, free bus use had displaced some car journeys. The qualitative data suggested that although young people still expected to learn to drive as a rite of passage to adulthood, bus use had been 'normalised' by the intervention such that it was not seen as a transport mode of last resort.

What impact has the scheme had on safety?

We assessed the associations between the scheme and road traffic injuries and assaults. We identified a relative reduction in road traffic injuries which was consistent with the mode changes observed, i.e., a reduction in car occupancy and in cycling. Against a background decline in road

traffic injury rates, the decline seen in 12-17 year olds was greater, primarily reflecting declines in car and cycling injuries after the introduction of the free bus travel scheme.

Quantitative evidence indicated that assaults in young people had risen compared with adults in London and with the national population of young people. However, the increase predated the introduction of free bus travel. Qualitative evidence suggested that for most young people, the risks associated with travel were to some extent mitigated by free bus travel, which allowed: 'practice journeys'; a contingency plan for avoiding getting stranded; and (for girls) a perceived safer alternative to walking.

Has the scheme reduced social exclusion?

Quantitative data suggested a rise in the number of journeys to school or work after the scheme was introduced, but no evidence of a flattening of the socio-economic gradient of travel for educational purposes. Qualitative data suggests that transport exclusion is not a barrier for young people in London. For those able to use the bus service, the scheme has ensured that all can access education, training and the social opportunities essential for social inclusion. For young people with disabilities, however, buses represented a barrier to, rather than a facilitator of, social inclusion.

While we couldn't directly measure the effect of the scheme on young people's well-being, the qualitative data suggested a number of benefits from increased bus use for young people, including increased ability to be independently mobile, increased control over their travel, and fostering a feeling of 'belonging' to London. These are difficult to quantify, but confidence, independence and a sense of belonging make an important contribution to young people's wellbeing.

Has the scheme displaced older people from buses?

There was no quantitative evidence that young people's free travel had displaced older citizens from the buses. The qualitative data suggests that older citizens often preferred to travel at non-school (and non commuter) times for reasons of comfort and convenience, but did not experience young people as a constraint on their travel behaviour.

Does the scheme represent value for money?

From the perspective of the cost benefit framework and representative year 2009, the policy has reduced road traffic casualties, increased bus travel and reduced car travel whilst not reducing levels of active travel in the city. In the base case the monetised benefits have substantially outweighed the costs, providing what the Department for Transport considers "high" value for money.

Conclusions

To address some of limitations in quasi-experimental designs, we have integrated quantitative and qualitative evidence as part of a multi-method approach to build up an assessment of public health impacts of free bus travel in an iterative way, and assessed these in the light of the broader changes that happened in London, particularly the growth of bus transport. The intervention is best conceptualised as 'universal free travel for young people in the context of an efficient and accessible bus network'. Our findings suggest this intervention has had the following implications for public health:

- The most significant implications of the free travel scheme for the public health of young people and London as a whole may be on young people's wellbeing, which is difficult to measure. The free bus travel scheme offered different possibilities for young people to travel together, it opened up the bus network as a place for sociability, and enabled both the opportunities to enact 'independence' and the opportunities to develop skills in independent travel.
- There are mixed implications for physical exercise. We did not identify strong evidence of a negative impact on distances walked, given that the scheme appeared to generate new trips, and replaced some more 'passive' car travel. However, we also found no evidence of a beneficial effect. Cycling was not considered a candidate mode of transport for young people, and had declined relative to adults, though from a low base.
- The scheme has removed one important contributor to transport exclusion for young people: transport costs. This is an important condition for social inclusion, but the experiences of young people with disabilities suggested it is not a sufficient condition in the absence of an accessible bus network.
- In the context of a good bus system, the scheme contributes to the 'normalisation' of bus travel, which has been identified as an important precondition of decreased dependence on cars for transport.

To further our understanding of how transport interventions such as this contribute to health, the determinants of health and health inequalities, the following are research priorities:

1. Our systematic review identified a paucity of robust research on the health impacts of increasing the amount of 'active transport' in the population, despite promising cross-sectional evidence that those who do more walking and cycling are healthier. Intervention studies are urgently needed to improve the evidence base in this area.

2. One policy driver of this intervention was the desire to inculcate 'healthier' travel habits among young people, and reduce future car dependence. It is not known, however, how far transport mode choices in adolescence are maintained into adulthood, or how far mode changes achieved in interventions are maintained long term. More research from cohort studies is needed on the maintenance of transport mode change habits, and more qualitative research on the role of driving in young adulthood.
3. This study has suggested that, in London, where bus travel has been 'normalised' it does not carry the stigma associated with bus travel reported in other research. This suggests that an important influence on transport mode choice is the cultural associations of those modes. As these are likely to vary across populations, and over time, more research is needed on how environments, policies and cultures interact to make (for instance) walking, cycling or public transport use more or less common across population groups. More research is also needed on how public transport provision alters young people's orientations to and use of car transport.
4. The economic cost benefit analysis relied on monetised benefits from the scheme which are based on standard adult values. To inform economic evaluations in the area of transport and health, more research is needed on how differences in value of a statistical life for children might affect cost benefit calculations.

List of Abbreviations

BCR	Benefit:Cost Ratio
BTP	British Transport Police
CBA	Cost Benefit Analysis
CI	confidence interval
CV	Cardiovascular
DfE	Department for Education
DfT	Department for Transport
GB	Great Britain
GC	Generalised cost
GLA	Greater London Authority
HEAT	Health economic assessment tools
HES	Hospital Episode Statistics
IMD	Index of Multiple Deprivation
ITS	Institute for Transport Studies
Km	kilometres
LATS	London Area Transport Survey
LSHTM	London School of Hygiene and Tropical Medicine
LSOA	Lower Super Output Area
LT	London Transport
LTDS	London Travel Demand Survey
MPS	Metropolitan Police Service
MRC	Medical Research Council
NPV	Net Present Value
NTS	National Travel Survey
NSB	Net Social Benefit
PTALs	Public Transport Accessibility Levels

PVB	Present value of benefits
PVC	Present value of costs
RCT	Randomised controlled trial
RTI	Road Traffic Injury
TfL	Transport for London
TGF	Trip generation factor
UK	United Kingdom

Glossary

Active travel	Travel by modes which require physical exertion, such as cycling and walking.
Elasticity	Responsiveness of one variable to another, measured as the proportionate change in the first variable divided by the proportionate change in the second, for small changes.
Freedom Pass	Card entitling older citizens and people with disabilities free access to most public transport services within London, paid for by borough councils.
Natural Experiment	Study of an intervention over which the researcher has no control, but which allows quasi-experimental evaluation (eg through comparisons of before and after and/or 'exposed/non-exposed' populations).
Oyster Card	Plastic smart card used to access public transport services within London, which is preloaded with season tickets or cash for 'pay as you go' trips.
STATS19	National statistics on road accidents and the underlying data collection system, involving the police, local government and central government
Trip	A journey from an origin to a destination, which may involve multiple stages by different modes. In quantitative results section, 'trip' refers to a whole journey, including all stages, and defined by the 'main mode' (by distance).
Trip mode	Main mode used for largest (by distance) part of trip
Zip Card	Oyster card with photo, used to access free bus and tram travel

Abstract

Objectives: To evaluate the impact of free bus travel for young people in London on the public health. Specifically, to: provide empirical evidence for the impact of this 'natural experiment' on health outcomes and behaviours (e.g. injuries; active travel) for young people; explore the effects on the determinants of health; identify the effects on older citizens of increased access to bus travel for young people; and to identify whether the intervention represented value for money.

Design: Quasi-experimental design, using secondary analysis of routine data, primary qualitative data and literature reviews.

Setting: London, UK

Participants: Young people aged 12-17 years; older citizens aged 60 years and over.

Intervention: The introduction of free bus travel for those aged under 17 years living in London in 2005, extended to those aged under 18 years in 2006.

Main outcome measures: Quantitative: number of journeys to school or work; frequency and distance of active travel (i.e. walking and/or cycling), bus travel, car travel; incidence of road traffic injuries and assaults; socio-economic gradients in travel patterns. Qualitative: how free bus travel affected young people and older citizens' travel and wellbeing.

Methods: Quantitative component: change-on-change analysis comparing pre-post change in the target age-group (12-17 years) against that seen in 'non-exposed' groups (for travel mode, road traffic injury and assaults). Qualitative component: interviews analysed using both deductive and inductive methods. Economic evaluation: cost-benefit analysis.

Data sources: London Area Transport Survey and London Travel Demand Survey (travel mode); STATS19 (road traffic injury); Hospital Episode Statistics (assaults); interviews with young people and older citizens; cost data from providers and literature reviews.

Results: The introduction of free bus travel for young people was associated with: higher use of bus travel by adults and young people (31% increase, 95% CI 19% to 42% ; and 26% increase; 95% CI 13% to 41%, respectively), especially for short journeys, and lower car distances relative to adults (relative change 0.73; 0.55 to 0.94); no significant overall reduction in 'active travel' (reduction in number of walking trips but no evidence of change in distance walked (relative change 0.99; 0.92 to 1.07); significant reduction in cycling relative to adults but from a very low base); a reduction in road traffic injuries for car occupants (relative change 0.89; 0.84 to 0.95)and cyclists (relative change 0.60; 0.55 to 0.66) (but not pedestrians); an overall modest increase in journeys to work or school (relative change 1.09; 1.06 to 1.14); equivocal evidence of impact on socio-economic gradients in travel behaviour; and no evidence of adverse impact on travel of older people aged 60+ years. An increase

in assaults largely preceded the scheme. Qualitative data suggested that the scheme increased opportunities for independent travel, social inclusion, and a sense of belonging and that it 'normalised' bus travel. The monetised benefits of the scheme substantially outweighed the costs, providing what the Department for Transport considers "high" value for money.

Conclusion: The free bus travel scheme for young people appears to have encouraged their greater use of bus transport for short trips without significant impact on their overall active travel. There was qualitative evidence for benefits on social determinants of health, such as normalisation of bus travel, greater social inclusion and opportunities for independent travel. In the context of a good bus service, universal free bus travel for young people appears to be a cost effective contributor to social inclusion and, potentially, to increasing sustainable transport in the long term.

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Prior publications

This report draws on the following work already published or under review:

Jones A, Steinbach R, Roberts H, Goodman A and Green J. (2012) Rethinking passive transport: bus fare exemptions and young people's wellbeing *Health and Place* **18**: 605-612

Jones A. (2010) Free for some: Setting the context for the "On the Buses study. *Occasional Papers in Transport and Health (1).* London: LSHTM. 978 0 902657 82 8

Wilkinson P, Edwards P, Steinbach R, Petticrew M, Goodman A, Jones A., Roberts H, Kelly C, Nellthorpe J and Green J. (2011) The health impact of free bus travel for young people in London: protocol for an observational study *Occasional Papers in Transport and Health (2).* London: LSHTM 978 0 902657 83 6

Goodman A and Green J. Reciprocal recruitment and integrated work experience: combining youth involvement, engagement and participation in health research (*Health Expectations – under review)*

Green J, Jones A and Roberts H. (in press) More than A to B: the role of free bus travel for the mobility and wellbeing of older citizens in London. *Ageing and Society*

Edwards P, Steinbach R, Green J, Petticrew M, Goodman A, Jones A, Roberts H, Kelly C, Nellthorp J and Wilkinson P. Health Impacts of free bus travel for young people: evaluation of a natural experiment in London (*– under review)*

Saunders L, Green J, Petticrew M, Steinbach R and Roberts H. What are the health benefits of active travel? A systematic review. (under review)

Goodman A, Jones A, Roberts H, Steinbach R and Green J. (in press) "We can all just get on a bus and go": rethinking independent mobility in the context of the universal provision of free bus travel to young Londoners. *Mobilities*

Disclaimer

The views and opinions expressed herein are those of the authors and do not necessarily reflect those of the Department of Health.

Chapter 1 Free bus travel and public health

1.1 Introduction

Transport policies and systems are increasingly accepted to have the potential to be both health promoting and harmful to health (1, 2), and to contribute to the generation, maintenance or mitigation of health inequalities(3-6). However, the evidence base in this area remains relatively under-developed, with few evaluative studies which have examined the health and related outcomes of changes to transport policies (7, 8)and few studies which have identified the costs and benefits specifically of public transport use (9) although methodological work in this area is being developed (10, 11). This study aimed to contribute to this evidence base by evaluating the impact on the public health of a transport intervention in London: the introduction of free travel for young people.

1.2 The intervention: free bus travel for young people

In 2005, the Greater London Authority (GLA) granted secondary school-aged children unlimited travel on buses and trams displaying the London Buses symbol (both within and just outside London (see 12), replacing a reduced, 40p flat fare for each journey on the London bus network. This fare exemption was extended a year later to include 17 year-olds in full-time education (13: 7) and now also includes all 18 (and some 19) year-olds in full-time education or on a work-based learning scheme (14: 8-9). To access free travel, young people apply for an electronic photo card called a 'Zip' card, which is tapped on a reader on entering the bus. As well as granting the cardholder unlimited free travel on all buses, the Zip Card also acts as conventional 'Oyster' card, used by most residents and visitors in London. This can be loaded with pre-pay or travelcards for the cardholders to use on other parts of the TfL network (Tube, DLR, London Overground and most National Rail services operating in the capital) at a discounted rate (see 14: 6-11).

The stated aims of the scheme were "to help young people to continue studying, improve employment prospects and promote the use of public transport" (13: 7). That is, it was aimed first and foremost at mitigating the potential social exclusion effects for young people of fare-based urban transport systems (see 15). As stated more recently on the TfL website:

> Granting young people free travel is part of the Mayor's strategy to embed more environmentally sound travel habits from an early age while helping young people to unlock education, sport, leisure and employment opportunities (16).

By removing any need to pay, at the point of use, for travel on buses, it was argued that young people would be better (and more equally) able to access goods and services (schools, libraries, leisure facilities etc.), thus both improving social inclusion in the short term and contributing to longer term policies to improve the sustainability of London's transport system.

However, the intervention is likely to have had other implications for health and wellbeing. Policy concerns have centred on the potential impact on young people of both being at risk of, and the perpetrators of crime (17, 18); the impact on older citizens of buses with large numbers of young people; and the possible effects on 'active transport' at a time when health policy is geared towards encouraging walking and cycling. The latter issue is one that has explicitly been aired by both politicians (see Appendix 1) and practitioners:

> I would urge TfL to scrap concessionary bus fares for children in London.... They should be walking or cycling these trips for the sake of their own health and fitness. Yet many of them are taking the bus for just a stop or two - and getting fatter and fatter ... It is almost impossible to get secondary school kids on their feet or on their bikes in the face of the free [bus travel]. It's high time it was abolished. (19)

To date, there is little empirical evidence that would inform debate. Given the importance to public health of both addressing issues of sustainability in transport and the threatened 'obesity epidemic' (20-22), evidence on the health effects of interventions such as free bus travel is urgently needed.

1.3 Context: London's unique transport infrastructure

London's transport infrastructure is unique in the UK. First, since the deregulation of bus transport in 1985, it is the only region within Great Britain with a regulated bus system (23), with the elected Mayor of London having executive control over the transport in the greater London area. Over the past ten years, and since the establishment of the Greater London Authority (GLA) as a strategic governing authority for London in July 2000, London's bus network has been subject to significant operational changes (including changes to bus 'service levels'[a] as well as to the ways that

[a] In the transport field, "[s]ervice levels can be defined according to a number of dimensions, the key ones being the frequency of public transport services (services per hour), the hours they operate (period of

contractual agreements between TfL and bus operators are monitored and regulated) (25). These changes have been driven by an explicit commitment to public transport, with the GLA's first Mayor, Ken Livingstone (2000-2008) stating that to resolve the problems posed to "the business efficiency and quality of life of the city" by an inadequate transport system, "[t]he only viable approach…is one where passenger travel to, from and within central London must primarily be served by public transport" (26: 12). These policies have increased the numbers of bus passengers and bus trips in London, with buses now carrying around 2.2 billion passengers each year (27: 139). Public buses in London now operate according to a complex management and funding structure in which TfL's role is to plan routes and monitor service quality, as well as manage bus stops, stations and other support services. The bus services themselves are operated largely by private sector companies under contract to London Bus Services Limited ('London Buses'), part of TfL (See Appendix 1).

Car ownership is lower in London than other areas of the UK, and a number of policies in addition to the expansion of public transport aim to reduce car usage. An important one is the congestion charge, introduced in 2003 and currently £10.00 a day, which is levied on cars travelling into London within certain times[b]. This has implications for young people's travel patterns, which are unlikely to be typical of the UK as a whole. Department for Education (DfE) data, for instance, records higher levels of public transport use for school journeys, and lower levels of car, walking and cycling use for school journeys than for the rest of England (See Appendix 1, Table A1.2)(28).

Finally, the greater London area covers 33 boroughs, with marked differences in transport modal share between them. One measure of transport accessibility is Passenger Transport Access Level (PTAL) scores (1 is poor and 6 excellent, and 0 is no public transport accessibility within the specified parameters[c]). As Figure 1.1 shows, public transport is, in general, less available the further one goes from the centre of London. With less access to public transport, and fewer disincentives for driving, car travel remains higher in the outer compared with inner London boroughs (modal share 41% and 26% respectively) (30).

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operation), where they operate and the origins and destinations they serve (both related to network coverage)" 24. KonSULT. Public Transport Services: Summary Leeds: University of Leeds; 2010 [cited 2010 1 November]. Available from: http://www.konsult.leeds.ac.uk/private/level2/instruments/instrument042/l2_042summ.htm..

[b] There are a number of discounts and/or exemptions, including for London residents, disabled people and greener vehicles. http://www.tfl.gov.uk/assets/downloads/congestion-charging.pdf.

[c] As the London Travel Report 29. TfL. London Travel Report 2007. In: London Tf, editor. London: Transport for London; 2007. puts it, in the calculation of PTAL scores analysts factor in "the access time (by walking) from the point of interest to public transport service access points (SAPs, e.g. bus stops, stations) within a catchment area; the number of different services (e.g. bus routes, train services) operating at the SAPs; and levels of service (i.e. average waiting times, with an adjustment for the relative reliability of different modes)."

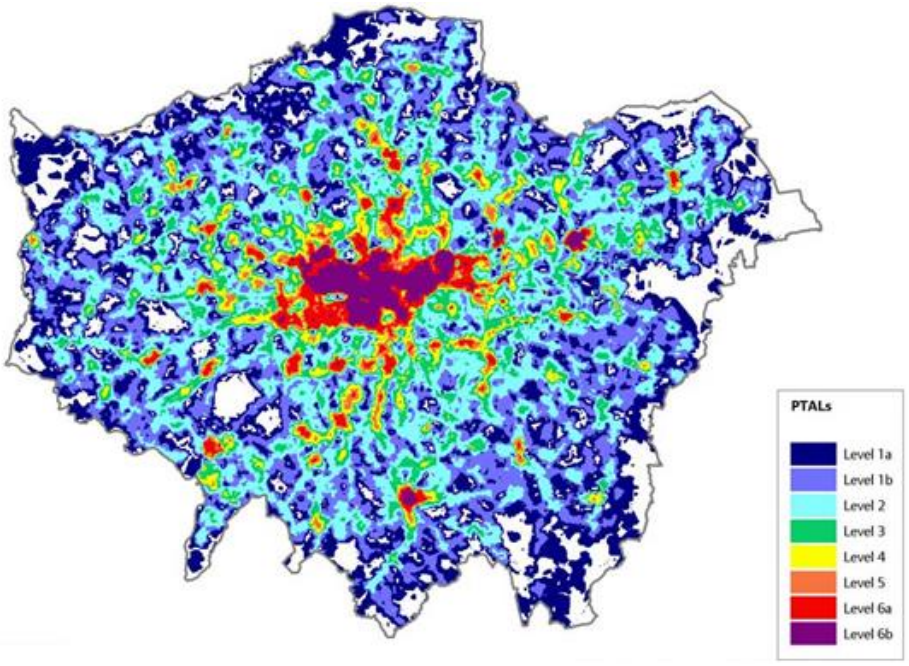


Figure 1.1 Map of pan-London PTAL scores (source 31: 57). Reproduced with kind permission of GLA.

Although the distinction between inner and outer London is significant, there are other differences between the 33 boroughs in London in terms of typical transport modes used. As Figure 1.2 shows, bus density (indicated by the number of bus stops) varies across with boroughs, as well as across inner and outer London.

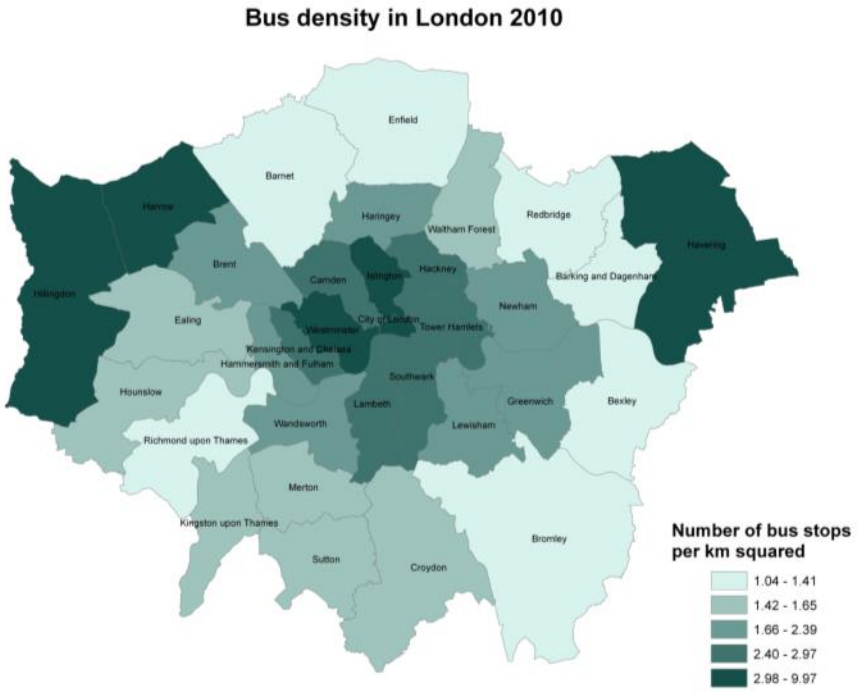


Figure 1.2 Bus density in London, by borough

1.4 Young people's travel in London

The free bus travel scheme introduced for young people in London in 2005 was not introduced in isolation, but within a context of other explicit policies and secular changes that shape the ways that people in London travel and which potentially impact on health (2, 32, 33). The policies and broader cultural shifts that provide the context for young people's travel over the period of this study include:

- Substantial improvements to the bus network (and public transport network more broadly) since the establishment of the GLA in 2000 (see above and Appendix 1);
- The congestion charge scheme, which provided disincentives for driving in the central area and which has reduced car journeys within the zone (34).
- The expansion of road engineering interventions, such as 20pmh zones, which have made local environments safer for walking and cycling (33) and therefore may have encouraged active travel;
- The increasing distances that young people travel to school in the UK. National Travel Survey (NTS) suggest that between 1985-2004 the average journey length to school has increased by about 800m (35). In London in January 2010 the average distance (calculated as a straight line using post code data) travelled to school by secondary school pupils was 1.5 miles (28: 37, Table 7). Of these pupils, 24.8% travelled 2 or more miles to school and so covered distances that might not typically be considered appropriate for walking or cycling.
- Broader cultural shifts that increase the number of children being driven to school (36, 37).
- A focus on cycling in London, with for instance The Evening Standard's high profile 'safer cycling' campaign [d] which included coverage of cycling deaths in London, potentially adding to anxieties that parents feel about their children cycling to school. Conversely, the work of the TfL Smarter Travel unit has targeted reducing car travel to/from school and the workplace in particular, with the outer London boroughs of Richmond and Sutton subject to extended smarter travel campaigns[e]. Although many cycling interventions have been focused on adult cyclists, such as government tax breaks on cycling to work introduced in 1999[f]., these form part of the backdrop of changing views of transport modes in the capital (see e.g. 38).

[d] http://www.thisislondon.co.uk/standard/article-23411440-safer-cycling.do

[e] http://www.richmond.gov.uk/smarter_travel_richmond_upon_thames; https://www.sutton.gov.uk/index.aspx?articleid=11904

[f] http://www2.dft.gov.uk/pgr/sustainable/cycling/cycletoworkguidance/

1.5 What is known already?

Assessing the impact of one transport policy on young people's health in this context of these multiple other potential influences first entails mapping the potential ways in which transport interventions might change behaviour, and how these in turn might influence the determinants of health. We first turn to the existing literature on the links between transport and health to outline what is known already about the likely causal chains between transport policy interventions and their health and other outcomes, and to outline the changes that might theoretically result from an intervention designed to change the ways that young people travel. We summarise this research below starting with the most immediate and direct effects of transport policies – injury – and ending with the more distal and difficult to measure.

Transport policy and direct effects: road traffic injury (RTI) Injuries are the health outcomes most obviously associated with transport, and there has been a general emphasis in public health research on negative impacts of transport associated with motorized road vehicles in particular on injury. In the UK, despite falling rates of road traffic injury, stark inequalities remain in the risk of being injured on the road, with those in more deprived areas and in some minority ethnic groups at highest risk (39-41) . In the UK, an important contributor to this risk is likely to be exposure. As young people's travel behaviour changes, their exposure to the risks of road injury will change. Given that the risks of road injury are higher for pedestrians and cyclists (42), the greater likelihood of those in lower income groups to be walking rather than driving or being driven may put them at greater risk. Increasing access to bus transport may reduce injuries and, potentially, inequalities in injury risk if bus transport displaces those modes more exposed to road danger (i.e. walking, cycling).

Encouraging 'active travel' for public health From a public health perspective, policy initiatives to encourage 'active travel' (primarily walking and cycling) have become a key element of strategies to address increasingly sedentary lifestyles and the threatened 'obesity epidemic' in the UK (43-45). Walking in particular has been widely promulgated as a way to improve cardiovascular and mental health and reduce obesity at a relatively low cost to both the individual and the health care system (46, 47). There is a growing body of international evidence demonstrating associations between 'active' commuting and lower risks for overweight (see e.g. 48, 49) with one systematic review estimating that active commuting was associated with an 11% reduction in cardio-vascular risk (46). These gains are also seen for adolescents cycling or walking to school (49, 50). In addition to the direct health gain for the individual, increasing the proportion of active transport compared with

private car transport has been linked with ambitious public health gains, such as reduced global warming and increased social cohesion and community safety (1, 20, 51).

There is some evaluative research on interventions to increase active transport. Ogilvie et al. (47) conducted a systematic review to examine the effectiveness of a range of interventions to promote walking. Those found ranged from individually-targeted interventions (such as brief advice to individuals) up to group, and area-based approaches, including school travel initiatives. Overall, the evidence suggested that interventions which tended to be effective in promoting walking were more likely to be targeted (for example, interventions offered to individuals identified through prior screening), and tailored to participants' requirements. However, they noted that evidence that other types of intervention have been effective in promoting walking is "inconsistent, of low validity, based on single highly contextual studies, or non-existent."

Does public transport use encourage 'active travel'? 'Active travel' is usually conceptualised as walking or cycling, in contrast to 'passive' modes such as car travel, with an assumption that encouraging public transport use will reduce car travel, and in doing so, at least generate some active transport in terms of travelling to and from public transport. However, this does not inevitably follow. In one study on the provision of alternative transport services in a sample of commuters registered with telecommuting centres in California there was a 24% decrease in reported distance travelled on foot or by bike on telecommuting days, the implication being that although telecommuting was associated with decreased car use, it also may have led to less active transport use (reported in 52). Such unanticipated effects illustrate the limited understanding to date on how public transport interventions are likely to influence active travel. In the United States, where public transport is more likely to be an alternative to private car use than to walking and cycling, there is some evidence that increasing access to public transport can *increase* activity levels by increasing walking to public transport sufficiently to have a public health impact on obesity, particularly for men (53-55). However, it is possible that in contexts such as London, with lower levels of private car use, improving access to affordable public transport may *reduce* the amounts of active transport undertaken, as it may replace walking rather than car use.

Transport interventions, active travel and inequality Ogilvie et al (52) noted that we know relatively little about the social distribution of health impacts of transport interventions. International comparisons suggests that the distribution of active transport across a population depends on the inter-relationships between transport systems and social structure (56): for young people, for instance, active modes of travel to school or college were more likely in high income groups in the United States (48) but less likely for immigrants and high income groups in Canada (57). The impact

of interventions aiming to change transport mode choices may, therefore, vary across populations. In addition, the impact of policies such as free bus travel may well have differential impacts on different population groups over time, as the social meaning of bus travel, or walking, changes. Whereas active travel may have health benefits for those who *choose* it, qualitative evidence suggests that there may be negative effects on health for those for whom it is compulsory since they have no choice (58). Given the suggestion that perceived health benefits may be an important determinant of whether an activity does confer health benefits or not (59), and that views on the role of transport vary by socio-economic status (60) how people *understand* the role of transport (particularly active travel) and health will be key to unpacking potential pathways linking transport policy and health inequalities.

Transport and social exclusion Free bus travel for young people was intended to address social exclusion due to 'transport exclusion', with the explicit intention of improving access to education, training, and recreation that resulted from limited (financial) access to transport. Social exclusion is a complex and multi-dimensional concept that resists definition. Church et al (61) note that 'poverty' and 'social exclusion' are often used interchangeably, although 'social exclusion' suggests a broader concept, incorporating not just limited access to material resources, but also a relative loss of ability to 'participate'. Limitations in ability to participate result not just from material restrictions, but also from those social, cultural and environmental contexts which may make some groups more vulnerable than others. This has implications for citizenship, and a broader sense of wellbeing that arises from ability to experience social interaction and feel 'part of' a wider communality (62).

Transport for London commissioned some evaluative work on the impact of free bus travel on outcomes related to inclusion (63, 64), based on surveys of users and non-users of the scheme. However, as the samples were not representative of the population, and the findings based on self-report, no firm conclusions can be drawn about the impact of the scheme on access to education, training or independent mobility. Given that limitation, 14-15 year- olds reported that access to free bus travel had increased access to sports and other recreational opportunities(63), and the majority of 16-17 year olds 'strongly felt' that the scheme had increased their likelihood of staying in full time education, particularly those in lower income and minority ethnic groups(64).

Independent travel For young people, access to transport is likely to have implications for inequalities in a second sense, in that as a population group, there is evidence that young people are increasingly social excluded from public life through limitations on their ability to be 'independently mobile'. Environments that prioritise the needs of motorized transport and increasingly 'tightly govern' public spaces have, it is argued, resulted in young people leading increasingly domesticated

lives, with less 'independent mobility' than previous generations (65-67). For example, Hillman *et al.* (68) showed that between 1971 and 1990 British parents raised the age at which they granted their children 'licences' to undertake different sorts of journeys (e.g. going to school unaccompanied or cycling on the road), a trend that has since continued (69). This decline in independent mobility has been linked to a range of negative outcomes including decreased physical activity (70) reduced opportunities for social, emotional and cognitive development (67) and increased fear of and alienation from the local environment (71).

1.6 What this study will add

Theoretically, then, the free fare scheme for young people may have had a range of effects on the public health of Londoners. Evidence to date suggests that effects on 'processes' such as travel mode choice and travel mode distribution are likely to affect health behaviours and outcomes such as active travel and injury rates. Reducing fares (in this case to "no cost") is likely to increase use of bus travel in the target population (72) displacing other modes of transport and/or creating additional journeys.

To summarise, the risks and benefits to health from the provision of free public transport are likely to accrue from the *increased availability* of transport and changes in the share of *modes* of transport used (e.g. switching from walking to bus travel). In the United States, where public transport is more likely to replace car use than walking and cycling, there is some evidence that increasing access to public transport can *increase* activity levels. Increased walking to public transport is enough to have had a public health impact on obesity, particularly for men (53-55). In England, free bus travel has been identified as providing a benefit for the health of older people (73, 74). However, it is possible that in settings such as London, with lower private car use than other parts of the country (75), improving access to affordable public transport may *reduce* the amounts of active travel undertaken by replacing walking or cycling rather than car use. As the risk of road traffic injury varies by transport mode (42), any modal shift is likely to have implications for injury rates. Young people are at particular risk of assault (76), and greater access to public transport potentially increases this risk. More tangential benefits which may be associated with young people's increased access to public transport include increased social inclusion, and decreased future reliance on private car travel. They are also likely to have effects on broader determinants of health, such as social inclusion and independent travel. These broader health implications of wellbeing that arise from social inclusion or the ability to make independent choices about travel are important, but there is in general less

evidence on the wider social and health effects of different transportation choices (77) and real challenges in operationalising concepts such as 'inclusion' for research (78). Clearly, an evaluation of the public health effects of a transport intervention needs to account for potential effects on social inclusion and wellbeing, but these are difficult measure. Finally, in addition to benefits or costs for the target group (12-17 years), there may be effects on other transport users if they are displaced from buses.

The free bus pass scheme is a 'natural experiment' which allows us to evaluate these potential pathways linking a large scale transport intervention to health determinants, behaviours and outcomes. Given: the range of health benefits and disbenefits that theoretically arise from the intervention; the complexity of the system in which this intervention was introduced; and the difficulties in operationalising distal health outcomes which are important but (to date) under-researched, any evaluation will require a mix of methodological strategies. This study therefore aimed to evaluate the impact of free bus travel on the public health by identifying the best available strategies to explore these pathways, , using a mixed method design. Our specific aims were to:

1. provide empirical evidence for the impact of this intervention on key health behaviours and outcomes (e.g. injuries, active travel) for young people;
2. explore the effects on the determinants of health (e.g. access to education and training);
3. identify the effects of increased young people's access to bus travel on older citizens;
4. develop and apply methods for economic assessment; and
5. contribute to the development of methods to strengthen causal inference in non-randomised designs.

The approach we took to meeting these aims is outlined in the next chapter.

Chapter 2 Methodology: evaluating 'natural experiments' using mixed methods

2.1 Introduction

Drawing on existing research, Chapter 1 outlined the range of health impacts free bus travel may have had on the public health, and summarised the aims of an evaluation of these impacts. Like many other policy interventions with potential impacts on the determinants of health, it is impossible to generate 'best evidence' such as that from a randomised controlled trial (RCT) on the effects of the intervention. The scheme has already happened, there are no obvious control groups, and no opportunities for the research team to control exposure to the intervention. The intervention could, however, be considered a 'natural experiment', in that although not under the control of the research team, it is amenable to research using natural variations in exposure (79), such as between the target group (young people) and others in the population. Given the urgent need to improve the public health evidence base in general (43), and for evidence on transport interventions in particular, there have been calls to exploit 'natural experiments' to contribute 'good enough evidence' to inform policy decisions. (9, 80). The free bus scheme is one such opportunity. This intervention has a number of advantages which make it suitable as a potential natural experiment (79). A RCT is not possible; we already have (from research evidence) some reasonable expectation that health impacts will accrue from changes in transport behaviour; there are available secondary data sources on some of these impacts that cover both pre and post intervention periods; and there are potential 'exposed' and 'non-exposed' individuals. Finally, there is a policy incentive, given that there is little evidence to inform current debate, and London's transport interventions are of wider interest in the context of policy drivers to increase the sustainability of transport systems.

This Chapter describes the design and approach we took to evaluating the free bus travel scheme as a natural experiment. We discuss the overall design and aims of the study, the methodological challenges in evaluating 'natural experiments' of this type and how we addressed them, and the specific methods used for the quantitative and qualitative components of the study.

2.2 Study design: the logic model linking free bus travel to health outcomes for young people

To map the possible range of public health effects which could be evaluated, we first developed an initial (summary) 'logic model' (81, 82) of the pathways hypothesised to link the intervention with outcomes relevant to public health. This was developed after reviewing the literature summarised in Chapter 1 and in collaboration with key stakeholders, including our steering committee, young people (participants in the LSHTM Young Scientists programme[g]) and colleagues, to ensure we had captured outcomes that were important to policy makers, the public and researchers.

As discussed in Chapter 1, the introduction of free bus travel hypothetically impacts on health through a number of pathways. Our first three aims were to assess the evidence for these pathways, and specifically to:

- provide empirical evidence for the impact of this intervention on key health behaviours and outcomes (e.g. injuries, active travel) for young people;
- explore the effects on the determinants of health (e.g. access to education and training);
- identify the effects of increased young people's access to bus travel on older citizens;

The first step was to outline these pathways and to identify and include the main outcomes of interest. Second, we identified what indicators were possible and feasible to measure for the variables on the pathway and the key outcomes of: safety, active travel, social inclusion, effects on older passengers. Third, we identified the potential sources of evidence for these indicators: existing quantitative data sets which covered both pre and post intervention periods; primary qualitative data; and reviews of the literature.

At this stage, other possible (distal) health effects of free bus travel, such as the impact on pollution, were eliminated from the model. Evaluations of other large scale transport interventions, such as the congestion charging scheme, suggested only modest changes result from transport mode shifts (83), and effects from the free bus scheme were unlikely to be measurable or distinguishable from those from other causes. To simplify the task of assessing transport mode shift, we also did not assess the impact of the scheme on underground (tube) and over-ground train journeys, given that these form a relatively small proportion of young people's travel in London (see Appendix 9, Table 9.7).

The main pathways selected as important to evaluate are summarised in Figure 2.1, which also shows the main data sources used to evaluate each pathway.

[g] http://www.lshtm.ac.uk/aboutus/introducing/volunteering/ysp/

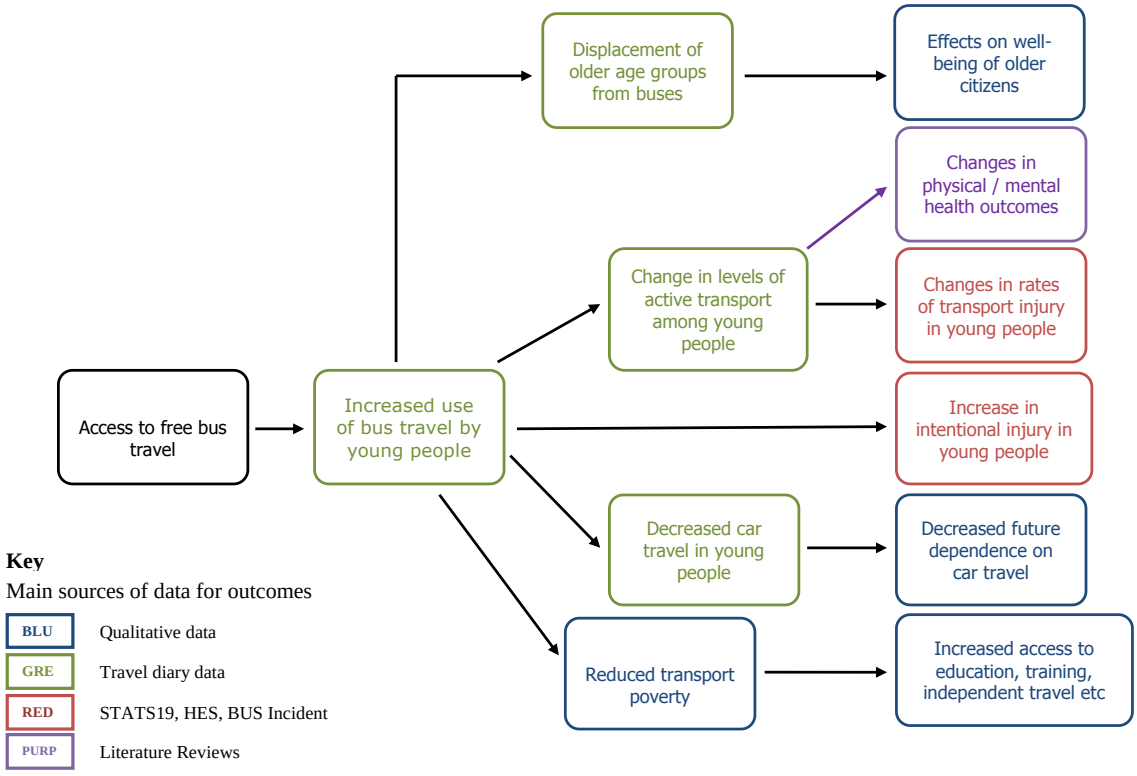


Figure 2.1 Hypothesised causal pathways

Finally, to address our fourth aim (to develop and apply methods for economic assessment) we identified sources of data for economic values for these health outcomes, largely from existing literature, and costs of the scheme, largely from Transport for London.

2.3 Aims, hypotheses and objectives

The model in Figure 2.1 suggested a number of hypotheses related to the first three aims. Specifically, that the free bus scheme would be associated with:

(i) an increase in bus use and overall 'independent' travel (the latter represented from available data by all non-car travel[h]), but a reduction in active travel (walking and cycling) and car use, among the target age-group;

(ii) a reduction in bus use and trips <1 km made by people aged 65+[i], especially during the hours when children usually travel from, school;

[h] Independent travel refers to travel young people do without guardians. With no direct measure of this, we use a proxy measure of all travel except car travel and, for those under 17 years, motorbike travel.

(iii) a reduction in road traffic injuries in the target age group; and

(iv) an increase in intentional injury rates in the target age group.

If these changes were associated with the free bus scheme, we also hypothesized that:

(v) changes will be more pronounced in the inner-London boroughs (with denser bus networks) than in outer-London boroughs;

(vi) changes will be more pronounced in boroughs with a known higher take-up of free bus travel;

(vii) changes in distance/frequency of bus travel, independent (non-car) travel, and active travel, and in injury incidence, are greater in households with low income;

(viii) reductions in car use will be greater in households with high income;

(ix) changes in distance/frequency of bus travel and active travel, and in injury incidence, will be the same across all ethnic groups.

For a number of hypothesised effects, such as decreased dependence on car travel, and reduced transport poverty, there were no available direct measures from secondary data sources. For these, we aimed to generate primary qualitative data to provide some insight into broader determinants of health and wellbeing. This qualitative data would also be used to provide evidence for the plausibility of causal claims made on the basis of quantitative analysis, through identifying potential mechanisms, or (for instance) generating data on young people's accounts of their travel which could be compared with data from secondary sources. The objectives for the qualitative component of the study were therefore to:

(i) Identify the ways in which young people and older citizens understand the role of bus travel and other transport modes in facilitating and constraining their wellbeing.

(ii) Identify, from analysis of interview data, plausible pathways by which policy, access to transport and behaviour interact to impact on wellbeing.

Good practice in evaluating natural experiments calls for an assessment of value for money considerations (79). We therefore also aimed to undertake an economic evaluation of the scheme which took into accounts evidence on the public health effects.

[i] We subsequently chose to include 60-64 years to increase our available sample size and thereby increase statistical power to detect differences between groups. The older age group was therefore 60+.

This study therefore aimed to evaluate the impact of free bus travel on these outcomes, using a mixed method design, and to assess the economic costs and benefits of the scheme. Our final aim was a methodological one of contributing to the development of methods to strengthen causal inference in non-randomised designs. In Chapter 10 we discuss the methods used to do this, in particular through revisiting and revising the causal model in Figure 2.1. (see Chapter 10).

2.4 Challenges in assessing the public health impacts of transport interventions

Calls for 'evidence' on the public health effects of policy interventions (43) generate challenges, given the difficulties in making causal claims about the relationships between policies and their intended and unintended outcomes. 'Real world' interventions are inevitably messy, often in themselves complex (with heterogeneous, often ill-defined, components) (84) and implemented in poorly-bounded target populations and settings, with unknown exposures for those intended to benefit. The systems in which they are implemented (cities, schools, countries) are simultaneously subject to a range of other 'interventions', both explicit policies and less easily delineated cultural and social changes. More challenging, methodologically, are the feedback loops – both predictable and less obvious – that might mean causal directions change over time or are modified by unknown other influences.

The intervention evaluated in this study is a typical example. The introduction of free bus travel for young people in London had wide ranging intended consequences, including addressing social inclusion, through increasing access to education and training, and reducing future car dependence among young Londoners. Given concern about obesity in young people, there has also been political interest in the unintended consequences of potentially reducing the amount of 'active' transport. This is a classic 'messy' intervention. Without evidence from randomised trials (hardly logistically possible), or even plausible control settings (there are no obvious comparators to London, given its size and unique transport infrastructure), designing a study with high internal validity: i.e. likely to make credible claims about the causal effect of the intervention on public health in London, is challenging. Also of concern is the question of external validity: how can we make credible claims on the more general causal question of whether public transport concessions are likely to benefit or harm the public health?

The 'complexity' of both the intervention and the setting are immediately apparent. Free bus travel was introduced in two stages in 2005 (for under 16 year olds) and 2006 (for under 18 year olds). Further, 'the intervention' is not neatly delineated in time, as it replaced a range of other concessionary fares for young people, and, as young people had to apply for a photocard (now called

a ‘Zip’ card), take up was gradual and unevenly distributed across the study area (Greater London). Given London’s unique transport infrastructure, there are no obvious external comparison populations of young people in other cities. Potential confounders in any before and after design range from the theoretically knowable (eg other interventions potentially influencing the behavioural outputs in which we are interested) to the more general and difficult to measure cultural shifts, such as rising concern about children’s independent mobility, or changes in the ways in which urban environments are conceptualised.

Challenges to making credible claims also arise from the relatively complex causal pathways that connect the intervention (providing free bus travel) and the outcomes (various health behaviours, determinants of health and health outcomes) summarised in Figure 2.1. Providing free bus travel might increase or decrease the amount of walking or cycling young people do, which in turn may positively or negatively influence health. More walking and cycling may have implications for obesity or future cardiovascular health (50, 85, 86), for instance, but also increase exposure to pedestrian or cycling injury risk (42). It is theoretically possible to quantify these different effects, and calculate (however imprecisely) likely aggregate benefits (77). However, the evidence base on links between active transport and health outcomes is currently weak (87) (See Appendix 8), and is particularly weak for young people, for whom putative health benefits may be too far in the future to measure. What is even more challenging is accounting for (possibly unknown) feedback loops which potentially change these effects within the system. As Shiell et al (88) note, the challenges of evaluating interventions in complex systems require new ways of thinking to deal with self-organising systems which may be sensitive to initial conditions and in which components are tightly inter-connected.

One potential example of a feedback loop is that the effect of walking on health may be modified by both known and unknown factors, such as the cultural meaning of walking. Bostock (58) for instance documents the negative impacts on health of walking for those who have no choice but to walk. Such factors might not only change the likely benefits of walking for different sectors of the population – these cultural meanings themselves may change as a result of the intervention, thus either modifying the effects of an intervention over time.

Notwithstanding these challenges, development of the evidence base for public health in this area is important, and ‘natural experiments’ despite their inherent weaknesses may offer the best way forward for evaluation (9, 80). Ogilvie et al (9) also suggest that single studies of transport interventions are unlikely, on their own, to provide credible evidence for causal claims, and we need to begin to build the evidence base to generate ‘good enough’ evidence for policy, and for potential

future integrative reviews. This study aimed to provide one such contribution, using a pragmatic, mixed method and iterative approach to addressing the challenges above.

2.5 The general approach: a mixed method study

This evaluation treated the introduction of the free bus scheme as a 'natural experiment' to which young people in London were exposed after 2005/6, and other populations (young people before 2005, adults in London, the population outside London) were not. This therefore permitted a number of comparisons, including some 'change on change' comparisons using before and after and comparative populations. We used a mix of secondary quantitative data, primary qualitative data and reviews of the literature to generate evidence for the links in the causal pathways hypothesised in Figure 2.1.

The design was pragmatic, in that our aim was not to assess whether receiving a free bus pass had a health benefit or loss for an individual, but rather to evaluate the broader impact on the public health of the scheme as a whole. The analysis is therefore conducted at a population level. Quantitative data, largely from routine data sets (including police records of road injuries, Hospital Episode Statistics and travel diaries), were used to assess links between the intervention and: bus use; mode change (active travel/car use); displacement of older passengers and injury. Drawing on best practice guidelines for natural experiments (79) we published a protocol for the quantitative component (89). This specified hypotheses and main sub group analyses (90) (See Appendix 7). To minimise the threats from confounding, we used change-on-change analyses with adult passengers as a comparator where appropriate. To strengthen the credibility of causal claims, we employed a range of sensitivity analyses to test the credibility of inferences and (where possible from available data sources) time series or 'dose-response' analyses.

To explore outcomes for which there are no routine data sources, and which are more difficult to quantify, we generated qualitative data from interviews with young people and older citizens. This data was also used to offset some of the limitations in using secondary data and to explore mechanisms for putative causal relationships. Our design was iterative in that these data were also drawn on throughout the study in order to refine the analyses of routine data sets, and to refine our understanding of the logic model.

On the final link in the causal chain, the impact of active transport changes on health, we had no direct measure. We therefore conducted a systematic literature review to assess the strength of evidence for the credibility of the link (87) (See Appendix 8).

The economic component aimed to represent the health consequences of the intervention and compare this with the cost of implementing the scheme. This utilised outputs from the quantitative analysis on 'change attributable to the intervention' to populate the benefits of the scheme, with data from Transport for London (TfL), Home Office and Department for Transport (DfT) to estimate costs for crime on the transport system, and additional data from Transport for London for costs of the scheme and operating costs. The economic evaluation involved a comparative analysis of alternative scenarios in terms of their costs and consequences.

The key alternative scenarios compared were:

- Do - Something – the bus network is free for 12-17 year olds
- Do - Nothing – the bus network is not free for 12-17 year olds

The methods for the quantitative and qualitative components are detailed below. Details of the specific methods used for the economic evaluation can be found in Chapter 9, and for the literature review in Appendix 8.

2.6 Methods for the quantitative components

London's transport system, comprising dense private and public transport networks and a focus for national road and railway networks, is unique in the UK. There are therefore no obvious comparator cities, or settings, which could be used to account for national trends in use of alternative transport modes, or to account for national trends in levels of safety. London has also experienced the introduction of other transport policies over the study period (e.g., London Congestion Charge was introduced in 2003), which may have altered choices of travel mode within the population.

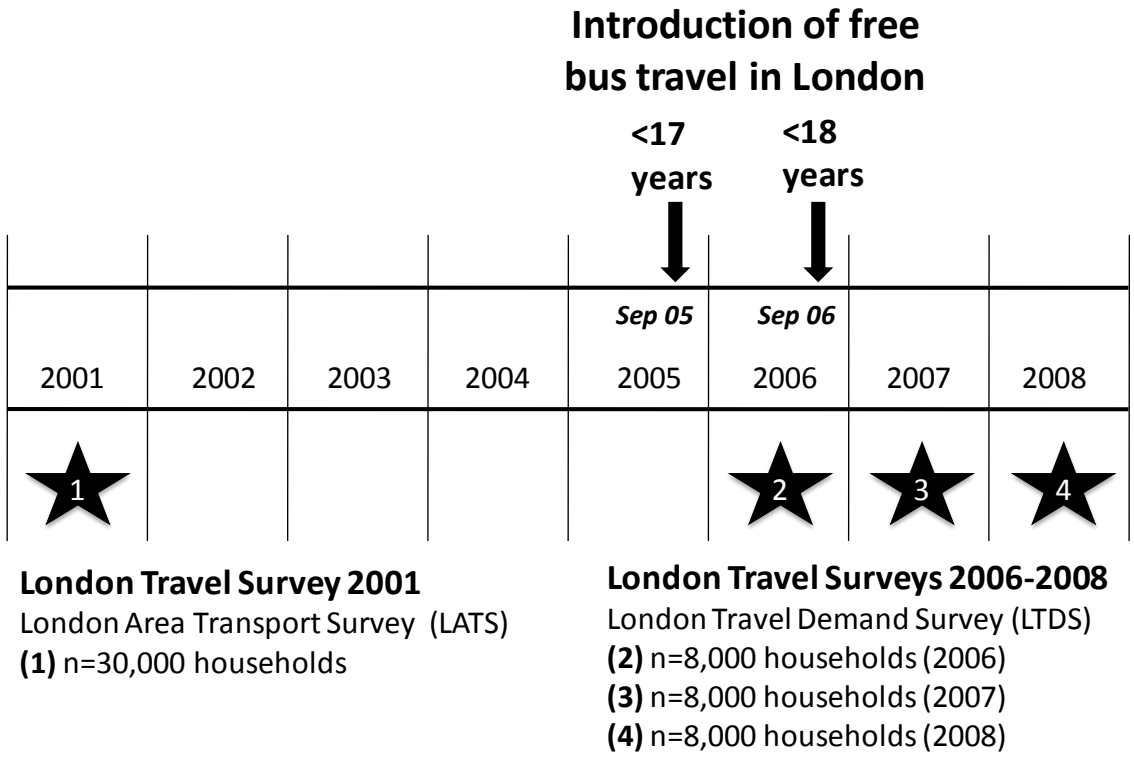
Design

We estimated health impacts of introducing free bus travel for young people by analysing routine data sets on travel and safety. To control for secular trends and the effects of other transport policies, we used a *change-on-change* analysis to estimate any changes in travel and safety in the target population of young people that were associated with the introduction of free bus travel. This change-on-change analysis compared pre-post intervention change in amount of travel (or safety) in the target age group, with the corresponding pre-post change in amount of travel (or safety) in an older age control group (adults aged 24-59 years). The age range of the control group was chosen to

exclude younger adults who may also have experienced free bus travel, and to exclude older adults who may also qualify for an older citizens' bus pass.

As a sensitivity analysis, we also examined pre-post intervention change in safety in the target age group in London, with the corresponding pre-post change in the target age group *outside* of London, using national data for the rest of England.

Figure 2.2 Timeline showing travel surveys and introduction of free bus travel in London



Data sources

The travel and safety data sets used were:

- London Area Transport Survey (LATS)
- London Travel Demand Survey (LTDS)
- STATS19 police traffic injury data
- Hospital Episode Statistics (HES)

Travel in London

The LATS and LTDS travel surveys include randomly sampled London households and are comparable as they use similar sampling designs and daily travel diaries. The sampling design is multi-stage, using postcode geography as primary sampling units and households selected at random at the second stage of sampling. LATS surveyed 30,000 London households in 2001 and LTDS has surveyed 8,000 London households each year since 2006.

Within each selected household, all people aged over 5 years record in a travel diary the start, interchange (e.g. from bus to train) and end of every trip made on a single day. Journey times are collected and journey distance is estimated using the start-point, interchange and end-point of each trip. Missing journey times and missing distance were estimated using the median times and distances for each age group and travel mode. Where reported times and distances were deemed implausible, these were treated as missing and replacement values were imputed (See Appendix 2). LATS sampled travel on weekdays during school term only and so for analysis we used LTDS relating to during school term only. Our quantitative results are therefore representative of term time weekday travel only.

The LATS and LTDS also record ethnicity, household income and census Lower Super Output Area (LSOA) of residence (areas that include approximately 1,500 residents). Ethnicity was coded using four categories: 'White', 'Black' (Black-Caribbean, Black-African, Black-Other), 'Asian' (Indian, Pakistani, Bangladeshi) and 'Other'. Household income was coded using three categories: <£15,000, £15,000 to £49,999 and >£50,000. Each respondent was assigned a deprivation score (using Index of Multiple Deprivation 2004) according to their LSOA of residence. We also assigned each respondent to Inner or Outer London based on LSOA of residence (See Appendix 2).

Travel diary outcome measures

In this report, we use three main outcome measures from the travel diary data: number of trips, distance travelled, and proportion of short distance trips by mode of travel. In the travel diary data, a trip is defined as a journey from an origin to a destination and can be comprised of more than one mode of travel. For instance, a journey to work may entail a 0.5km walk from home to a bus stop, a 2km bus ride, and a 1km walk from the bus stop to a place of business. When we examined the number of **trips by mode**, the mode assigned to each trip is the "main mode of travel", i.e. the mode that covers the most distance (the above example would be defined as a bus trip). Alternatively, when we examined **distance travelled** by mode, we summed the distances travelled in every interchange of every trip. The example above would contribute 2km to distances travelled by bus

and 1.5km to distance walked. When we examined proportion of **short distances trips**, we defined a short distance trip as less than 1km.

We estimated the distribution of trips by main mode and distance travelled by travel mode in each age group in the pre-intervention period using data from LATS 2001. We estimated the distribution of trips and distance travelled by travel mode in each age group in the post-intervention period using data from LTDS 2006–2008.

Safety: road traffic injuries

The STATS19 dataset records all vehicles and people injured in road traffic collisions on the public highway in the UK that are reported to the police. We obtained an extract of STATS19 data for England covering the period 2001 to 2009. In London the STATS19 data also record the ethnicity of casualties, which were coded as described for the travel survey data (above). The STATS19 data also include latitude and longitude co-ordinates of the road traffic collision locations. Using the geographical location of the traffic collisions we linked each to a LSOA. We then assigned each casualty to a deprivation score and to Inner or Outer London based on the LSOA of collision.

We estimated the incidence of road traffic injuries by travel mode in each age group in the pre-intervention period using STATS19 data for 2001 to 2004, and in the post-intervention period using STATS19 data for 2006 to 2009.

Safety: assaults requiring hospitalisation

Hospital Episode Statistics (HES) record episodes of care provided by NHS hospitals in England and for NHS patients treated elsewhere. We obtained an extract of HES data for England covering the period 2001 to 2009. All individuals were identified using the unique person identification code available in HES data, and we identified all London and non-London residents using LSOA code of residence in the HES extract. We identified all hospital admissions due to assaults (intentional causes of injury ICD-10 codes X85-Y09).

We planned to conduct a sensitivity analysis using severe injury admissions only (i.e. to assess whether differences in admissions policies and admission rates may have introduced bias). However, only a very small proportion of records for which ICD diagnosis code indicated severe injury(91).

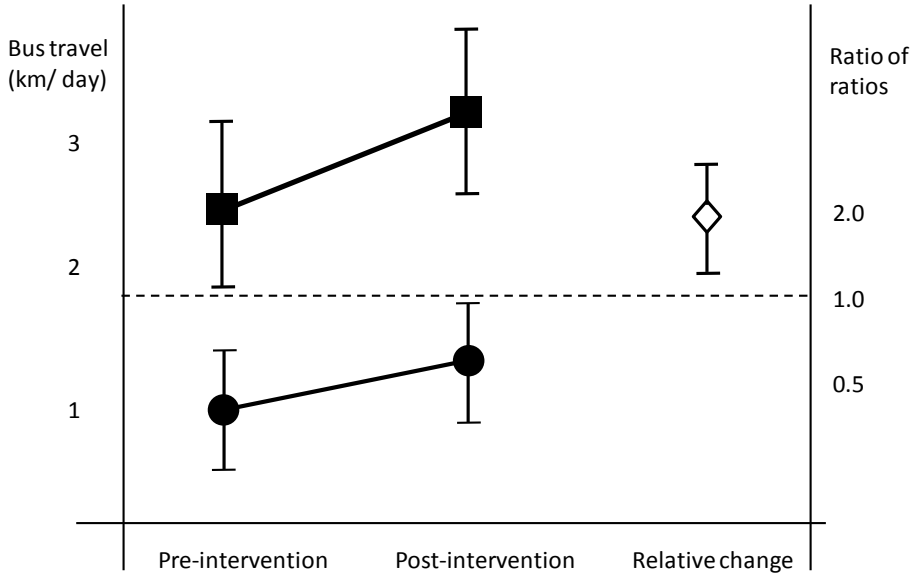
HES data include information on ethnicity which was coded as for travel survey data above. We assigned each person admitted to hospital to a deprivation score and to Inner or Outer London based on the LSOA of residence.

We estimated the incidence of assaults requiring hospitalisation in each age group in the pre- and post-intervention periods using HES data for the period 2001 to 2009.

Change-on-change analysis

To test each hypothesis (listed in section 2.3 above) we estimated the pre-intervention and post-intervention mean of each travel and safety indicator and calculated 95% confidence intervals using bootstrap methods implemented in Stata statistical software (StataCorp, Texas 77845 USA). These results are presented graphically for each indicator; Figure 2.3 below gives an example.

Figure 2.3 Example of graphical presentation of results showing change in travel and safety indicators.



Line joining solid squares shows change in target age group (12-17 years); line joining solid circles shows change in control age group (25-59 years). Diamond (right-hand side of figure) shows the change in the target age group relative to the change in the control age group. 95% confidence intervals are shown as vertical lines.

Sensitivity and subgroup analyses

As free bus travel was available to all young people in London, our primary analysis was of its impact on the whole population. However, take-up of the scheme was not universal and by 2010 the estimated 50% take-up among young people aged 5-15 years varied across London (TfL, personal

communication). [j] To consider whether changes to travel and safety associated with the introduction of free bus travel might be causally related, we conducted sensitivity analyses of effect according to amount of exposure to the intervention. Although the available data sets did not allow analysis of uptake of free bus travel at an individual level, or for our target age group, we used proxy indicators of uptake (aggregate take-up rates for young people aged 5-11 and bus network density by borough).

To assess whether the scheme had had differential effects across London's population, we conducted change-on-change analysis by area of London (Inner vs. Outer London); deprivation quintile (most deprived 20% of population versus least deprived 80%); level of household income (<£15k per year versus > £50k per year; for travel patterns only) and ethnicity ('White', 'Black', 'Asian', other).

Table 2.1 Sample sizes available from each data source in the pre- and post-intervention periods

Data source			Age group		
	Intervention period	Time period	12 to17 years	25 to 59 years	60+ years
London Area Transport Survey	Pre	2001	4,206	31,169	10,671
London Travel Demand Survey	Post	2006 to 2008	2,024	14,085	5,033
STATS19	Pre	2001 to 2004	11,221	89,661	13,337
	Post	2006 to 2009	6,657	65,542	9,283
Hospital Episode Statistics	Pre	2001 to 2004	2,321	11,829	905
	Post	2006 to 2009	3,322	14,641	959

2.7 Methods for the qualitative components

To generate data for exploring the pathways linking the intervention to social inclusion, future car dependence and the effects on the wellbeing of older citizens we conducted a qualitative study of

[j] Figures specific to those aged 12 and over are unavailable. As a photocard is not needed to access free travel for those under 11 unless they are travelling without an adult, or appear older than 10, few young people aged 5-11 would apply for a Zip card. The 50% take up therefore does not indicate low take up in our target population, but the variability across boroughs does suggest that take up is not universal.

young people aged 12-18[k], and older citizens aged 60 and over in London, based primarily on individual and small group interviews. These data were also used to explore the mechanisms for relationships measured using quantitative methods and to further our understanding of the intervention in context.

Sampling

The aims of the sampling strategy for the qualitative component of the study were to recruit a *maximum variation* sample in terms of those variables that we predicted on the basis of existing literature would shape experiences and accounts of transport behaviour. The primary ones were: transport availability, gender, age, ethnicity, disability and area deprivation. To ensure we included a range of participants, we first choose four contrasting boroughs of London to provide coverage of 'bus rich' and 'bus poor' areas in inner and outer London (which have very different typical transport networks and mode choices) with differing deprivation profiles (see Appendix 3 for detail). The boroughs selected are shown in Table 2.3.

	Higher levels of socio-economic deprivation	**Lower levels of socio-economic deprivation**
'Bus rich' – higher levels of bus use	Islington	Havering
'Bus poor' – lower levels of bus use	Hammersmith and Fulham	Sutton

Key
Inner London Borough
Outer London Borough

Table 2.3 Four boroughs selected for main qualitative fieldwork

Within each borough, a mix of recruitment methods was used to invite young people aged 18 and under, and older citizens aged 60 and over to take part in individual, pair or small group interviews. Young people were recruited through: secondary schools; an academy; local community youth clubs; an 'alternative provisions' facility (an arts-based education setting for young people who struggled in conventional schools/colleges); a 'pupil referral unit' (an education setting for young people

[k] A few participants with disabilities were over 18 at the time of interview

excluded from conventional schools/colleges); a local authority 'youth parliament'; and snowballing from personal contacts.

We recruited older participants through a local community centre; a local (borough-level) branch of Age Concern (a national charity for older people); a local amenity group; a local authority event for older residents; 'park bench' approaches and snowballing from personal contacts.

Theoretical sampling was also used where ongoing analysis suggested additional recruitment in order to test emerging analytical ideas. This included purposive sampling of passengers with disabilities, recruited with the help of personal contacts, and including those not living within these boroughs, and those aged over 17 in order to explore attitudes to driving among those with some experience. A final group of young participants came from young people engaged in LSHTM's Young Scientists programme (see Appendix 4). These were young people from a number of London boroughs engaged in a two week programme at LSHTM.

Within each setting, we purposively sampled young people and older people in order to include as broad a range as possible of transport availability, area deprivation levels, household incomes and age (within our target ages of 12-18 and over 60) in order to include those more and less likely to be bus users. This entailed working with contacts including schools and community organisations to help with recruitment, and (to identify older people less likely to be involved in organisations) some personal approaches in public places (e.g. park benches).

Additionally, the research team carried out informal observations on the bus network at various times of day to provide background understanding of who was using the buses, what they did on the buses, and how they interacted. Notes from these observations were kept in fieldwork diaries and used to inform interview topic guides but are not drawn on as a formal data set in this report.

Sampling continued to saturation: that is, when analysis of new data added little to our understanding of our research questions. Based on rules of thumb for estimating numbers of participant needed within homogenous groups (92, 93) we estimated a sample size of around 50 individual and 8 group interviews would generate enough variability by gender, ethnicity, age range and borough setting to do this for young people, and around 25 older citizens. Our final sample included 119 young people and 47 older citizens (see Table 2.4).

Table 2.4 Young people and older citizen participants in interviews and focus groups, by setting

	Number of interviews	Number of	Number of	Number of focus

	(individual and pairs)	interview participants	focus groups	group participants
Young people				
Islington	7	10	2	10
Havering	9	10	3	18
Sutton	5	6	4	19
Hammersmith & Fulham	9	11	2	12
Young scientists	6	9	1	4
Other	4	7	1	3
TOTAL	40	53	13	66
Older citizens				
Islington	7	10	1	6
Havering	2	2	0	0
Sutton	5	7	1	6
Hammersmith & Fulham	7	10	1	6
TOTAL	21	29	3	18

Data generation

For the interview data, we used a mix of individual, pair and group interviews. Different modes of interviewing can yield different kinds of data, with groups enabling an interactive discussion, increased potential for story-telling (in which we were particularly interested) but also increased potential for more confident and talkative respondents to take a lead, while individual interviews may be more likely to uncover sensitive data on, for instance, anxieties about particular modes of transport, or financial problems. A topic guide was designed to encourage talk about experience of using buses and other transport modes, preferences for transport modes, encounters with other passengers, impact on wellbeing of transport use, and views the schemes. Topic guides were iteratively developed as the project progressed, and in later stages of fieldwork focused more on particular areas (such as barriers faced by people with disabilities). Example topic guides are included for information in Appendix 6. To ensure we were recruiting a range of participants, we also asked each to complete a brief form with postcode, age(range), ethnicity and (for older citizens) last occupation. Participants were given a £5 store voucher to thank them for their time.

Data analysis

The key challenge was that our qualitative data were entirely post-intervention, so we could not simply compare participants' views before and after. To meet the aims of the project in providing some insights into the pathways that link the intervention to the determinants of health, our aim in analysis was to uncover *tacit* knowledge that would inform transport mode and other decisions, as well as to generate 'views' on travel. We also explored the data for evidence of mechanisms that might explain relationships found in the quantitative component. Our analysis therefore combined both inductive and more deductive approaches. We drew on elements of the constant comparative method (94), in that we used an inductive approach in 'open coding' early data to generate a grounded understanding of conceptual codes, which were refined as the analysis progressed. Analysis focused on those that were most closely related to our initial causal pathway (see Appendix 5 for an example). We also drew more deductively on emerging findings from the quantitative components (which generated specific questions to ask of the qualitative data set) and on existing theory and empirical literature, which provided a context for interpreting our data, and a number of more conceptual ideas against which to check our data. On children's mobility, for instance, studies have referred to the constraints acting on young people's travel in urban areas and the complex strategies young people adopt to maximise their own safety whilst travelling independently and allay parental fears about their independent travel (60, 95). A more deductive analysis organised by existing concepts from the literature and emerging findings from our quantitative component enabled us to follow up particular themes by descriptive topic. One example is the finding that cycling rates were declining relative to adult rates An analysis by the descriptive code 'cycling' enabled us to look at where, how and in what contexts young people discussed cycling, and add explicit questions to the later topic guide.

Data extracts were then collated for each descriptive and analytical code for analysis. This analysis entailed identifying the range, dimensions and context of accounts: for instance on whether they were evident only for those in some areas of London, or for some groups of young people, or how stories were responded to in group settings. Close analysis of deviant cases provided one way to check developing interpretations. For instance, in the case of the role of 'free' travel in young people's travel behaviour, deliberately examining the 'deviant' cases of those young people who had had their entitlement removed enabled us to identify what was taken for granted by other young people, and therefore not explicitly addressed in their accounts. Early analysis informed the topic guide, which was used for more focused enquiries in later parts of the fieldwork.

Our sample was not randomly drawn from the population, and we did not ask the same questions of all participants. We therefore do not report 'numbers of respondents' in the qualitative sections of

this report, as this would be misleading. When reporting accounts from participants, we note where necessary whether these were typical, unusual or more common in some groups.

Given the iterative and dual nature of our analysis, 'double coding' of interview transcripts by the research team would have been inappropriate, as assigning data extracts to thematic codes depended on the purpose for which the assignment was being used. Instead, the team met regularly to discuss analysis, and validation happened at the point of writing up, with discussion around interpretative claims and checking for disconfirming cases.

To provide context, we have tagged the interview extracts quoted in this report with a note of gender (M or F) for participant, [I] to indicate interviewer, and a note of where the participant came from (Havering [Hav],Islington [Isl], Sutton [Sut] or Hammersmith & Fulham [H&F], the Young Scientist scheme [YS] or Other [O]) and the age or (for groups and older citizens) the age range. To preserve confidentiality, we have not included other identifiers, such as ethnicity or previous occupation (for older citizens). We have also changed all identifying personal names and small area locations.

Table 2.5 shows the breakdown by ethnicity and age of young people included, and Table 2.6 the breakdown of ethnicity, description of last occupation and age of older citizens

Table 2.5 Young person interview participants N=119

Gender	Female	63
	Male	56
Age Range	Under 13	27
	14-15	61
	16-17	21
	>=18	10
Ethnicity*	White British	52
	White Other	8
	Black/Black British	22
	Asian/Asian British	15
	Mixed	18
	Other	3
	Not Answered	1

Table 2.6 Older citizen interview participants N=47

Gender	Female	33
	Male	14
Age Range	<=64	3
	65-69	6
	70-74	14
	75-79	6
	80-84	11
	85-89	4
	>=90	2
Ethnicity*	White British	32
	White Other	5
	Black/Black British	4
	Asian/Asian British	5
	Not Answered	1
Last Job*	Unskilled manual (eg cleaner, factory worker)	9
	Skilled/Semi-Skilled manual (eg machinist, driver)	4
	Clerical or shop work (eg book-keeper, cashier)	14
	Professional (eg teacher, nurse)	8
	Managerial/business (eg buyer, Executive)	9
	Other (eg homemaker, unspecified engineer)	4

*These are indicative groupings based on self-report.

2.8 Ethical issues

The study was approved by LSHTM's Ethics Committee (Application no. 5635). The quantitative component relied on secondary data analysis and did not raise particular ethical issues. For the qualitative interview component, the main ethical considerations were those of ensuring adequate informed consent and maintaining confidentiality. As our young participants were all of secondary school age, we considered they were competent to make an informed decision about participation without parental consent. Our consent forms included a space for parental permission in case gatekeepers (such as schools) required this: none did. Our consent procedures were discussed with young people in the pilot phase, who commented on our information sheet and whether they considered parental permission appropriate. Of perhaps more significance is the potential for studies such as this to exclude particular groups from the population. Given that our primary recruitment strategy was to work with community groups to identify participants to invite, we were mindful of the possibility of excluding those who may be most marginal in other ways (such as young

people excluded from school, or relatively isolated older citizens). We therefore sought deliberately to include participants through alternative approaches such as pupil referral units and personal contacts where appropriate. Observations conducted on the buses were of public behaviour and were used to inform our topic guides and interpretations only: fieldwork notes did not identify individuals, and are not quoted in this report.

Chapter 3 What effect has the scheme had on use of bus travel by young people in London?

3.1 Introduction

Bus fare subsidies are used as a policy instrument to achieve a number of goals, including those of equity (through addressing transport exclusion), reducing traffic congestion and sustainability (through encouraging mode shift from private car use) (23). Achieving these assumes 'demand elasticity': that a reduction in fares will increase the use of services. Although it is reasonable to assume that this does hold true, there is considerable debate around how to calculate demand elasticity, given that this depends very much on context: the availability and efficiency of bus services; the attractiveness of alternatives; local congestion; population ability to pay. There is evidence that increased demand from fare reductions take many years to accrue, for a number of reasons, including the difficulties for most people of making short term changes in travel behaviour, and the cohort effects of changing habits as children, for instance, become habituated as 'bus users' (96).

This project evaluated the effects of an intervention which reduced fares to zero. We therefore hypothesised that the first step in the causal chain would be an increase in bus use by young people attributable to the intervention. This could not be assumed, given that fares for young people were discounted before the intervention, and bus use in London was rising for the wider population (see Appendix 1) in the context of historical innovations such as integrated travelcards which facilitate ancillary bus use, and more recent policies such as the congestion charge for private cars. This Chapter first reports evidence from the analysis of travel diary data to identify changes in bus use that could plausibly be attributed to the intervention. We then draw on the qualitative data to explore the role of 'free bus travel' specifically in young people's travel choices in order to assess the credibility of this attribution and to provide some context for the kinds of journeys made by bus.

3.2 Quantitative evidence on impact on bus use

As described in the previous chapter we used a change-on-change analysis to estimate any changes in travel in the target population of young people that were associated with the introduction of free bus travel, rather than general changes in bus provision. Here we compare the pre-post change in weekday term time bus travel in young people with the corresponding pre-post change in bus travel

in adults aged 25-59 years. The changes to bus trips, distance and percentage of short distance trips made by bus are shown graphically below in Figure 3.1 (and in Appendix 9 Table A9.1).

Trips by bus as a main mode

The introduction of free bus travel was associated with a 35% (95% CI 25% to 47%) increase in the average daily number of trips by bus as a main mode made by young people. There was a similar increase of about one third (36%; 25% to 46%) in the average number of bus trips made by the control age group, 25-59 years, and so the relative change was the same (relative change 1.00; 0.89 to 1.10).

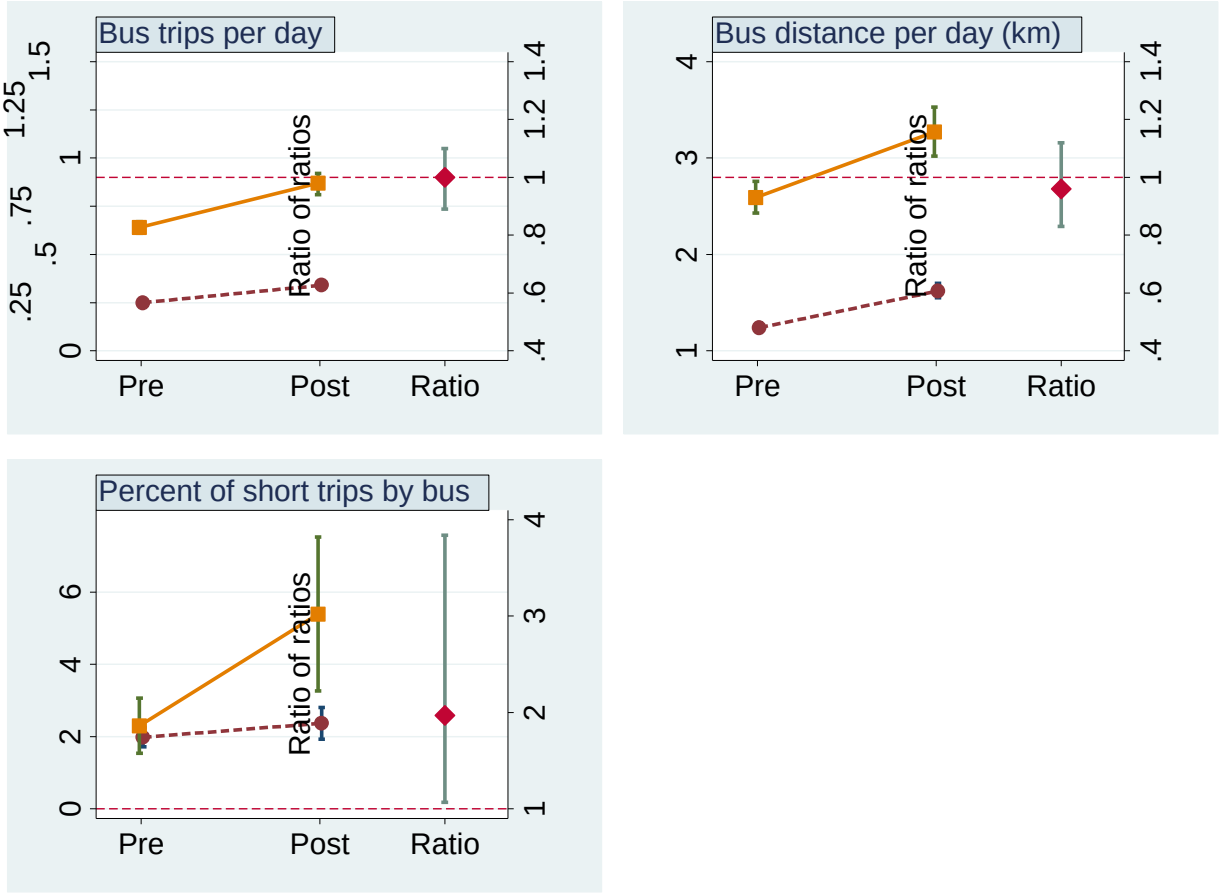
Distance travelled by bus

The introduction of free bus travel was associated with an increase in the average distance travelled by bus by young people, from around 2.6 km per day to around 3.3 km per day (a 26% increase; 95% CI 13% to 41%). The corresponding increase in the average distance travelled by bus in the control age group was from around 1.2 km per day, to around 1.6 km per day (a 31% increase; 95% CI 19% to 42%). However, the relative change was the same (relative change 0.96; 0.83 to 1.12).

Short distance trips by bus as a main mode

The introduction of free bus travel was associated with an increase in the proportion of short (i.e. under 1 km) trips made by bus by young people from around 2% of all trips to around 5% of all trips. The proportion of short trips made by bus by the control age group remained at around 2% pre- and post-intervention. Relative to the control age group there was therefore a 97% *increase* in the proportion of short trips made by bus by young people (relative change 1.97; 95% CI 1.07 to 3.84).

Figure 3.1 Changes in bus use, pre-introduction to post-introduction of free bus travel



Line joining solid squares shows change in target age group (12-17 years); line joining solid circles shows change in control age group (25-59 years). Diamond (right-hand side of figure) shows the change in the target age group relative to the change in the control age group. 95% confidence intervals are shown as vertical lines. Horizontal dotted line indicates a ratio of 1 (i.e. no relative change).

Bus travel by subgroups

Bus trips and distances travelled by bus increased at a similar rate among children and adults across levels of deprivation. We found no evidence for any differences in the relative change of proportion of short trips made by bus trips by level of deprivation (see Appendix 9 Table A9.5).

3.3 Free travel enables a range of journeys

The travel diary data includes only those trips made during term time weekdays. Young people from all ages and parts of London reported using buses for a range of journeys, including getting to school, visiting friends, getting to local amenities and for more extensive days out, across the week.

In all boroughs, young people emphasised the ease of getting around, and indeed the range of sites that might be visited by bus. The fact that travel was free was reported as a key reason that buses were used for a large number of discretionary trips, including those at weekends, as well as what could be considered essential journeys, such as those to school:

> M: I take the bus every day... [for] going to school, going to dancing, going to see my friends, maybe going to church... because it's free ... I can go to different places, so anywhere I want to go (Hav, 15)

> F: Mostly every Saturday we'll probably just jump on a bus because we have a free [pass] and go anywhere, and get another bus from there, and another one. And we just travel, we don't know where we're going ... [once] we ended up near Hammersmith, and near the West End (Isl, 16)

Indeed, free travel was reported to have opened up the range of places that young people could go in London, as well as the frequency with which they chose to visit these places. It made possible wide-ranging exploratory trips to the city centre and neighbourhoods at a distance, and it enabled young people to maintain (geographically) wide friendship groups.

3.4 Free travel enables the bus to be a site for socialising

Bus travel was frequently an end in itself: an activity undertaken to enjoy the journey rather than to get somewhere. That bus travel was free facilitated the treatment of London buses as a *site* for socialising by young people, with buses becoming key public spaces in the city for young people to convene and socialise both as part of their school journeys but also in the evenings, during school holidays and at weekends. This is not to say that prior to the intervention buses had not been treated by young Londoners as a space in which to socialise with their peers. Rather, by rendering bus use free for young people on an unlimited basis in London, the intervention dramatically shifted the degree to which buses could be used in this way. The bus network became a part of the freely accessible geography of London for young people, not only as a way of getting to and from destinations but also a vital set of destinations in itself. By contrast, if fares were reinstated one participant suggested that she didn't "think that anyone would really go out as much to be sociable" (Sut, 15-16). The bus was therefore not just a vehicle for a peer outing, but a site in itself which facilitated social interaction, primarily with peers:

> F: You see friends, when you go on the bus you can see friends on there sometimes.

All: Yeah, yeah, yeah.
F: You can talk about people as well ... reasonable amount when you're on the bus.
F: Yeah, exactly, when you get on the bus you can just see friends. If you're on your own and then you see someone, you just see them get on the bus ... (Sut, 15-16)

M: ... It's one of the main things you do on the bus, if you go out with someone you sit down and talk about things (Sut, 15-18)

Given that interacting was an important benefit of travel time, the bus was only preferable if it maximised these opportunities. Thus, when a more private conversation was wanted, or if friends were not able to take the bus, walking might be a better choice:

M: Sometimes I prefer walking because sometimes, when I didn't have my Oyster card and a friend used to take the bus but then he would stop and get off and we'd walk and that would give us more time to say what we want, because you know on the bus you can't really talk much. (Hav, 14)

For the majority of young people, travel and sociability with peers was emphasised in accounts, particularly those in group interviews. However, many also talked of ways in which the scheme had fostered travel with family members, and enabled family outings:

F: Before when I didn't have my Zip card I didn't really go out much. I didn't because I had to basically, I had to pay and then I managed to get my Zip card. I could go different places to socialise with friends and especially travelling around London because I actually quite like exploring it here with my mum…it's easier for [mum and me] because my dad doesn't have to drop us off all the time. (Hav, 15)

3.5 Short journeys: using the bus 'because it's there, and because it's free'

For short journeys, when there is no cost to the user, and buses are relatively available and accessible, there are no disincentives to using the bus, and many young people talked about using the bus to go "short distances, literally three stops" (Sut, 14-18). Indeed, the distances travelled by bus in preference to walking could be extremely short:

M: My dad takes me a couple of metres down the road, it's only about 200m down the road. And then from then I go and get the bus to school. And then there's only a few metres from

> where I get off the bus to go to school. [...] I'm on the bus for roughly about less than a minute. (Hav, 14)

In young people's accounts, this preference for bus travel over even short distances was clearly the default choice: it was, implicitly, 'just what you did'. Indeed this assumption that the bus would be taken as the obvious choice was recognised by many young people, who noted that on reflection, they would 'jump on a bus' even when this was an inefficient travel strategy in terms of getting to your destination quickly:

> M: Sometimes, because the 18 that goes past the [local community centre], that comes into Sutton, my mate and I stood there waiting for one, this is going to be completely strange to you, but by the time we got on it, we got there and thought, you know, it would have been much quicker if we just walked there. (Sut, 14-18).

The Zip intervention, which removed any economic disincentive to using the bus, was also acknowledged as the key reason for making 'jumping on' for a couple of stops the default option:

> F: I think that the fact that knowing the bus is free helps me want to get on the bus, so I'm saying I might jump on the bus, if I had to pay I would not get on the bus. (Isl, 16)

> M: Yeah, if it was a lot, if the price was higher I definitely would not be taking buses as much as I do. (Hav, 14)

3.6 Maximising sociability: the importance of free travel for all

If free bus travel removed disincentives to 'just jumping on', it did not explain why this was preferable even for journeys that might be more efficiently made by other modes that were also free, such as walking. One important contributor to making bus travel the default choice for most journeys, rather than the choice for certain journeys, was the ways in which the scheme maximised possibilities for sociability.

In young people's accounts of travelling around London, it was clear that socialising with peers was a pervasive aspect of, and influence on, young people's mobility, affecting decisions about whether, when, where and how to travel, ranging from the routes they chose to where they sat in the bus. Travel with friends was valued as: being a defence against boredom (a pervasive theme in many accounts); more fun; and as reducing the chances of getting lost, or as at least providing someone else to be lost with. Further, travelling was a site for demonstrating important aspects of friendship,

such as loyalty. Young people described situations in which travel decisions were made not because they resulted in a more efficient or enjoyable journey, but because to have done otherwise might be construed as a breach of friendship, as illustrated by this story:

> F: I got on the bus and everyone else was just left there. And then he [the driver] just, he, I was like can you open the door because you're not letting my friends on? I was going to come off. Drove off, I had to walk all the way [back to join my friends] and that's actually quite a long walk (Sut, 14-16).

The participants in this focus group then went on to highlight the possible consequences of failing to show this form of loyalty, with one participant recalling "we've had arguments over buses" and another describing having got "really angry" when she was left by herself during a bus trip. As she concluded "Your friends just like *leave you* on the bus. I said, like, I'll just sit by myself, thanks a lot. It's kind of loyalty to get on the bus with your friends." (Sut, 14-16, emphasis in original). Similarly in a different interview, one boy explained "[If a friend loses their Zip card and isn't allowed on the bus then] you'd have to get off or something. [...] If you leave them, if you, if they can't go on the bus or, they see it as a kind of betrayal." (Hav, 15). Travel choices were therefore not simply passive reflections of existing relationships. Rather they could also be *constitutive* of relationships by providing an active opportunity to demonstrate friendship (show 'loyalty') or fail to do so ('betray' a friend).

Given the importance of sociability and loyalty within friendship groups, the fact that everyone is entitled to free bus travel and could therefore all travel together is a key factor in choosing buses, at least for some journeys. Several participants, from all age groups, were explicit in giving this as a rationale for taking buses rather than other modes (such as the underground or train, which has to be paid for), so as not to exclude those who could not pay for transport:

> F1: [We sometimes go by bus] because it's free as well so if people run out of money on their Oyster then we'll all go with them because we don't want anyone to go by themselves.
> F2: [...] I usually travel everywhere by tube [London underground] if we can. But like you said, if some of us have got no money on our Oyster then we'll just take the bus. (YS, 17)

> M: [How I go] depends if I have friends with me, cos they don't like to go on the train, so if I have friends with me then go on the bus…cos they don't have to pay. (YS, 16)

That the intervention itself, rather than the general increase in bus transport, facilitated 'travelling together' was also evident in (rare) accounts of limitations in mobility experienced by groups in which one member didn't have free travel:

> M: One of my friends he'll actually, that's the only bus he can take [a particular bus route that was easy to board without paying] because he never applied for an Oyster. And I keep on moaning at him for it. But then so if we ever go anywhere it has to be on [that bus]. (Isl, 15)

The removal of financial barriers for all also increased young Londoners' options within the context of a *particular* bus journey. For instance, when it came to demonstrating friendship, free bus travel removed any economic disincentive to getting off a bus that your friends could not board. A few young people explicitly stated that this had an effect on their likelihood of showing this form of 'loyalty': "[We get off the bus if] a couple of people get on and then some of them are left. If we didn't, if we had to pay, I would stay on the bus. I would stay on the bus because I'm not paying no more money" (Hav, 14-16). More often, this absence of a disincentive was implicit in the way in which young people automatically accommodated friends without thinking, or else focussed on non-economic factors when relating stories of the costs imposed by accommodating friends (e.g. waiting for a long time, waiting in bad weather, 'having to walk' to rejoin friends).

Bus travel, therefore, had become the default mode because it was in part a 'lowest common denominator' activity for groups, not only for getting to destinations, but also an activity in itself that had no direct financial costs, and to which all members of a peer group therefore typically had financial access. Most obviously these considerations applied to 'bus hopping' journeys, which were undertaken primarily in order to spend time with friends and only incidentally to 'end up somewhere'. The same was generally true of recreational group journeys to destinations that were predetermined but not 'necessary'. Bus hopping and discretionary journeys also had in common the fact that the free nature of bus travel was often a key consideration: as one girl said "You wouldn't be willing to pay just to get on a bus for no reason at all" (Hav, 17). A final common element across these journey types was their frequent spontaneity, such that several participants described always taking their Zip card 'just in case' whenever going out to meet friends.

3.7 Conclusion

The increase in the number of bus trips and kilometres travelled by young people after the introduction of free travel mirrors that of adults in London, suggesting that other factors (such as improvements in the network) may be responsible for the increase in the number of journeys made by bus as main mode during term time weekdays. However, the qualitative data suggested that the intervention had a role in making bus travel the 'default' mode of transport for young people in London, particularly for short journeys. Offering 'free' fares was an important element of this, and for some young people, cost was explicitly a factor, at least for discretionary journeys. For most, free fares facilitated a rise in short journeys, as there was no financial disincentive to forgo a journey. Additionally, the bus was an important site for socialising in itself, as well as a mode of transport for instrumental reasons. Given the importance of sociability to young people's mobility, the universality of the benefit was important in making bus travel available to all within a peer group.

In summary, this suggests that first, the intervention is best conceptualised as 'Universal free bus travel', as it was this 'universal' element that determined some of the effects reported, and that second, there is weak evidence that this intervention had an important role in generating discretionary bus journeys that might not have been taken otherwise.

Chapter 4 What impact has the scheme had on active travel?

4.1 Introduction

That increased levels of physical activity have benefits for physical and mental health outcomes has long been recognised. In the 1950s, Jerry Morris identified health benefits from bus conductors' relatively more active jobs, compared with those of bus drivers (97). Given the challenges of increasing physical activity from sports or leisure participation (98, 99), policy interest has focused on encouraging 'active travel' as one way to increase levels of physical activity in the population (1, 43, 86), with evidence that obesity rates are increasing in countries and settings in which 'active travel' (walking and cycling) is declining (100, 101). It is therefore plausible to hypothesise that interventions which increase the amount of active travel within a population are likely to have a positive impact on health, and those which reduce it may have a negative effect. Appendix 8 summarises the evidence from a systematic review of the evidence that active travel confers health benefits. Although there is little prospective research addressing this question, and no studies to date that show an association between active travel interventions and obesity, there is some accumulating evidence that active travel can have benefits for other health outcomes.
Chapter 3 identified an increase in proportion of short journeys by bus by young people, which could plausibly be attributed to the intervention, in the context of general increases in bus use made by the population of London, and a suggestion from qualitative evidence that young people's discretionary journeys by bus had increased as a result of the intervention. This Chapter addresses whether this increase is at the expense of 'active travel', that is travel by modes such as walking and cycling. We first report on changes in young people's active modes compared with adults, as reported in travel diary data. To contextualise these changes, and assess how far the intervention may explain them, we then turn to the qualitative data.

4.2 Quantitative evidence on impact on walking and cycling

Here we compare the pre-post change in walking and cycling in young people with the corresponding pre-post change in walking and cycling by adults aged 25-59 years. Again, the changes to walking and cycling trips, distance and percentage of short trips are shown graphically below in Figures 4.1 and 4.2 (and in Appendix 9 Table A9.1).

Trips by walking as a main mode

The introduction of free bus travel was associated with a 16% (95% CI 6% to 23%) *decline* in the average number of trips by walking as a main mode made by young people each day. In contrast, there was a 10% *increase* (95% CI 1% to 20%) in the average number of walking trips made by the control age group. Overall, therefore, free bus travel was associated with a relative decline in number of walking trips made by young people (relative change 0.76; 95% CI 0.70 to 0.85).

Distance travelled by walking

The average distances walked each day by young people remained at around 1.4 km pre- and post-introduction of free bus travel. The average distances walked by the control age group each day remained at around 1.3 km. There was no evidence that free bus travel impacted on average total distances walked (relative change 0.99; 0.92 to 1.07).

Short distance trips by walking as a main mode

Similarly, there was no change in the proportion of short (<1 km) trips made by walking; this remained at around 80% of all trips made. There was an increase in the proportion of short trips that was made by walking in the control age group, from 70% to 76%. This meant that, relative to the control group, free bus travel was associated with a decline in the proportion of short trips walked by young people (relative change 0.91; 95% CI 0.87 to 0.97).

Figure 4.1 Changes in walking, pre-introduction to post-introduction of free bus travel

Line joining solid squares shows change in target age group (12-17 years); line joining solid circles shows change in control age group (25-59 years). Diamond (right-hand side of figure) shows the change in the target age group relative to the change in the control age group. 95% confidence intervals are shown as vertical lines. Horizontal dotted line indicates a ratio of 1 (i.e. no relative change).

Trips by cycling as a main mode

The number of trips made by cycling as a main mode is extremely low in the population in London, at around 2% of all trips made. There was no evidence that free bus travel was associated with any change in the number of cycling trips made by young people (from 0.06 to 0.04 trips per day; a 39% decline with a 95% CI from a 53% decline to a 10% increase). However, as there was a significant increase in cycling trips made by the control age group (from 0.05 to 0.07 trips per day; a 34% increase with a 95% CI from 1% to 20% increase), free bus travel was associated with a relative decline in cycling trips by young people (relative change 0.53; 95% CI 0.35 to 0.87).

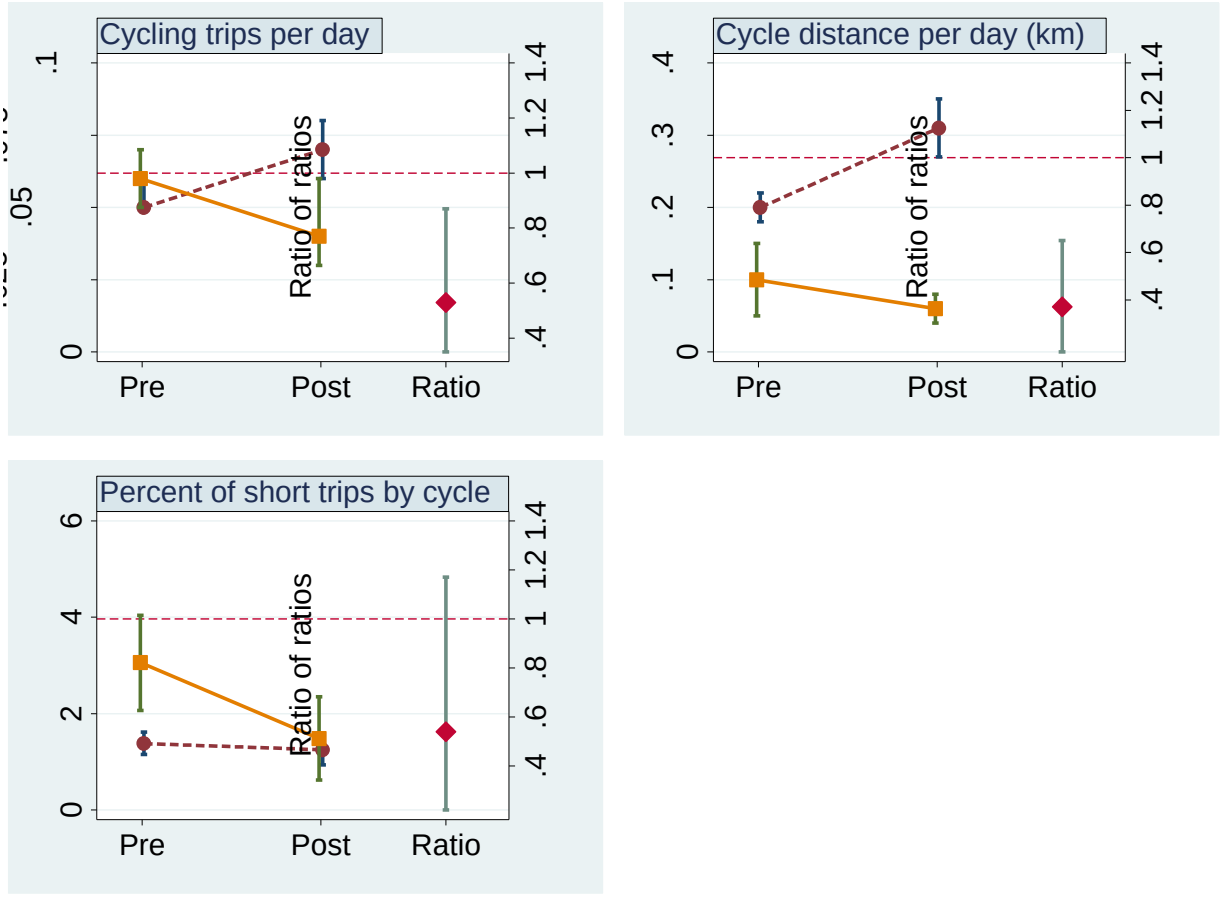
Distance travelled by cycling

The average distances cycled each day by young people declined from 0.1 km to 0.06 km post-introduction of free bus travel. The average distances cycled by the control age group each day increased from 0.2 km to 0.3 km. Free bus travel was therefore associated with an overall decline in total distance cycled by young people (relative change 0.37; 95% CI 0.18 to 0.65).

Short distance trips by cycling as a main mode

Similarly, there was a decline in the proportion of short (<1 km) trips made by cycling by young people, from 3% to 1% of all trips made. The proportion of short trips made by cycling by the control age group remained constant at 1% of all trips made. However, this was not statistical evidence that free bus travel had a greater impact on the proportion of short trips made by cycling in young people (relative change 0.54; 95% CI 0.22 to 1.17).

Figure 4.2 Changes in cycling, pre-introduction to post-introduction of free bus travel



Line joining solid squares shows change in target age group (12-17 years); line joining solid circles shows change in control age group (25-59 years). Diamond (right-hand side of figure) shows the change in the target

age group relative to the change in the control age group. 95% confidence intervals are shown as vertical lines. Horizontal dotted line indicates a ratio of 1 (i.e. no relative change).

Walking and cycling by subgroups

There was some evidence that free bus travel coincided with a greater relative change in the distances walked and/or cycled by young people in inner London (0.80; 0.66 to 0.97) but not in outer London (0.97; 0.87 to 1.05). The statistical test for interaction with inner/outer London produced p=0.06. There was no evidence for interaction according to level of deprivation of areas in which people lived, the level of household income, ethnicity, or the level of take-up of free bus travel (Appendix 9 Table A9.3).

4.3 Bus use replaces walking for short trips

In the last Chapter, we identified a preference for using buses because they were free, accessible and (crucially) because all members of a peer group could travel together. Although walking in theory would also offer these benefits, in general, young Londoners do not consider walking a viable mode of transport for any but the shortest of journeys. In part, as outlined in the last chapter, bus travel had become the default mode of transport for most young people, as suggested by these accounts of bus travel for journeys which, young people themselves suggest, could in theory be walking journeys:

> F: Sometimes if I'm really lazy or just can't be bothered. If I'm walking and I'm past a, I'm next to the bus stop and the bus is making its way up I just jump on. But if not, I just keep walking, I can't be bothered to wait. (Isl, 16)

> M: [I]f I'm like going to meet a friend or whatever and I'm, or I'm going to Romford, but I could walk to Romford in about ten minutes. But if there's a bus I'll get on it because it's quicker and easier. (Hav, 15)

With buses generally accessible, available and free, walking, as a main mode of transport, had become something of a 'last resort' for many situations, something done because you 'had to', implying that there were no other more attractive options available:

> M: My school is awkward... we *have to* walk
> F: you're at the top of the hill ...

M: no buses actually go right to the school ... and then you've *got to* walk through the parks to get to the other bus stop (Sut, 16 [emphasis added])

By extension, when asked directly, many participants suggested that if the free travel concession were to be removed it is likely that many short journeys would be done wholly on foot once more:

I: And you said earlier if you had to pay the fare you might change your journey? What do you think you would do different, differently?
M: Well it's pretty simple for me because I have only like on the bus is only one minute, it's pretty simple, it's not really a long walk at all, only it's for me personally I find that literally almost no effect at all, however now thinking about other people and their situations that's going to cause some effect but.
I: So you would just walk it if you had to pay it?
M Yeah I'd walk it, yeah. (Hav, 14)

I: [I]f you didn't have the free bus travel, how would you get to school do you think?
M: I'd have to walk, I'd probably walk. It's, it's about, but I'd have to leave much earlier because it's about a half an hour walk, five minute bus journey. I'll take the bus any day. (Hav, 15)

This is not to say that the Zip Card has eliminated all walking trips. In some instances, despite free bus travel, young people reported that they would opt to walk rather than take the bus:

F1: [I] walk [to school], because I live nearby so I feel a bit, I'd feel a bit stupid getting the bus…
F2:I used to quite often, during the summer I'd walk home from school. Even though it is a good 50 minute, hour long walk, but sometimes it's just easier than waiting for the bus and then getting all crammed on it. (Sut, 15-16)

As these instances suggest, however, opting to walk would usually be in response to perceived conditions (the crowdedness of the bus or the 'stupidity' of getting a bus short distance) rather than a proactive decision in light of the health (and other) benefits of travelling by foot. In this respect, it would appear that for the most part secondary school pupils are inclined to persevere with trying conditions before opting to walk:

F: And my friend who lives in between Epsom and Cheam said it got to a point where for two weeks, every day, the bus...was too full to just stop for her. So in the end she just had to leave her house half an hour earlier and walk. (Sut, 14-18)

4.4 The absence of cycling in accounts of transport

Cycling is notably absent from accounts of travelling and travel preferences, in particular as a candidate mode of transport. When asked directly whether they would consider cycling to school, most said no, offering a number of reasons for this as an inappropriate choice: main roads were too dangerous (several recounted injuries from cycling), or at least considered by parents as too dangerous; cycling was unpleasant in poor weather; cycles were at risk of theft from schools; and cycles that were owned were in any case (in most accounts) broken. More significantly perhaps, cycling rarely figured as a possibility for consideration as a method of transport, being (for many) inherently 'ridiculous'. As one young woman said of those who did cycle to school: "I just find it funny. I don't know why I just, I find that I do find cycling funny" (H&F, 12-17).

The exceptions were telling. Given the focus on sociability in young people's accounts of transport, cycles were notable for offering more individual, even confidential, travel. One young man, one of the few to cycle to school, also preferred to use his bike on occasions when he didn't want to encounter peers: one was going shopping for his mother "Because I don't like getting on the bus with shopping …[unless] I have one of them expensive bags" (YS, 14-15). In general cycling was associated with childhood:

F: I used to cycle every Sunday with my dad and younger brother, but now we don't anymore. Yeah, just, we kind of stopped, yeah. (H&F, 15)

It continued to be attractive to some as a leisure activity, and boys in particular talked of riding BMX bikes, "for, like, just going to the skate park and using it there" (HAV, 12). Here, cycling was a sociable activity for peer groups which, like opportunistic bus travel, was a possibility for offsetting boredom:

M: We're like sitting in the estate and talking and stuff, and it just gets boring after a while, so sometimes we just ride, ride our bikes and cruise (H&F, 15).

Free bus travel does not, then, seem to play a major role in decisions about choosing to cycle, as cycling is not primarily considered a candidate mode of transport for most journeys.

4.5 Free bus travel generates additional activity

The replacement of short (1-3 bus stop) walking trips by bus trips did not necessarily reduce the amount of physical exercise young people were getting, or even the amount of 'active transport'. For some, having the pass had clearly generated additional walking stages of a journeys or whole trips that would either have not been conducted without the free bus pass or would have been carried out as a car passenger. There was first some evidence (if at the margins) that a free bus pass enabled access to journeys that would not otherwise have been taken, providing possibilities for exercise:

> M: If I didn't have free travel...I wouldn't be going places I would be probably staying quite local and through using free travel it means I can go places that I've always wanted to go, maybe heard of from friends and family because they've gone on trips. (Sut, 15-18)

By the same token, other journeys might be undertaken less often if free bus travel was not available. As one focus group participant put it when asked how journeys would change without free bus travel, "I don't think anyone would really go out as much to be sociable" (Sut, 15-16). She goes on:

> F: [S]ometimes when I go out with my friends I get three buses there and three buses back, depending on where I'm going, and I wouldn't pay that much to spend three hours out, because you think about it, if they started making us pay, that's like, at the moment it's what, £2.00? £2.20 for [a] single bus fare. You times that by six that's, you're going to end up paying a lot of money for just going out with your mates for three hours. You're already trying to save money doing stuff that doesn't cost us. [You don't want to be paying for] getting there as well. (Sut, 15-16).

Free travel, in that it facilitated travel with friends, particularly to new places, therefore encouraged extra trips, and trips further afield than would otherwise have been made. Such 'exploratory' trips inevitably entailed some physical exercise (even if minimal) either as an end in itself or as a by-product:

> F: Me and my friend tend to just get on the bus and go somewhere and then just get off and get the bus back… We saw a park once on a bus and we were like, that's nice, and got off there for a while. (YS, 12)

M: If I didn't have free travel I would have to be doing everything through walking and stuff but I wouldn't, that means that I wouldn't be going places I would be probably staying quite local and through using free travel it means I can go places that I've always wanted to go […] and then you can explore places on your own, you can see what you want to see, not with the guidance of someone who's obliging you to go and see a museum. (Sut,15).

Bus travel replaces some car travel, particularly in outer London

A marked geographical distinction was apparent between accounts from inner and outer London. In inner London, with a higher density of bus stops and more bus routes to choose from, young people would report that bus trips tended to displace walking trips. In outer London, however, where residents can expect to walk further to their nearest bus stop, young people would report that bus trips were displacing less active car trips. As one young person in Sutton put it when asked if they use the bus for a journey they might otherwise walk without the free bus pass: "I hardly ever go in the car anymore … I can't remember the last time I sat on a front seat" (Sut, 14-16). Having free travel rendered them less reliant on lifts to places from their parents:

M: [F]or example if I was getting a lift with parents because I'm not old enough to drive they might be doing something in the day and so they're going to be, oh I can only give you a lift at this time because I need to go out to do this before work. So it's just through that bus journey means I have, time is not a problem (Sut, 15-18)

In outer London in particular, then, the free bus pass generated instances of active transport by encouraging hybrid walking and bus journeys instead of door-to-door lifts by parents or guardians.

Activity within the transport system

With the free bus pass at their disposal, young people felt less limited in terms of their transport choices, and would often take journeys involving multiple buses (and inter-changes) if the most direct bus did not arrive or "to get a shorter bus" (Sut, 15-16). Such 'hopping on and off' was a feature of travel across the city: for "fun" (Sut, 15-16), comfort, or convenience:

M: Well there a lot of buses, so if I get a bus, so I change either three times or two times, so it depends on what comes first. And because I have the free Oyster card I'm not restricted

to get a certain bus, so I can get any bus, get off and...change, so that saves me time (H&F, 12-17)

Regardless of motive 'bus hopping' would invariably involve walking or running between buses and between bus stops. Thus, while strategies to avoid unnecessary walking as a main mode of transport pervaded accounts of such journeys as getting to school, this preference for less active ways of travelling did not necessarily extend to within the transport system itself. Additionally, on the buses themselves, behaviour was not necessarily inactive. For example, respondents would report choosing to stand on the bus (for very short journeys) rather than sit and, crucially, riding the bus did not necessarily connote sedentary behaviour, in particular where no seat was available on the bus or where adjacent seats for groups of young people were not available. Rather, the priority for young people travelling with friends was to be able to convene as a group, while for those travelling alone some would refrain from sitting so as to reduce the likelihood of having to engage in unwanted interactions with unknown others. This finding was reiterated during observations (on buses and other public transport modes) recorded over the course of the fieldwork period. These showed that young people using public transport, in particular on their way home from school, would often be active during their journeys – moving between friends sitting on different parts of the bus, running between buses and even using metal bars intended to help passengers support themselves as ad hoc exercise frames.

4.6 Preferences for active travel

A preference for using buses because they are convenient, sociable, free and everyone can therefore use them was not necessarily a preference for bus travel per se. Indeed, inherent dislikes of being on buses, particularly crowded buses, were common, with concerns about crowds, dirt, germs and the lack of hygiene commonly articulated:

F: And the thought of the germs travelling in the air. And the fact that that swine flu has just hit as well, so it puts you off public transport (Isl, 15-16)

M: It was very packed on the bus, it was quite hot and sweaty and yeah, there were a lot of people crowded into little spaces and buggies and crying babies and everything, it was horrible. [W]hen I'm going to school it's normally quite quieter because there aren't as

> many people, but today because I was going into Romford, I had all the work people and everyone and it was oh, horrible. … I feel claustrophobic. (Hav, 15)

These dislikes meant that more active modes such as walking were widely seen as 'healthier' in principle. Young people often spoke of their own preferences for bus travel as being 'lazy', for instance, and, when reflecting on the Zip card scheme, many recognised the potential health limiting effects of possibly replacing walking with bus travel:

> I: What do you think...about why you guys get free bus travel?
> M1: I think it could be because some people are lazy, tired, if they're tired they won't go to school. So then the government try and encourage them to go in, and they've got free travel. You don't have to use your legs that much to get in there, so.
> M2: But then wouldn't that be against the whole, defeat the point of the whole government thing, the government fitness thing? Because if they're trying to encourage people to get fit, why encourage them to take the bus then?
> M1: True. (Isl, 15-16)

Although, as detailed above, these considerations did not generally translate into personal preferences for what were perceived as 'healthier' modes of travel, some individuals did report preferences for walking because of the intrinsic pleasure of exercise:

> M: [W]hen I didn't have my Oyster card when I walked to school I felt, because like I was in the air, fresh air, I had fresh air and I could exercise a bit, walk my legs, when I was at school I felt much, much more concentrated and much more alive. When I'm on the bus it's like, 50% of the time I would slouch on the table, sleeping, even if I'm standing up on the bus, whether I'm sitting down or standing up it just like this musty atmosphere on the bus, it smells a bit and it's just dull really. So outside, when you're outside walking it just makes you feel more alive and it does, it makes you feel a bit healthier even though it's such a short walk. (Hav, 14)

The exceptions, those who did explicitly choose to walk where possible rather than get the bus, attributed this preference to health aims:

F: I want to be, like, fit and everything, so exercise wise, I make sure I don't get the bus too much, so it helps (Hav, 17)

For the majority, though, 'fitness' as a health goal did not feature as a factor in decision making around transport decisions, and was not something prioritised in stories of travelling around the city. Rather, the wellbeing considerations of young people were more closely aligned to social wellbeing: ensuring a journey that maximised social inclusion (in travelling with peers, as described in Chapter 3) and minimised certain risks (which we turn to in Chapter 6).

4.7 Conclusion

There is credible evidence that although the intervention increased the use of bus travel for short trips, in the context of rising general use of bus travel in the population, that this did not necessarily mean that young people were significantly reducing their amount of active travel overall. The apparently paradoxical finding from travel diary data that although the number of trips by walking as a main mode reduced, that there was no significant difference in the distances walked, was explained to some extent by the qualitative data, which suggested that the bus pass facilitated more journeys, and given that all bus journeys require some walking, therefore undertaking some active travel as part of a trip served to offset the loss of trips by walking as a main mode that were not undertaken. Although the bus pass may have had only a marginal role in generating exercise as an end in itself (e.g. to access sports facilities), exercise as a by-product of public transport was more common. 'Bus hopping', although generating a large number of very short trips which may not be recorded in travel diaries, also generates activity, and simply being on the bus was not necessarily sedentary. The oppositional, and at times explicit (e.g. (102, 103) assumption that urban bus travel is a purely 'passive' mode in contrast to the 'active' modes of walking and cycling may underestimate activity.

On cycling, levels in young people declined, from a very low base. The use of adults as a comparator group here is perhaps less helpful for attributing change to the intervention, given the rise in adult cycling for other reasons (including a number of schemes to increase cycling levels). Although there is little evidence from the qualitative data that cycling is considered a candidate mode of transport for many young people, we do not know how far this has changed since the introduction of free bus travel. It is clear that young Londoners have not benefited from the increases in cycling seen in adults.

What is encouraging from a public health perspective is that health is a consideration for many young people in thinking about their transport behaviour, and one which means that at times 'active' modes are preferred. However, the health outcomes that are implicitly prioritised in the majority of young people's accounts of travel are those of social wellbeing. The scheme may (as young people themselves note) reduce the incentives for 'healthier' active travel, but it also provides the conditions for travel that is both sociable and inclusive: travel that is inherently 'healthier' from the perspective of young people themselves.

In summary, there was no evidence from the travel diary data that the intervention had reduced, overall, the amount of active travel that young people did. The qualitative data suggested that treating bus travel as a non-active mode of transport may be inappropriate if the aim is to use active travel as a proxy for physical exercise, as bus travel generates both additional trips (particularly discretionary ones) and some activity within the transport system itself.

Chapter 5 Has the scheme fostered sustainable transport?

5.1 Introduction

The sustainability of transport policies is a key issue for public health (20). The OECD Vancouver conference (104) identified the growth in motorised private transport as a severe challenge for developing sustainable transport systems. Mass transit systems, in general, are less environmentally damaging, and subsidising bus travel has long been seen as a promising policy for reducing private car use, with evaluations of concessionary schemes for older passengers suggesting some displacement of car trips (105). One explicit aim of the intervention was to foster sustainable transport, both by displacing private car journeys in the short term, and by inculcating more sustainable travel habits in the longer term. This chapter first assesses the evidence for short term change using travel diary estimates for change in young people's car travel. Evidence for longer term change is more difficult to assess, given the relatively short time frame of this evaluation. We therefore use the qualitative data to explore young people's views of driving and public transport, to provide some insight into these longer term implications.

5.2 Quantitative evidence on impact on use of private motor cars

The changes to trips by car as a main mode, distance travelled by car and percentage of short trips by car are shown graphically below in Figure 5.1.

Trips by car as a main mode

The introduction of free bus travel was associated with a decline in the average number of trips by car as a main mode made by young people, from around 0.6 to 0.5 trips per day (a 15% decrease; 95% CI 5% to 23%). There was a similar decline (a 19% decrease; 95% CI 15% to 23%) in the average number of car trips made by the control age group (from around 1.4 to 1.2 trips per day). Overall therefore, free bus travel was not associated with a greater relative change in number of car trips in young people (relative change 1.05; 95% CI 0.94 to 1.18).

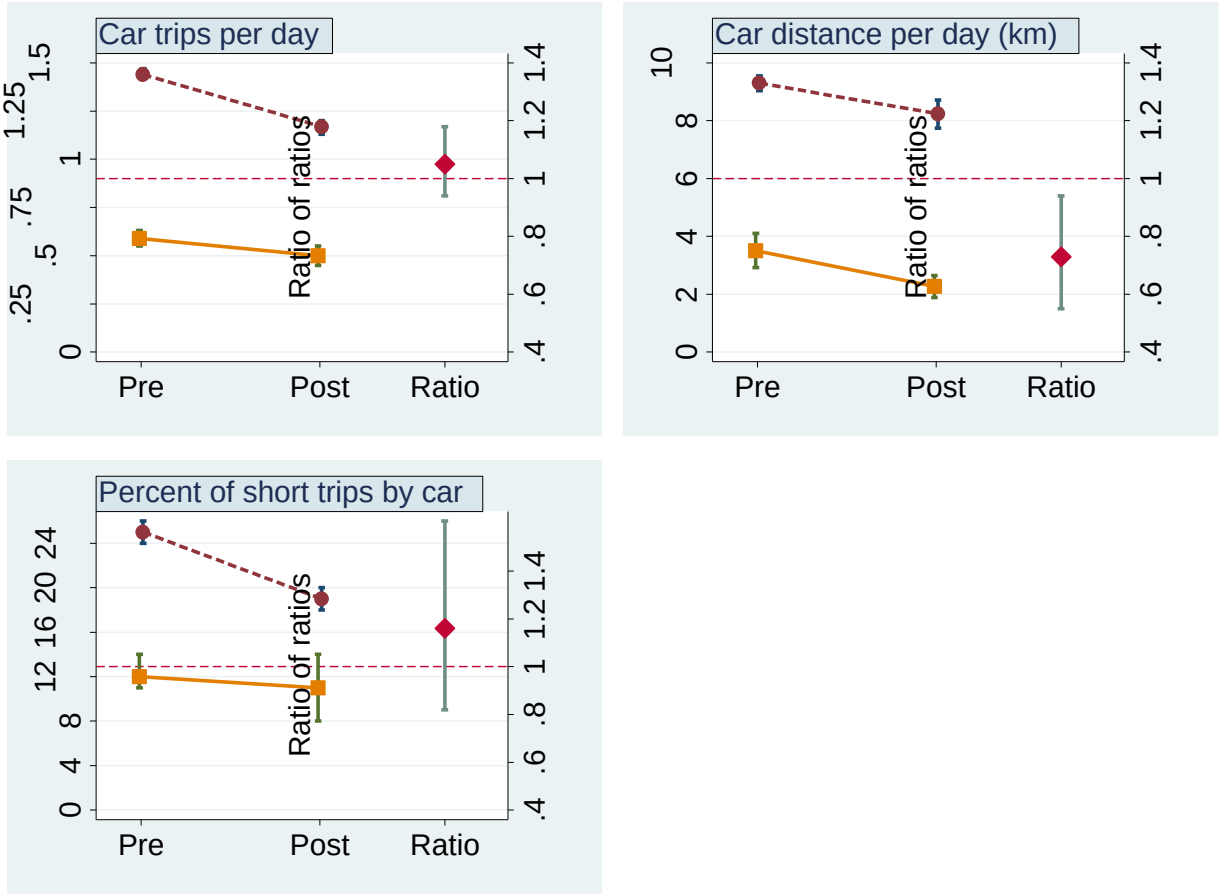
Distance travelled by car

The average distance travelled by car each day by young people decreased from around 3.5 km to around 2.3 km post-introduction of free bus travel. The average distances travelled by car in the control age group decreased from around 9.3 km to around 8.2 km each day. The introduction of free bus travel was thus associated with a *greater* overall reduction in total distance travelled by car in the target age group (relative change 0.73; 0.55 to 0.94).

Short distance trips by car

There was no change in the proportion of short (<1 km) trips made by young people by car post-intervention, which remained at around 11% of all short trips made. There was a decrease in the proportion of short trips made by car in the control age group, declining from 25% to around 19% of all short trips made. Relative to the control group, free bus travel was not associated with a change to the proportion of short trips made by car by young people (relative change 1.16; 95% CI 0.82 to 1.61).

Figure 5.1 Changes in car travel, pre-introduction to post-introduction of free bus travel



Line joining solid squares shows change in target age group (12-17 years); line joining solid circles shows change in control age group (25-59 years). Diamond (right-hand side of figure) shows the change in the target age group relative to the change in the control age group. 95% confidence intervals are shown as vertical lines. Horizontal dotted line indicates a ratio of 1 (i.e. no relative change).

Car travel by young people is dependent on car travel by the control age group, as the majority of young people are too young to be able to drive themselves. The changes in car travel by the control age group will therefore partially explain the change seen in young people.

Car travel by subgroups

Car travel by adults and young people declined in inner and outer London, in terms of trips by car as a main mode and distance travelled (See Appendix 9 Table A9.6). There was some suggestion that the relative decline in car distance was greater in inner London than outer London. As the London Congestion Charge Zone (which substantially decreased car travel within inner London) came into effect between the pre- and post-intervention period, these results on car travel within inner London must be interpreted with a degree of caution.

5.3 Qualitative evidence on impact on current car travel

The free bus pass had displaced some walking trips (Chapter 4), making the bus the default option for what might have been short walking trips. For longer trips in the city, however, walking was rarely considered to be a viable option even if there were cost or other disincentives to alternative modes. In the absence of free bus travel, hypothetically, young people thought they would typically forgo the journey, pay for the journey, or persuade parents to provide lifts, depending on the need. As described in Chapter 4, young people in outer London in particular said that if they had to pay for the bus, some trips would be made by asking parents for lifts:

> M: If I was casually going out somewhere I probably wouldn't have got the bus, but if I needed to go... I'd probably pay for it. But usually I'd catch cadge a lift … parents always seem to be conveniently free… (Sut, 14-18)

Again, the importance of *universal* free travel was key to explaining the displacement of some car journeys, given the importance of sociability to travel planning. Unlike bus travel, parental lifts might not be easy to co-ordinate with others for planning travel and socialising:

M: [Free bus travel] makes things easier because if it was, for example if I was getting a lift with parents […] they're going to be, 'oh I can only give you a lift at this time' (Sut, 15)

M: My mum or dad would drive me if I want them to but it's like I said you meet friends on the bus and things like that. (Sut, 13-16).

To some extent, free bus use had therefore replaced some private car use, particularly for the kinds of discretionary journeys for which lifts from parents would have been a potential option for longer trips, and a first port of call for many. As these discretionary and longer trips may be more likely to be outside term time and weekdays, the travel diary data may have underestimated the impact of the scheme on displacement of car travel.

5.4 Driving remains seductive in prospect, if not reality

Current preferences for bus travel with friends over some lifts from parents did not, though, necessarily translate into imagined future preferences. Indeed, the majority of young people expressed a desire to drive when older, with initial comments about driving apparently reflective of beliefs about the status and value of driving widely reported in other research (106). Future car use – for almost all young people – was still either a normal expectation or an aspiration, and older friends with cars were already a valued resource:

F: ... I'll get a car.
F: Yeah.
F: Loads of people now, you know some of them that's old and that, I've got friends now though that are 17 they've got cars already, and they've actually got a license, so you'd probably go with them or whatever.
F: Yeah ...
I: Get lifts with them?
F: Yeah.
F: If I haven't got my own car or something, I'll call my friend up ... (Sut, 15-16)

Car driving was for many (particularly young men) a rite of passage that was eagerly awaited as a route to enhanced status with peers and potential partners, in contrast to still using an 'Oyster', which would mark you out as somehow deficient, as these boys jokingly agree:

M: As soon as I'm old enough to drive I'm going to drive

M: I'm waiting for the day that I get my hazards

M: I'm going to get it before all of you, ha ha!...

M: ... when I come home from parties I'm cold... so cold, so I always imagine I have a car just come...

M: Yeah, a car you could drive!

M... also it's more impressive to girls if you've got a car, if you're 20 and you haven't got a car and you

M: just do public transport

M: can't go out to meet girls and that ...

M: If you're still rocking an Oyster!

All: [laughter] (YS, 14-15)

However, to some extent stated desires to drive were reflective not just of the anticipated status attached to car travel, but also of its significance for achieving independence. Here, for instance, a disagreement between two friends reflects their differences in how 'independence' is constituted in relation to learning to drive:

I: What is it that makes you want to learn to drive?

F1: I want to be free, I want to be independent and anyway, driving's fun isn't it?

I: Yeah, so what will be more independent about it?

F1: I'll be able to do things myself, be able to go where I want. [...] I'd just be more independent because you see a lot of working people always in their cars.

I: How about you, are you planning to drive or?

F2: Well we all want to be start driving now but I don't want to. I want to do it at a time when I'm able to afford lessons for myself, so I can buy myself a car because I don't really, again I think it's independence, I want to be able to pay for myself rather than depend on my mum. (YS, 17)

Some young people in inner London did challenge their peers' accounts of the future benefits of driving in London. One young man noted the practical problems of "long" traffic, and being stuck "in the High Road for 40 minutes in a hot car", before countering his friend's rationale for wanting a car when older:

M1: Do you know how many girls you can get with cars bruv? You just honk at them …

> M2: I think driving in London is stupid, I don't see the point…I like cars, but in London, no. (Isl, 15)

Such practical objections to the rewards anticipated from driving were rare, but were unsurprisingly more common for the few participants who were already driving, for whom the realities of parking, congestion and the implications of not being able to drink had already tarnished any romanticised views of driving bringing independent travel or freedom. One, who now regularly drove to school since passing a test recently, noted that parking was expensive, and buses (as well as still being free) could be more convenient for many journeys (Sut, 15-18). Additionally, she and a friend note that buses are intrinsically more interesting:

> F: Yeah I do like getting the bus because you can meet new people on the bus and because everyone's doing the same thing and it's every day it's nice to see the same people and it's quite a nice commute so it gives you a lot of independence… every single bus journey is always interesting because something would always go on and you could listen to other people's conversations if you want to and brighten up your day a bit.
> F: I love the bus, I like journeys with my friends, obviously bus is good because if you want to have a drink then you don't, you can use the bus to get home instead of driving. And always, you can always have funny conversations with people on the bus when you're on the way home from a club or something (Sut, 15-18)

What is notable about this exchange is not that these young women, at an age where they are just learning to drive, prefer the bus (indeed they note that driving would be preferable to waiting in the rain for a bus) but that the bus is not only 'normalised' as a mode of transport, but even attractive. There is no sense in this account that using a bus is stigmatised as a young person's mode of transport, or one primarily for poor people, or only for those unable to drive. For those old enough to have actually experienced the advantages and disadvantages of different travel modes in the city, driving is (they admit) still a novelty attached to adult identities, but not intrinsically more socially valued than the bus.

5.5 The normalisation of bus travel?

Demonstrating an absence is difficult, but what was striking across the data was perhaps the lack of any comments about the inherent low status of bus travel. Although buses were often unpopular

for being dirty, crowded or potentially risky (see Chapter 6), because all young people used them, there was no stigma attached to using the bus. Neither was there any sense that they were, as young people, relegated to public transport. Indeed, bus travel was, in the accounts of many young Londoners, simply the way in which many Londoners got to work and other destinations. This exchange gives a flavour of the accounts of bus journeys, with the range of other passengers who might be encountered on a typical journey:

> F: I've had many a conversation with older people, not so much like 30 to 50 year olds they don't, they keep to themselves … You can see mothers chatting to other mothers from their primary schools and stuff
> M: Those are the workers who are so miserable that they just stand there and then especially when a bus is packed they say like, so rude and they get in your face and they're just like, why are you standing in my way? …
> M: And then the school kids
> F: And then school, well children yeah
> M: And then, but the good thing, sometimes the good thing about having old people in the bus is that you get that moral side out of you because when they come on the bus and you're sitting down in the seat you feel like oh because they're old you should give them your seat. So you feel good when they seat down because they normally say thank you (Sut, 15-18)

It is not that free bus travel in itself created this normalisation. Two other conditions were necessary First, the fact that universal free travel meant that bus travel had become a default, taken for granted mode of transport for all young people, meant that bus travel was 'normal' for all their peers, whatever other modes of transport were financially or otherwise available to them (See Chapter 3).

Second, was the context of enhanced bus provision, which had increased the modal share of bus travel in general in the capital (See Appendix 1). This generated routinely experienced encounters with a range of other Londoners, and visitors, on the buses (including older citizens, commuters, mothers with young children), making bus travel very visibly a 'normal' way for all kinds of people to travel. Without the relative accessibility and availability of buses in London, free travel, even if universal, would not become a preferred mode for so many journeys. A few, particularly those who

had experience of other places and who lived more centrally, where bus services were in general more frequent, noted this explicitly:

> M: The good thing about London is the amount of buses we have because when you go to other places you're waiting half an hour for a bus scheduled to come at this time. And here you can just wait two minutes, you're on a bus, you know what I mean (Isl, 15)

For most, however, the taken for granted accessibility, and ubiquity, of bus travel as a normal way for a range of travellers to get around was merely an unremarkable backdrop to their accounts of travel in London.

5.6 Conclusion

In the short term, it is difficult to assess how far this intervention has changed the levels of private car use in London. A range of other policy interventions (notably the Congestion Charge) have reduced the advantages of car travel, and the number of trips by car has declined for all Londoners. Additionally, as the majority of young people's car journeys are those made by adults as well, the reduction in young people's car travel is included in that of adults.

In outer London, the qualitative data suggest that the free bus pass has displaced some car journeys, reflecting young people's preferences for travel independent of parents and which allows sociable travel with peers. In the longer term, it is difficult to assess how far the intervention may have shifted perspective on the desirability of driving. However, although most young people still express positive views of learning to drive, what is notable is that bus travel has become normalised for this group. The broader context of London's changing transport system is an important condition of the effects of free travel. In a transport system in which bus travel is in general more available and more reliable than in other parts of the country, it carries little of the stigma attached to bus travel in other parts of the UK, where bus use is disproportionately a mode used by the young, older citizens and poorer households (107, 108).

In summary, a range of policies contributed to the reduction in car travel by young people in London in term time weekdays, and to the normalisation of bus travel as a non-stigmatised alternative to driving.

Chapter 6 What impact has the scheme had on safety?

6.1 Introduction

Transport policies have the potential to impact on safety and inequalities in safety through a number of pathways. First, different modes of transport incur different risks of road traffic injury (RTI) for users and others (42), so policies that shift mode distributions are likely to change the numbers of RTIs. However, mode share may also affect relative risks (as in the example of 'critical mass' effects for walking and cycling, see 109), so there may be feedback loops which reduce these effects over time. In Chapters 3-5, we noted a rise in bus use and a decline in other (currently more risky) modes, which could reduce the number of injuries young people experience on the road. Second, perceptions of risk may change as transport modes become more or less acceptable or well used. Third, as the overall number of trips or distance travelled goes up, young people may be more exposed to both road injury, and other risks, such as assault.

This Chapter assesses the impact of the intervention on the risk of RTI and risk of assaults by comparing changes over time in young people with those in adults. Given that a range of other factors also contributes to declines in road injury, and in assaults, we also compare what happened in London with the rest of England. We then draw on the qualitative data to provide evidence on young people's views of the risks of transport mode use in the context of free bus travel.

6.2 Quantitative evidence on road safety

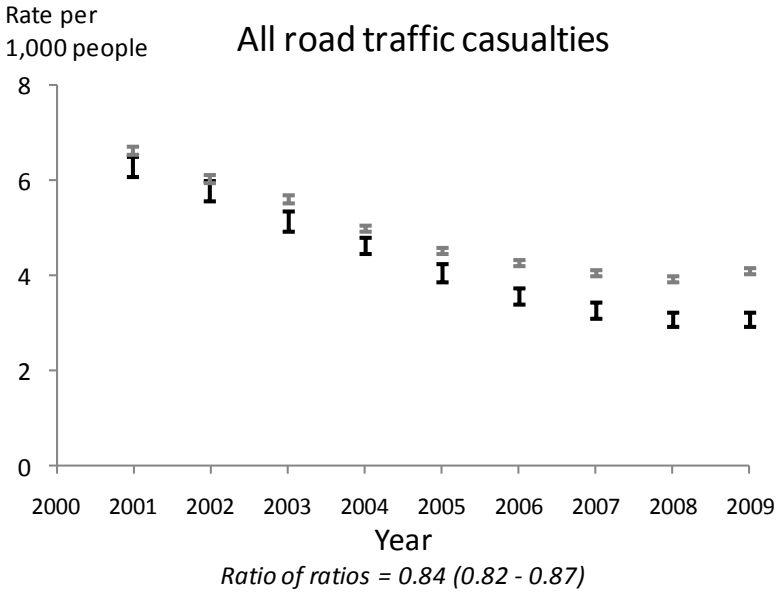
As outlined in Chapter 2, we had hypothesised that the introduction of free bus travel for young people in London would result in an overall reduction in road traffic injuries in young people relative to the control age group. Trends in road traffic injuries and assaults by year are shown in Figures 6.1-6.4.

Road traffic injuries in London

Using police reports of road traffic injuries in London (STATS19), we found 11,221 road traffic injuries in young people in London in the pre-intervention period (2001-2004), compared with 6,657 in the post-intervention period (2006-2009). Among adults aged 25-59 years, there were 89,661 road traffic injuries in the pre-intervention period and 65,542 in the post-intervention period.

The *incidence* of road traffic injuries for all modes of transport in young people declined over the study period from 5.46 injuries per 1,000 person years to 3.23 injuries per 1,000 person years, a reduction of 41% (95% CI 39% to 43%). In the control age group there was a reduction from 5.81 injuries per 1,000 person years to 4.08 injuries per 1,000 person years, a reduction of 30% (95% CI 29% to 31%). The introduction of free bus travel was therefore associated with a *greater* reduction in road traffic injuries in young people (relative change 0.84; 95% CI 0.82 to 0.87).

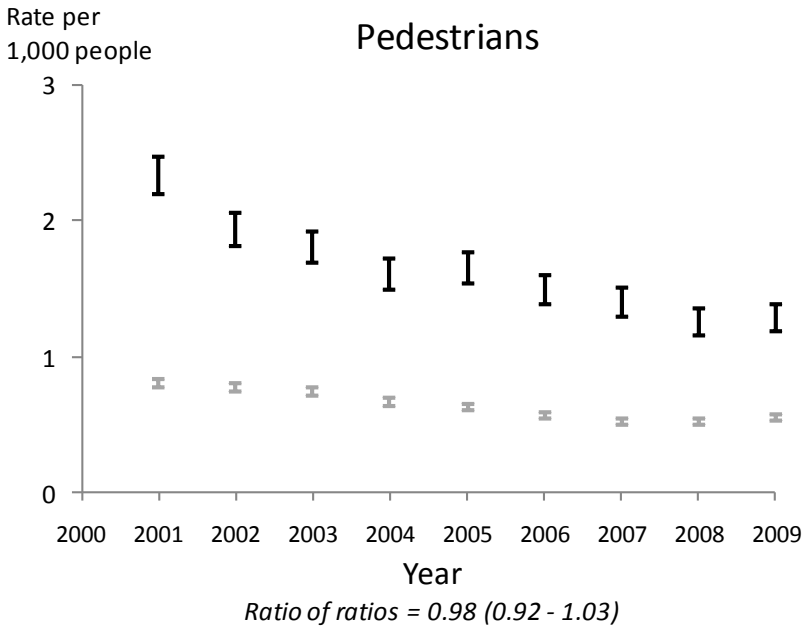
Figure 6.1 Annual rates of road traffic injury in London



Pedestrian injuries in young people declined from 3,948 in the four years before the free bus travel scheme (2001-2004) to 2,795 in the four years after the intervention (2006-2009). Among adults, pedestrian injuries declined from 11,563 in the pre-intervention period to 8,723 pedestrian injuries in the post-intervention period.

Pedestrian injury *rates* declined in young people over the study period from 1.92 per 1,000 person years to 1.36 per 1,000 person years, a reduction of 39% (95% CI 26% to 33%). In the control age group there was a reduction from 0.75 per 1,000 person years to 0.54 per 1,000 person years, a reduction of 38% (95% CI 26% to 30%). The introduction of free bus travel was *not* therefore associated with a greater reduction in pedestrian injuries in young people (relative change 0.98; 95% CI 0.92 to 1.03).

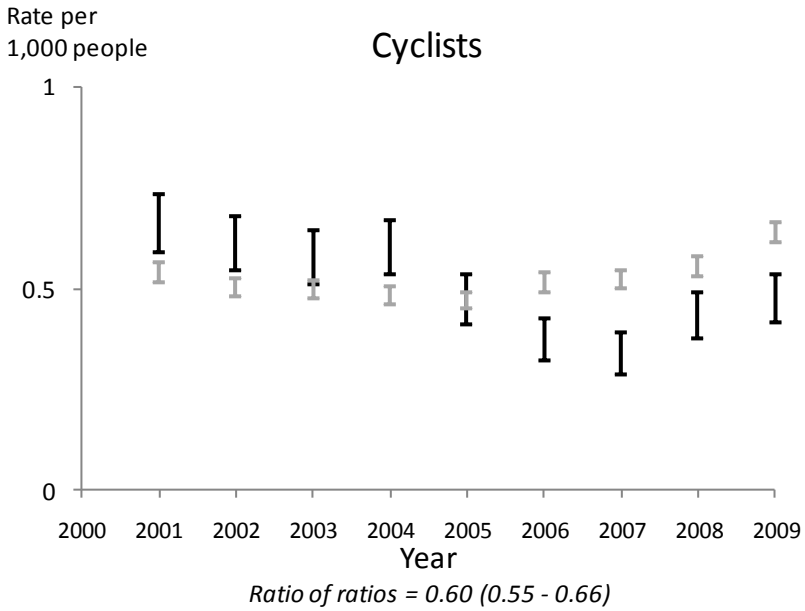
Figure 6.2 Annual rates of pedestrian road traffic injury in London



young people 12-17 adults 25-59

Cyclist injuries in young people declined from 1,263 in the pre-intervention period to 837 in the post-intervention period. Among adults, cyclist injuries increased from 7,802 in the pre-intervention period to 8,976 in the post intervention period. Cyclist injury *rates* declined in young people over the study period from 0.61 per 1,000 person years to 0.41 per 1,000 person years, a reduction of 34% (95% CI 28% to 39%). In the control age group there was an increase in cyclist injury rates from 0.51 per 1,000 person years to 0.56 per 1,000 person years, an increase of 10% (95% CI 7% to 14%). The introduction of free bus travel was therefore associated with a reduction in cycling injury rates in young people (relative change 0.60; 95% CI 0.55 to 0.66).

Figure 6.3 Annual rates of cyclist road traffic injury in London

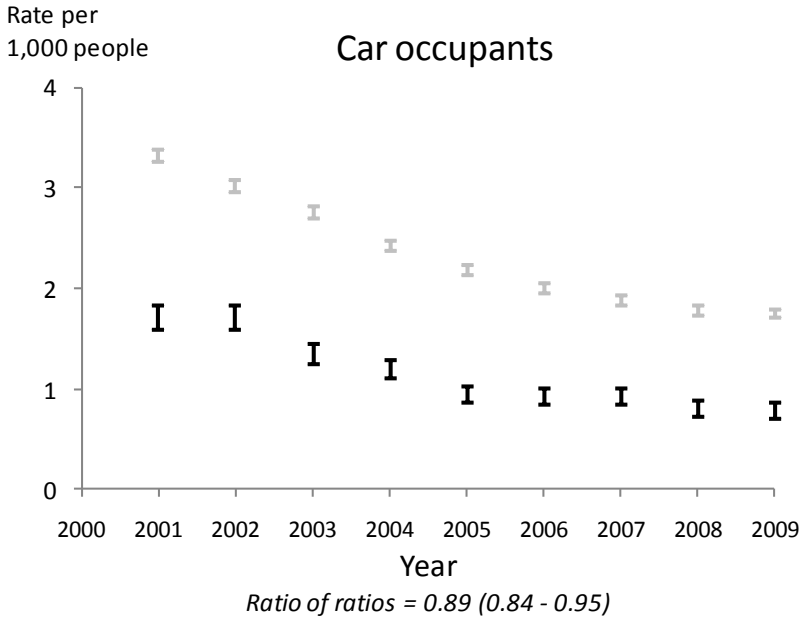


young people 12-17 adults 25-59

There were 3,602 car occupant injuries among young people in the pre-intervention period compared to 1,765 car occupant injuries in the post-intervention period. There were 44,432 car occupant injuries in adults in the pre-intervention period compared to 29,752 car occupant injuries in the post-intervention period.

Car occupant injury rates declined in young people over the study period from 1.49 per 1,000 person years to 0.86 per 1,000 person years, a reduction of 42% (95% CI 39% to 46%). In the control age group there was a reduction from 2.88 per 1,000 person years to 1.85 per 1,000 person years, a reduction of 36% (95% CI 35% to 37%). The introduction of free bus travel was therefore associated with a *greater* reduction in car occupant injury rates in young people (relative change 0.89; 95% CI 0.84 to 0.95).

Figure 6.4 Annual rates of car occupant road traffic injury in London



I young people 12-17 **I** adults 25-59

Road traffic injuries in London by subgroups

To assess whether the scheme had differential effects across London's population, we conducted change-on-change analysis for inner and outer London. There was strong evidence for a greater relative decline in inner London in the incidence of road traffic injuries among young people compared with adults (21% decline; 95% CI 17% to 25%) than in outer London (p=0.001 from a chi-squared test of homogeneity of effects in inner and outer London). There was no evidence that the relative decline in road traffic injuries differed in terms of area deprivation, ethnic group or intervention take up rate (Appendix 9 Table A9.3).

Road traffic injuries nationally

The incidence of road traffic injuries for all modes of transport in young people also declined *nationally* (i.e. England outside London) over the study period, from 6.69 injuries per 1,000 person years to 5.62 injuries per 1,000 person years. The reduction seen in London (from 5.46 to 3.23 injuries per 1,000 person years) was greater (relative change 0.59; 95% CI 0.57 to 0.61) (See Appendix 9 Table A9.4).

When compared with the (older) control group in London the reduction in road traffic injuries was 16% (95% CI 13% to 18%) and when compared to the same age group (12 to 17 years) nationally, the reduction was 41% (95% CI 39% to 43%).

6.3 Quantitative evidence on assaults

We hypothesised that the introduction of free bus travel would result in an increase in injuries to young people due to assaults as they travel further and more frequently.

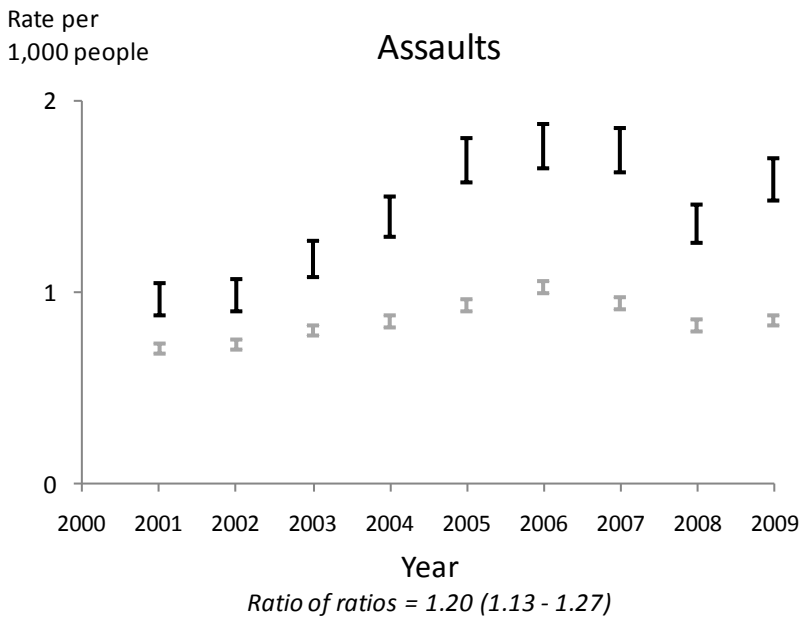
Assaults in London

Using Hospital Episode Statistics we found that the number of young people hospitalised with injuries inflicted by assaults increased from 2,321 in the pre-intervention period to 3,322 in the post-intervention period. The number of adults hospitalised with injuries inflicted by assaults also increased over the study period, from 11,829 to 14,641 admissions.

The *rate* of hospitalisation for injuries in young people inflicted by assaults increased over the study period, from 1.13 hospital admissions per 1,000 person years to 1.61 admissions per 1,000 person years. This change represents an increase of 43% (95% CI 35% to 51%) in the admission rate. In the control age group, there was a smaller increase from 0.77 admissions per 1,000 person years to 0.91 admissions per 1,000 person years, a relative increase of 19% (95% CI 16% to 22%).

Our measure of relative change therefore suggests that free bus travel was associated with a *greater* increase in rates of assault in young people (relative change 1.20; 95% CI 1.13 to 1.27). However, examining trends in hospital admissions for assaults by year, as shown in figure 6.5 below, it appears that the largest increase in assaults among young people occurred between 2002 and 2005, i.e. predominantly before the introduction of the free bus travel scheme.

Figure 6.5 Annual rates of hospital admission due to assaults in London



young people 12-17 adults 25-59

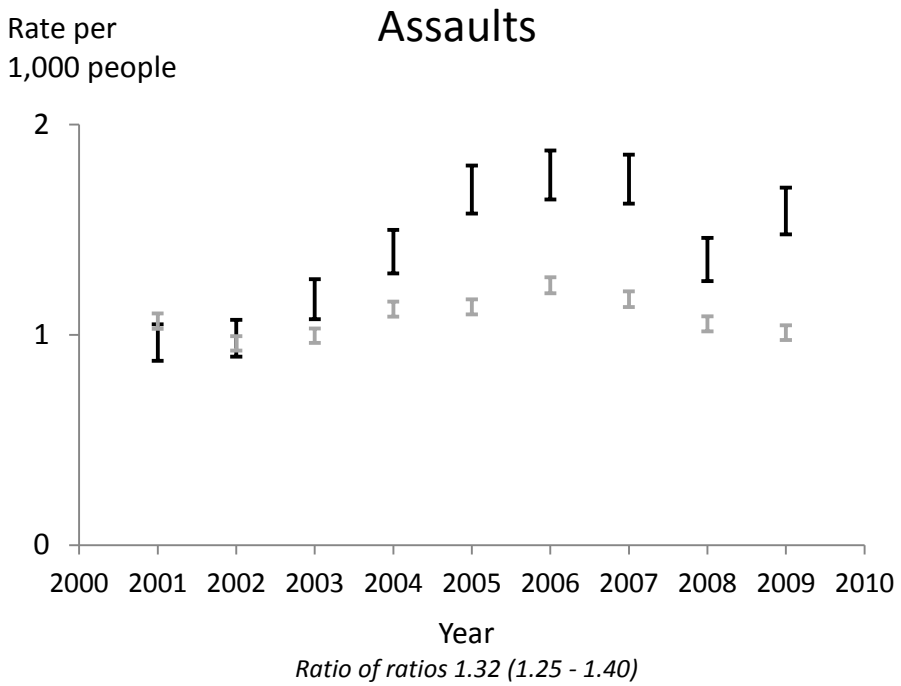
Assaults in London by subgroups

There was strong evidence for a greater relative increase in the incidence of injuries to young people inflicted by assaults, compared with adults living in Inner London (p=0.001), living in the most deprived areas of London (p=0.001), living in areas with a high take-up of free bus travel (p=0.001), and in people of 'Black' ethnic origin (p=0.001) (Appendix 9 Table A9.3).

Assaults nationally

Hospitalisations from assaults increased among young people aged 12-17 years living outside London over the study period from 1.04 per 1,000 person years to 1.12 admissions per 1,000 person years, an increase of 8% (95% CI 5% to 10%). Compared to young people living outside London, the free bus travel intervention was associated with a greater increase in rates of assault in young people in London (relative change 1.32; 95% CI 1.25 to 1.40).

Figure 6.6 Annual rates of hospital admission due to assaults in London compared with outside London



6.4 Free travel as a facilitator of risk management

Free bus travel was reported to have had an important role in allowing young people to 'practice' skills necessary to negotiate London's bus network. Such skills were sometimes acquired by making 'rehearsal' journeys: journeys which, importantly, could be undertaken without any economic disincentive. For example, one girl described how when she first got her Zip card she tried out "getting on the bus three times just to see how it worked – I just went round the corner three times and got off" (YS, 12). Other young people described learning by initially making sure they travelled with someone who already knew the route:

> F: Yeah, I know [my trip today to central London is quite far], but I know how to go somewhere when someone's like shown me. I brought my dad up here and I followed Annie and my brother this morning. (Hav, 14)

> F: I feel so much more confident going by myself everywhere now....[but before] if I wanted to go to say Oxford Street to return something I'd be like to my friend, I'd be, 'oh do you

want to come shopping with me' rather than just go and return it. But now I just go by myself, and I'll be fine with it. (YS, 17)

Thus for many young people, the company of friends or family enhanced their sense of security on novel journeys that involved travelling further afield than their familiar, local area. Being able to do this without financial cost facilitated these rehearsals. For many, the fact that buses were free was also to some extent a safety net, preventing one being 'stranded' and providing a contingency plan if things went wrong:

> M: When I came here to London I didn't have free bus travel by that time […and] it actually limited me and didn't allow me to go to places that I would actually go to when I had the free bus travel. For example, when you go out because since I still knew I can get lost easily, you know? If you have to pay for the bus it's going to limit you from getting back. (YS, 14)

> F: Say if I go out, and it's getting late, or if my original journey, say if the train's cancelled, I know I can just get a bus. I've got it free, I can go a different route. Whereas if, say if I'd already paid for a train ticket, and then I was halfway through the journey and then the train stopped, and then I didn't have any money, then I couldn't go another route. So it's like really important, I think, yeah, so security. (Hav, 17)

6.5 The bus as a site of risk

If travelling for free helped young people develop their skills in independent travel, the buses themselves were to some extent also sites of risk. There were gender differences in how risk was reported. For boys, in particular, the most potentially harmful threat on buses is older teenagers: "like 18 years old, 16 years old" (Hav, 14). Many talked in general about the types of incident which could 'kick off' on a bus, with arguments generated if disrespectful looks were perceived, or you were on a bus in the 'wrong' part of town:

> M: Also buses are really easy place to get attacked, in our area there's some gangs, and some of them live in different parts, and one day when I was on the bus one of the boys who lives in another part of town was on the bus, but in the wrong part, and a guy came on the bus with a bottle and started hitting him saying, why are you here? (YS, 14-15)

> M: Yeah, it's one of those… things because say if you're a girl and then you're actually pretty good looking, the guys [will be] catcalling and stuff. Or if you're a guy, yeah, and then you're

> one of those alpha male guys, and then they'll end up, you're going to end up having a stare off or something. They'll be, and it's usually called screwing or whatever, looking at them funky, like neh, and then they'll just be like, oh I'm watching you and then just start stuff. And then it's just not really safe… (Isl, 15-16)

For all secondary school aged young people, whatever gender and wherever they lived in London, the most commonly reported risks were those of encountering those from other schools or neighbourhoods on the buses:

> F: I've got people from other schools that stare at you because of what uniform you wear … and if you get on the bus that ain't your school
> M: It just gets awkward …
> F: I don't know, you just get glared at. And it's more likely to trigger an argument, rather than getting on a bus with your school (Isl, 15-16)

Typically, direct experiences recounted were of routine aggressive interactions between other teenagers. These were risky in that they had the potential for generating more serious incidents, but assaults were rarely reported as directly witnessed or experienced. Very serious assault incidents, were usually only recounted as 'moral tales' that happened to (often unknown) others, and used in group discussions to illustrate the kinds of risks that one should be aware of, and which were 'common knowledge':

> F: It's actually been on the news that people were actually glaring at each other, a couple of people were actually glaring at each other and a fight broke out and someone actually died from it... (Isl, 15-16)

Extreme stories relating to gun and knife crime, much covered in the media, were told as 'the kind of thing that happens' and a perceived risk, but were rarely part of the direct experiences of the young Londoners in this study. It is perhaps telling that in group interviews, such stories often had particular functions, such as to illustrate (often jokingly, as in the extract below) the dangers of neighbouring areas. Not quite urban myth, but certainly not a routine expectation of most bus travel, the limited direct visibility of knife and gun crime for most young people was illustrated by the ways in which stories were challenged by peers as atypical of bus travel in general, as in this brief exchange from a group discussion, which moved quickly from disbelief from two participants to joking aside about the neighbourhood of one participant:

F: I've seen a lot of dodgy goings-on on buses though.

F: Yeah.

M: Yes.

F: People get out guns.

M: What, whoa, sorry?

M: Qu'est-ce que c'est?

F: That was around Meadwell Bridge though.

F: What are you trying to say about Croydon?

M: It's a sprawling urban mass of despair! (Sut, 14-18)

For girls, fear of "perverts" (H&F, 15) was a commonly mentioned concern, with stories of being followed by men from the bus reported across the boroughs. Again, despite the common knowledge of this as a risk of bus travel, few actual incidents of assault were reported. One exception recounted being sexually assaulted (by other school children) during a bus journey, an assault which was reported to the police ([borough deleted], 15-16). However, for many girls, buses were recounted as more secure than other modes of travel, particularly walking, after dark:

> F: If it's late at night time, probably around five or six … then depending on how it is around the estate and how I'm feeling I might jump on a bus, just to get past the estates. Yeah, just for the sake of safety. (Isl, 15- 16)

Boys also discussed avoiding certain areas, particularly after dark, but were more likely (particularly in one to one interviews) to suggest that buses were a riskier form of transport at night:

> M: … but at night around [area], the main town is quite, yeah you, because you get all the people going to the clubs and stuff and it's, it goes mental... because you get club people and gangs and stuff … I try [t]o be at home before it gets really dark too. ...[A]nd when you do get on the buses at night, because I've been to competitions ... got back about 9, 10 o'clock at night and had to get on the buses you do find that you find some weirdos on the buses, which isn't nice. (Hav, 15)

> M: Yeah, I would go on the bus but I wouldn't go upstairs on a bus at night because I've had a few situations where there's quite like dangerous people upstairs like … So I wouldn't, I would definitely not go upstairs when it's dark and I would want to get, say if I want, it is dark and I want to, and I need to get to a place, I would want to get there faster, so I wouldn't take my time going upstairs and take my time getting downstairs, I'd get off bus straight home, finish. (Hav, 13)

As these accounts suggest, although concern about potential assaults was common, in the main young people discussed their ability to manage these risks, rather than their vulnerability to them. Strategies for avoiding or mitigating the risks that were routinely encountered in travelling around London included avoiding certain places, or being outside alone after dark, but also adopting a 'street wise' deportment, which was essential for avoiding confrontations, especially with other young people. This entailed avoiding eye contact, appearing confident and knowing when to back down: "keep yourself to yourself, head down, headphones in" (Hav, 14).

In terms of avoiding potential conflicts, many timed journeys to avoid other school's leaving times, or covered identifying school uniforms if they were travelling alone. If you had to travel alone, personal stereos were useful for creating a 'private space' in which interaction was less likely to happen, and mobile phones provided some widely described risk management strategies: allowing the creation of the 'social' through real or pretend phone calls "so they don't target you" (S51-70) or the use of a 'fake call' app to make the phone ring. Other strategies included speaking in non-English languages to arrange 'escapes' with friends (Isl, 15-16) and staying on the lower deck of the bus near the driver. The Zip card, on occasion, was mentioned as reducing the level of risk associated with travelling – not just in ensuring that one could afford to get home (as above) but providing a free 'escape plan' of 'just being able to jump on a bus' to avoid risky situations. In short, although a few participants preferred to avoid buses altogether (or at particular times) because of the risks of aggressive incidents, and most considered the bus as a *potential* site of such incidents, in general the risk of assault was not a major factor in accounts of bus travel.

6.6 Managing risk: a source of pride and entertainment

One reason that these risks, despite causing some anxiety, were not reported as a deterrent to bus travel is that they are also a source of spectacle and entertainment. Dramatic incidents were often discussed humorously in group discussions, and in individual interviews (as above) young people stressed their skills in managing the risks. Encounters that could be unpleasant or risky were simultaneously an attraction of the bus journey, providing a source of potential entertainment and a fund of stories that served to create shared narratives of 'us and them'. 'Weirdos' for instance, were often mentioned as a risk of a bus journey but rather than being necessarily threatening, these were sometimes known eccentric locals, who were part of the community, and, as noted here (following a discussion of the risks of bus use) they were explicitly part of the 'fun' of travel:

M: you do meet a few weirdos on the bus

F: Yeah

M Yeah, that's part of the fun

M: Like the dancing guy ...

F ...He's a local celebrity

M ...He's like the wizard man! ... singing to people on the bus

F: There's so many people like that (Sut, 14-18)

Indeed, in focus groups in particular, telling stories about interesting or unusual encounters on the bus, which may have been unpleasant or even frightening at the time, was related as part of the excitement of travelling, particularly with friends. The key issue of whether incidents were risky or entertaining was whether travelling was alone or with friends. Although choosing a particular mode or route was on occasion presented as a risk assessment strategy (for instance avoiding a park, or an area after dark), a major contributor to whether the choice was risky or not was the availability of peers to travel with, as we outlined in Chapter 3.

6.7 Conclusion

Road traffic injuries declined among young people relative to adults after the introduction of the free bus travel scheme. The major contributions to this decline were reductions in car occupant injuries and cyclist injuries. Pedestrian injuries in young people declined at a similar rate to adults. These findings are consistent with the changes in travel patterns reported in Chapters 4 and 5, which suggested a relative decline in distance travelled by car (Chapter 5), a relative decline in distance cycled (Chapter 4) and no change in distance walked among young people (Chapter 4).

Quantitative evidence indicates a relative increase in assaults among young people in London compared to both adults in London and young people living outside London. However, there is some suggestion that much of the increase in assaults in young people in London occurred before the introduction of free bus travel in 2005.

For young people, the bus was a frequent site of conflict between different groups (schools, gangs, older teenagers), and a place where (reportedly, but rarely in their own experience) more serious incidents happened. However, bus travel was also recognised (particularly by girls) as safer than other modes of transport (especially walking) and most young people had a range of strategies at their disposal for managing the routine risks encountered. At the margins, free travel enabled

'escape' strategies, from both the worries of being lost, and (on occasion) the ability to just jump on a bus to avoid a troubling situation.

In summary, there is no strong evidence that the free bus scheme contributed to an increase in assaults in young people, and some evidence that the scheme is associated with a decrease in road traffic injuries, reflecting the transport mode changes following its introduction.

Chapter 7 Has the scheme reduced social exclusion? The impact on participation and independent travel

7.1 Introduction

Social inclusion is fundamental to wellbeing, and transport access is increasingly recognised as important to social inclusion in settings such as London (61, 78, 110). Differential access to transport is one of the ways in which health inequalities between people and places are generated (5), and age is one social factor that influences the risk of 'transport exclusion'. In the UK, for instance, the Social Exclusion Unit (111: 2) cited transport-related problems as restricting young people's capacity to take up education or training opportunities. Young people's exclusion from participation has been variously conceptualised as arising from immobility (112, 113), disempowerment (95, 114) or dependency on adults for transport (65, 115, 116). An explicit policy aim of the free bus travel scheme was to increase access to education, training and other opportunities for young people – aims which have significant potential to enhance future public health and address one contributor to inequalities in health.

However, measures of 'social inclusion' are problematic, in that this is a multi-dimensional concept that is inherently difficult to operationalise (78). We had no direct measures of changes in dimensions of 'inclusion' which might be important, such as 'participation' or 'access to social networks'. Further, outcomes which may be causally related to inclusion, such as changes in participation in training or education, are likely to be casually distant from an intervention such as free travel. We therefore used the travel diary data to provide some evidence on one proxy measure: how that the number of trips made by young people to work or school changed relative to adults after the intervention. Additionally, we looked specifically at distances travelled by level of deprivation after the intervention to see if there was any evidence that impact of the scheme changed social gradients in this measure of participation.

The qualitative data analysis provided evidence on the salience of transport exclusion in young people's current travel decisions, and the ways in which the free bus travel scheme was used in fostering independent travel and access to a range of goods and services that are essential to social inclusion.

7.1 Quantitative evidence on participation and inequalities in participation

In the absence of direct markers of social inclusion, we analysed data on the frequency of journeys by all modes during the week, and on the socio-economic gradient in distance travelled by all modes by purpose of journey.

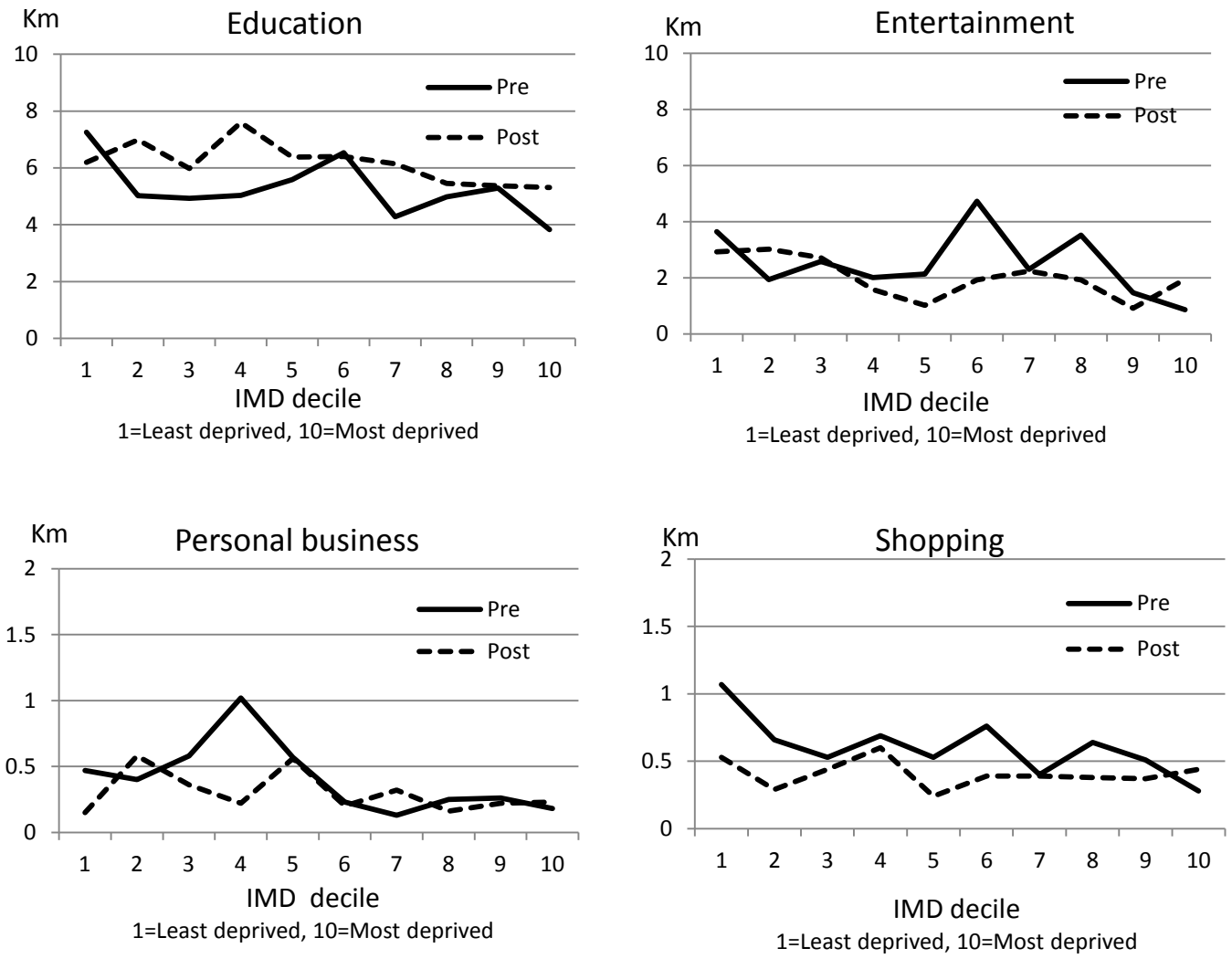
Frequencies of journeys

The frequency of journeys per day to/from work or school on a weekday in the 12-17 age-group was slightly higher after the introduction of the free bus travel scheme for young people (relative change 1.09 (95% CI 1.06 to 1.14)), while that in the 25-59 age-group declined: ratio of change in the 12-17 age-group compared with the 25-59 age-group was 1.19 (95% CI 1.13 to 1.25). In contrast, the frequency of all journeys in the 12-17 age-group was unchanged in absolute terms and relative to that in the 25-59 age-group: ratio of ratios 1.00 (95% CI 0.97 to 1.04) (See Appendix 9, Table 9.1).

Distances travelled by level of deprivation

We also examined whether there had been any chance in the distances travelled by young people by level of deprivation and purpose of journey before and after the intervention. Figure 7.1 shows trends in distances travelled by young people for education, entertainment, personal business and shopping pre and post intervention by decile of IMD. The figures generally show no clear evidence of diminution in socio-economic gradients following the introduction of the free bus travel scheme for young people. Nevertheless the patterns were suggestive of a flattening in the gradient for travel for shopping (at an overall slightly lower level post-intervention; p-value for change of slope with IMD was p=0.024).

Figure 7.1. Distances travelled by young people according to journey purpose by decile of Index of Multiple Deprivation (IMD), pre and post introduction of the free bus travel scheme.



7.2 Zip and social inclusion

Qualitative evidence suggested that universal free bus travel for young people removes one barrier to social inclusion: that of transport costs. The intervention was reported to have facilitated participation through making some journeys financially accessible, at least at the margins. Although most young people were not explicit about the ways in which this happened, there were a few comments on how free bus travel offered opportunities for access to sport and leisure:

> F: The local sports centre near me is, we've got to get a bus to get to it. So my brothers do that, and my mum takes my sister because they have like that little baby club thing there. So if a bus, the price went up, my mum wouldn't take my sister to the little clubs where she

> can meet other little kids. And my brothers probably wouldn't go to the gym at all. (Sut, 15-16)

For some, free travel did make a reported difference to family budgets, not only for those in the poorest groups, but also for those whose families nevertheless struggled:

> F: My mum's lost her job and stuff, so it's difficult for her. [For me to take the bus] doesn't cost my mum anything, and it just helps her out. (H&F, 12)

> F: I don't think that's fair because personally in my family, which you guys won't repeat, my dad's only bringing in one income and my mum's not working because she's looking after the twins at home. And she's got me and Callum to look after as well. So because my dad's bringing in probably, I don't know, probably about 1,000 over the limit that it's supposed to be, or however much over the limit, I'm not entitled to get EMA, free school meals, and if it was, free travel. But we're still struggling so it's not fair how it is. (Isl, 15-16)

Notably, the instances of increased opportunity of access recounted were often group-based activities, with the intervention enabling families to more easily afford to go on outings:

> M: When I was younger because my mum was pregnant at the time... me and my dad used to go up London because it was free for me… We used to go the Science Museum and things like that... so it was quite fun. (Sut, 13-16).

To some extent our data generation method (with most young people interviewed in small groups) perhaps discouraged disclosures of the financial impact of free travel for less well off young people. The young woman above, for instance, prefaced her account of the difficulties her family would have without the fare concession with a plea to other interview participants not to repeat her circumstances outside the group. However, the fundamental impact of free bus travel on social inclusion was evident in the taken-for-granted nature of inclusion implicit in young people's responses. Across the data set, at every age, in outer and inner London, young people's accounts suggested their independent access to both local and more distant destinations by bus was an absolutely routine expectation: a normal and unquestioned entitlement:

> F: I just get two buses to school, and on the weekends same, *I just get the bus anywhere*. Like sometimes it can be far like the West End, or not, it could just be like [local high street] or something. (Sut, 15-16 [emphasis added]).

In this respect, transport-related exclusion due to financial factors was notably absent as a salient concept for the participants in this research. Indeed the taken-for-granted nature of being able to

afford to get anywhere is perhaps indicated by the rather extreme response of one participant (echoed less succinctly by others), who told us that if she could not use the buses for free she "wouldn't come to school" (H&F, 15). Across the boroughs, young people emphasised the ease of getting around, and indeed the range of sites that might be visited by bus:

> M: I normally go [by bus] just to go to school, go see family.
> M: Probably the same thing, [I use the bus to] go to school, see family. Probably get the bus to football match, Regent's Park, Camden.
> M : I get the bus to school and my cousin's house.
> F: I get the bus to school and other activities. I go to music classes. ..
> M: I normally get the bus everywhere, (Isl, 12-13)

> M: [T]hat's [fare exemption] really helpful, whenever I really need to go anywhere it's just, it's no hassle (Sut, 14-18).

The importance of the intervention in facilitating the ability to travel without restriction ('no hassle') is perhaps evident in the fact that, for most young people, the only accounts of limitations in mobility came from reports about those who had no Zip card to prove their entitlement:

> M: [T]he day I was robbed I lost my Oyster. I had a missing [glasses] lens ...buttons ripped off my shirt and a bruise on my face. And then I tell him [the bus driver] I don't have my Oyster, I got robbed, and he's like 'I've heard all these excuses…' and he was actually swearing at me…and then he kicked me off (Isl, 15-16)

Another participant had had his right to free travel rescinded by Transport for London (as part of the 'Behaviour Code' penalties introduced in relation to some travel concessions for young people (117)):

> M: [W]hen I didn't have [free bus travel] I did struggle in terms of not getting everything done because I didn't have that freedom to get on a bus (H&F,12-17).

Similarly, one young man noted of four friends who had their passes taken away: "It puts a strain on their social activities because they can't go out as much" (Hav, 15).

7.4 Social inclusion: the importance of transport access for discretionary journeys

As one young man put it: “with my free travel I always explore places that I didn’t even know were real” (Sut, 15). He gave an example of a trip to a distant part of London with friends to a vintage clothes market they had heard about in a popular TV programme . As several participants explained, this role of free bus travel was particularly important for such social or recreational trips because these were not “necessary”. Such trips were therefore most likely to be abandoned if bus travel were not free: “[Without free bus travel] I think that under-sixteens would only go to places that they thought were really necessary like school […but] I think they would stop going to places like the park. [...] If it were a park that was far away I would go there less often if I had to pay” (YS, 15). Such discretionary trips were highly valued, providing opportunities for young people to travel together, and to participate in social life, and to travel independently of parents. This ‘independence’ was not framed solely in terms of travelling without parents, but also as travel that did not entail reliance on parents to either transport or the costs for transport:

> F1: [Free bus travel] is good, it’s really useful. It gives, at this age especially, it gives us more independence *to do what we want*, especially on buses […because] if it was too expensive we’d probably end up getting our parents to drive us everywhere which would be a real problem, so.
> F2: I think at this age it’s really important to have that because we need to learn about the world or London now sort of thing, and how to *travel by ourselves*. (YS, 12-13)

7.5 Social inclusion and independence

Linked to this sense of independence is the equality of opportunity that free travel had provided all young people in London to experience the city, and develop their growing sense the world and their place in it, providing, as one put it, “A sense of freedom” (Sut, 16). New journeys provided opportunities for young people to test their skills in planning and managing the unexpected. For the work experience students included in the study, the trip to LSHTM was a good example. When asked, they reported a variety of methods for preparing for what was a ‘new’ journey: using google maps, TfL journey planner, and ‘common sense’ to find new routes.

For all participants, access to free travel meant young people were better able to explore London, and develop an understanding of the city’s geography without fear of ending up somewhere with limited means to return to known parts of the city:

> M: When we [my friends and I] was in London we just saw a bus that was going to, we was by Trafalgar Square... and we saw the buses that, is going towards Oxford Street, didn't know exactly where it was going … and, and we get on it, we're lost, see, see where we end up ...
>
> I: [...I]f you didn't have the bus pass, like would you, would you have gone up to Trafalgar Square if you didn't have it, for example?
>
> M: Yeah. We, we would've walked, but it'd probably taken us like an hour so we might not have got round to Oxford Street probably[...] The amount of time it takes. (Hav, 14)

This is not to say that prior to the introduction of free bus travel young Londoners only made 'necessary' trips or did not experience themselves as becoming more independent. Indeed, several participants said that it would not affect their travel behaviour if they had to pay. Others, however, described the Zip card as making a real difference at an age when you may have a parental permission to travel by yourself, but prefer the company of peers than travel 'alone'

> F: The good thing about free travel is that when you're old enough to be able to get places your own, your parents don't take you, […you're still] not going to be employed because you're in fulltime education. And you might actually be at that stage where your parents give you a certain amount of money or no money and you have to use that money to get, to do what you want to do. And then you're old enough to want to go to the cinema every weekend and see your friends and just get out of the house and if you can't afford that then it is a little, it's annoying. (Sut, 18).

These benefits for independent mobility did not just apply to those with limited family finances. Rather it was raised by participants from a range of social backgrounds, as well as by both genders and by participants from across London. The benefit arose not simply from simply the removal of financial barriers, but from access that did not require parents to fund it. Importantly, even families with better resources might be unwilling to subsidise discretionary journeys: "That's the only trouble, you don't, it's not essential that you get travel and you get to where you want" (YS, 14) .

7.6 Fostering 'belonging': Zip cards and citizenship

Through its fostering of wider-ranging travel, the intervention contributed, for some, to a sense of 'belonging' to London as a community and of 'being a Londoner'. For young people, often aware that their concession was unusual to their city, this sense of belonging was at times explicitly framed as having an effect on wellbeing through fostering pride:

M: It [the Zip Card scheme]...makes you feel proud [to be a Londoner] because you're at the front of everyone, because you're the ones who have brought in these new schemes that are working and making your life easier...
F: And also you have this mutual understanding of [being...] a Londoner, you're the same as me now. ...And there's…this sense of community in this huge, huge [city.] (Sut, 15-18)

There was an awareness that this was a benefit not enjoyed by peers outside the capital, with one focus group participant describing how her "cousin [who] lives really far away...just wishes she could have more buses and the free travel...to get around more" (Hav, 14-15). Beyond the pride in having a scheme that was innovative, and marked their unique city, the Zip card enabled participants to 'know' a larger geographical area than would otherwise be the case. We have already outlined in earlier chapters the ways in which young people made excursions to the city centre and other parts of the capital. Many of the young study participants, in particular from the outer London boroughs, would recount exploratory bus journeys they had conducted 'up London' or to 'the West End', and those from all boroughs talked about the ways in which bus travel had opened up other parts of the city:

F: Mostly every Saturday we'll probably just jump on a bus because we have a free [pass] and go anywhere, and get another bus from there, and another one. And we just travel, we don't know where we're going ... [once] we ended up near Hammersmith, and near the West End (Isl, 16)

M: I think if you get the bus a lot you can try and, like, vary it [the routes you take] up so you get to know London (Isl, 12-13)

Concessionary bus travel, that is, affords young people a topographical engagement with their urban surroundings which enhances their familiarity with the city by rendering them "more aware of where you're going, how to get to places" (F, O, 14-15), and a number of young people explicitly welcome the opportunities they had to not only 'get to know' or 'learn about' London by travelling widely in it, but also feel that they 'belonged' as citizens. As one young person put it:

F: I like it [having the Zip Card] because you feel kind of unique... and it's only in London. [Y]ou can travel around London because you're a kind of a Londoner, but other people can't. (Sut, 17)

7.7 Social exclusion: young people with disabilities

Although financial barriers did not exclude young Londoners from travel in the city, this does not mean that the transport network was universally accessible. Young people with disabilities faced a number of problems in using buses, and transport exclusion was a key issue for them. For those using wheelchairs, limited space on the buses meant that only one could be accommodated at a time. This made it impossible to travel with friends if they were also using wheelchairs. Given the importance of travelling together, and for the journey to be part of the outing, outlined in earlier chapters, this is a real limit on social inclusion for young people.

Across three interviews with young people with disabilities, including six young people, only one person said they preferred the bus, because of the challenges of finding somewhere to park (even with a blue badge). The young people with disabilities used Freedom Passes, rather than Zip Cards, to access public transport (see Appendix 1). Notably, in contrast to the Zip Card holders, they did report any bus journeys as entertaining outings in themselves. Also in contrast with their more able bodied peers, who talked of bus travel as 'no hassle', and could recount a number of positive aspects of bus journeys, for young people with disabilities, buses were generally experienced specifically as 'hassle', and a barrier to participation, rather than a route for enacting participation. Journeys themselves were liable to be inefficient, as the wait for a bus with room to board might be long, and at times embarrassing, given the frequent problems with the wheelchair ramp:

> Some ramps don't tend to work, so that's a bit of a hassle … sometimes it's dangerous with an electric chair, it's heavy… I just think the bus driver should check the ramp is working (O, >16)

In addition to the practical problems encountered (e.g. difficulties in seeing the visual destination display from the wheelchair space; not being able to see outside on older buses, with their high windows), some had experienced a lack of consideration from other passengers and drivers. One example came from a young man with epilepsy, who recounted how when he had had a seizure on the bus:

> … people completely ignored my pleas for help. The driver drove on as if nothing was happening (O, >16)

Free bus travel was not, then, a sufficient condition for transport inclusion in the absence of accessible transport.

7.8 Conclusion

The quantitative evidence suggests some increase in travel for work or education among young people in London relative to adults. The scheme also appears to have influenced the travel of young people for education, entertainment and personal business in a relatively similar way across areas of deprivation.

The qualitative analysis suggests that financial barriers to transport were not an issue for young people in London. As we have no historical data to compare, it is impossible to attribute this specifically to free bus travel, but it seems likely that free and – crucially - universal free bus travel, in the context of a reasonably accessible transport system, meant that for most young people, lack of ability to pay did not restrict their mobility, or their opportunities to be independently mobile in their neighbourhoods and in the wider city. The exceptions (those with no Zip card; those with disabilities) support this interpretation.

Although social inclusion was explicitly tied in the policy aims of this scheme to access to education and training, our qualitative data suggests that a more salient aspect of the scheme for many was the enhanced access it provided to discretionary journeys. These were important journeys in terms of enabling participation in social life for young people, but parents may be less willing to pay for discretionary travel. **In summary, there is some evidence that the free travel scheme promoted access to education and training for young people, and good evidence from the qualitative data that it fostered social inclusion and independent travel for those young Londoners able to access the bus network.**

Chapter 8 Has the scheme displaced older people from the buses?

8.1 Introduction

One policy concern was that older citizens, in particular, would be displaced from the bus network if numbers of young people using the buses increased, either because of overcrowding, or through 'fear based exclusion'(17) (18). Older citizens also receive free bus travel, and in London a 'Freedom Pass', paid for by the London boroughs. Until April 2010, older people with their principal residence in London were eligible for a pass at 60 entitling them to free travel on bus, underground and tram services within the capital, without time restrictions, and rail services at off-peak times. Since then the qualifying age has been increasing in a graduated way, and will become 66 by 6 October 2020, As older citizens are also vulnerable to transport exclusion, with a consequent impact on their wellbeing (118, 119), one potential negative effect of young people's increased access to bus travel might be a reduction in their ability to use buses.

We used the travel diary data to explore whether there was any evidence that older people were in general using the bus less, or were specifically displaced from the network at times when young people were more likely to be using it (i.e. during peak school journeys times). We also explored older citizens' accounts of using the bus to explore how far the presence of young passengers affected their uptake and experiences of bus services.

8.2 Quantitative evidence on impact on older people's bus use

Trips by bus as a main mode

Before January 2009, older people could not use their Freedom Pass before 9.30 in the morning, so we restricted the analysis of impact on older people's travel to the afternoon school travel hours (i.e. 3pm to 4 pm, Monday to Friday) to assess any evidence of displacement. The average number of bus trips per older person per day remained at around 0.06 per day pre- and post-intervention. At other times of the day the average also remained constant pre- and post intervention (around 0.36 bus trips per person per day). The introduction of free bus travel was not therefore associated with a change to the average daily number of bus trips made by older people (relative change 1.07; 95% CI 0.91 to 1.21) (See Appendix A Table A9.2).

Distance travelled by bus

The average distance travelled by bus by older people remained constant during school travel hours at around 0.25 km per day, and at other times of the day it remained constant at around 1.2 km per day (relative change 0.95; 95% CI 0.80 to 1.11) (See Appendix A Table A9.2).

Short distance trips

The proportion of short (i.e. under 1 km) trips made by bus by older people during school travel hours increased from 7.1% to 8.4% of all trips, however this was not statistically significant (19% increase; 95% CI 47% decrease to 65% increase). The proportion of short trips made by bus at other times of the day declined from 7.3% to 7.0%, again not statistically significant (4% decrease; 95% CI 20% decrease to 14% increase) (See Appendix A Table A9.2).

8.3 Older citizens' accounts of sharing the bus network with young people

Some older people voiced a degree of disapproval of free travel for young people. This was based on a perceived 'unfairness': the Freedom Pass benefit was associated with a 'reward' for working hard all their lives, something young people had not yet done (120) . There was also a sense of temporal unfairness, with older citizens noting that they had not benefited from free travel when they were young themselves, or when their children were young. Some also expressed a dislike of young people 'abusing' the privilege, by jumping on and off the bus needlessly:

> F: Look how long we waited to get our Freedom Pass. Then these youngsters got it straight-away haven't they? (Sut, 80-84)

> F: Well I used to have to walk to school. They're not now, they get on for two bus stops.
> F: Yeah.
> F: And what are two stops? …
> F: Should use their legs. (H&F, 75-84)

However, on reflection, many considered that free travel for young people was a socially useful benefit, with advantages to young people and their families:

> M1: But what if they're young people who want to maybe go and see their old granny at the weekend or go and do her shopping in the evening?
> M2: Well
> M1: Yeah, it's a difficult one really.
> M2: Debatable, isn't it?

M1: Yeah.
M2: But basically it's supposed to be in education, isn't it? (Isl, <65-80)

F: It helps the parents especially now that things are a bit tight. I do believe they should. (H&F, 70-74)

Older people were, then, not particularly positive about the free fare concession for younger people in general terms. What was notable, however, was not the range of opinions on whether young people should have free bus use or not, but that this disapproval of the Zip Card scheme was never couched in terms of young people displacing them from the buses. This is not to say that there were no complaints about behaviour on the buses: indeed, some older citizens did report finding younger passengers on the bus network intimidating, and a few reported having changed their behaviour in response to the noise, crowds or jostling of school children on the buses:

M: Well you would have near enough got a seat straight away. Now you don't. They're so busy shouting and drinking and, because they all bring these bottles of stuff with them and talking to each other about what they're going to do and on their mobiles as well, that they just don't take any notice of you. And they're, they're in the way as I say, these great big pack bags, you can't get past them at all. It does spoil your journey really. (Sut, 80-84)

F: I don't go out when the children are coming out of school.(H&F, 74-85)

F: I think that most older people like me, over 60s, think the same as I do, that they're gonna wait for the 9.30 because the rush oh, the rush hour's over by then. And they can go whenever they wanna go (Isl, 70-74)

However, more typically, there was a general tolerance of the behaviour of young people, and even in instances of (as above) of 'discomfort based' displacement, these were reported to result in changed, or less pleasant, rather than abandoned, journeys. There were very few reports of fear based exclusion from transport. Despite many not enjoying travelling on buses used by school children, most pointed out that the noise and jostling was what one might expect from excited young people. Crucially, there was general agreement that this did not put them off using the services.

I: So it's not something you think it puts you off using the bus because there's children …?
M: Oh no, no, no, no
F: No, no.

M: No, no, never, we never think you know sometime you just, most of the time it happens so we are at that time about three o'clock, between two and three is when they come out, four they come in. But it doesn't matter it's a day …
F: It doesn't bother us really us no, no.
M: It doesn't bother us. (H&F, 70-79)

F1: Probably we done it when we were kids but we don't notice it you know
F2: It's high jinks isn't it? It's high jinks more than, we've never been involved in anything any time on the bus where there's been
F1: Trouble
F2: You know a stabbing or something like that or somebody's got beaten up. They seem to interact with one another, boisterous but not vicious. [Isl, 70-74)

Indeed many older citizens, from all boroughs, reported general civility from younger people, who would offer seats and allow them on first:

M1: Yeah, I must say, another thing, following what M2 said, I find the young people tremendously
M2: Helpful and kind.
M1: Willing to get up and give you their seat. (H&F, >90)

F: Because you're standing at the bus stop with hundreds, it seems like hundreds of girls screaming around you, the bus pulls up, they are polite, they do at least let you go first. (Sut, 70-74)

M: Young kids you'd think wouldn't let you off, but in fact I generally find, they may not be terribly nice to each other but to old, what they regard as old people they're quite good I have to say. Another example we were riding a bus quite late when we, 7.30, Ann and I were, and there were some young lads kicking the bus shelter. We didn't think this was the best place to be. When the bus came in they stood back and said, oh no, after you. You were first… (Sut, 60-69)

In part, the lack of reported displacement or explicit conflict with school children resulted from a normative assumption that school aged children and older people used buses at different times and

in different ways. Specifically, apart from avoiding school journey times, older people reported rarely using the upstairs of double decked buses, or the back of single deck buses:

> F: Well I can't say I have been on buses that often when schoolchildren, when youngsters have, but occasionally I do. And yeah, sometimes they're a bit noisy and so on but then I would probably go downstairs if they're all rushing upstairs. (Sut, 60-69)

> I: And would you ever go upstairs?
> F: Oh no
> **I:** No?
> F: No. [*Laughter]*
> I: Is that because of?
> F: It's not because of the children it's because I can't be bothered walking up the stairs
> F: I just don't bother about going up, if I had to go upstairs we'd have to but we never ever go up there we'd rather stand (Isl, 70-74)

The reluctance to use the upstairs of the bus reflected a general consensus about where and when was a reasonable and comfortable time and way to travel, with older people avoiding the school run times, and the places on the bus where young people preferred to sit (upstairs, or downstairs at the back). These preferences were, as in the quote above, rarely attributed to intimidation, but rather to decisions about maximising comfort and convenience. They also, of course, became part of a culture of expectations about where and how to travel, with 'taken for granted' nature of the division of space and time according to age on the buses evident in the fact that breaches of the norm were often a source of amusement:

> F: If I'm out at the weekend with my friend, if we're going say to Kingston, we'll go upstairs on the bus. [Laughter] We behave like kids. (Sut, 70-74)

> F: I will pick my, grandchildren up, sometimes…And they always want to go upstairs [*general laughter*]. (Isl, 65-89)

Data from young people reiterated these normative expectations about the arrangements of seating on the bus (what one young person called 'the segregation'):

M: [T]he reason why I'd go on the top deck [is] because sometimes the bottom's really congested yet there's so many seats available on the upper deck. ...
F: And that's why... most children are on the upper deck, more seats for the elderly and adults down on the lower deck. ...
M: [Y]ou're doing it so there's more space at the bottom deck for the elderly and that. (Sut, 13-16)

Older citizens' choices of when to travel were, then, largely rationalised as made for comfort and convenience reasons, and the expectations of where different passengers preferred to sit were in general shared by younger and older passengers. There is little sense of 'exclusion' based on fear. Further, if 'discomfort based' exclusion from certain journeys, such as school run times, was an issue, this was as likely to be generated by the desire to avoid crowds of commuters as young people.

I would avoid the peak times, if I can
[noises of agreement]
?: And, um, in the morning when everybody's rushing to work. I mean we've been there [we've worked], we know what it's going to be like.
?: Yeah, yeah [laughing]
?: And, um, coming home times if you can avoid them
?: And I, yes
?: And I think, and I, I do try to avoid the school bus.
[General agreement and laughter]
?: And you see loads of us have got all day, we, we, we know the times to go, you know
?: When the school get out. (Isl, 65-89)

Indeed on occasion, children were overtly preferred as fellow passengers:

F: Yeah, yeah, between the office mob and [the young people] … if I had to choose who to travel with I'd choose the school boys… I used to avoid, um, travelling early in the morning, because obviously people are going to work and, and they're all sort of focussed on going to work, so they, you know, there's no give-and-take then. And I would avoid school runs, obviously, and then the same in the evening. But now, in between, you've got these mums, as well… (Isl, 70-74)

Avoiding rush hour commuter and school travel meant that older people were more likely to be in conflict over space and seats on the bus with other adults, and specifically (in the accounts we have of displacement) parents with young children, particularly those with large pushchairs. Indeed, the final comment in the quote above is typical in that the most likely conflicts over the space on buses reported were around the space reserved primarily for wheelchairs or pushchairs, which was typically near the more accessible seats at the rear door, simply because those using them tended to travel at the same times of day as older travellers and be 'competing' for the same restricted space. These conflicts were often reported with vigour and irritation:

> F: And do you know that bus driver… came up to me, and asked me to get out of my seat and give it up for the lady with the buggy. He wouldn't move [the bus] off until I got up off that seat… I got off the bus because I was like [gestures angrily with clenched palms] (Isl, 65-89)

This is in contrast to the tenor of reports of conflicts with younger passengers, which had a sense of routine disapproval, but rarely anger. Indeed, rather than being a source of comment on fear or risk, stories of encounters with younger travellers, particularly children, were often used in interviews as a way of demonstrating strategies for dealing with potential difficulties. Older passengers were clear that they could 'manage' conflicts, and were not intimidated by the crowded and on occasion confrontational bustle of a busy city. This woman, for instance, talking of how difficult it can be to board a bus in the mornings, goes on to say that she personally has few such problems:

> F: But I can get to the front of the queue quite easily.
> *Laughter*
> I: OK, what tricks do you use to get to the?
> F: Shopping bag. Well you have, you have to. But I notice we all use the same techniques and the bus drivers are very good. If they see an elderly woman there and all these children they come right where the elderly person's standing. (Sut, 70-74)

This ability to 'manage' and the strategies used to negotiate access to their rightful place in the queue or a seat on the bus meant few older participants reported limitations on their ability to travel that resulted from other passengers. Typically participants ended comments about rowdiness or unpleasantness from young people with a comment asserting that they (if not necessarily other people) were able to cope:

> F1: Yeah, yeah young people it doesn't really stop you going anywhere or whatever

F2: We go wherever we want don't we?

F1: Yeah that's right.

F1: It doesn't stop us. (Isl, 70-74)

This is not so say that managing such navigation and the potentially difficult interactions with other bus users was necessarily pleasurable. Some participants did report limited, or decreasing, confidence in using the bus service, and talked of avoiding certain routes or times of day (121). Indeed, a number talked of the challenges of access as physical impairments began to limit ability to stand, or balance on a moving bus. However, the presence of larger numbers of young people were not reported as a significant cause of anything more than unpleasantness, and even stories of challenges had some positive implications for older citizens' self-esteem simply because they provided opportunities to both exercise, and then account for, valued agency in the world, as a competent, coping and even 'hardy' traveller. The presence of young people on the buses might be a reason for avoiding the school run if possible, but so was the presence of large numbers of other travellers. It was never given as a reason for avoiding buses.

8.4 Conclusion

We found no quantitative evidence that older passengers had been 'displaced' as a result of the introduction of free bus travel for young people, and our qualitative data provided further evidence that displacement due to overcrowding or fear was not a major issue. Our qualitative data may have underestimated the impact of young people on older people's travel behaviour simply because we are less likely to have included older people who did not travel, and we therefore may have missed examples of fear based exclusion. However, the older citizens who participated came from a range of backgrounds and settings, and were in general articulate on their complaints about other passengers, and about young people's entitlement to free travel. What was notable was the lack of any overt complaints about young people making them unwilling to travel, in comparison perhaps to the more open commentary on the unpleasantness of conflicts with other passengers. This is largely because older citizens and Zip card users are not competing for the same 'space': older citizens preferred different seats on the bus, and tended to avoid times of day when young people (and commuters) are using the buses anyway.

In summary, there is no evidence that free bus travel for young people had an impact on older people's travel behaviour or, therefore, the travel-related determinants of their wellbeing.

Chapter 9 Does the scheme represent value for money?

9.1 Aim and perspective

This chapter describes the methodology and results of an economic evaluation of the free bus travel scheme. The aim of the economic evaluation was to determine whether the intervention 'free bus fares for 12-17 year olds' represents value for money if we take public health effects into account, by comparing two alternative scenarios in terms of their costs and outcomes. These two alternative scenarios are:

- *Scenario 1: Do-Something – the bus network is free for 12-17 year olds*
- *Scenario 2: Do-Nothing – the bus network is not free for 12-17 year olds*

Before free bus travel was introduced in 2005, secondary school-aged children paid a reduced flat fare for journeys on the London bus network. Therefore, we assume in Scenario 2 that the target group, 12-17 year olds, are charged half the adult fare. While Scenario 1 can be observed in recent years since the intervention, Scenario 2 requires that a counterfactual be created; describing the state of the world *if* the intervention could be removed. This is a standard requirement in *ex post* evaluation.

In terms of determining the impact of the policy the research has utilised the methodology of developing counterfactuals to determine what would have happened in the absence of the policy (*Scenario 2*). The core counterfactual has been developed based on a comparison with what happened with the age group 25 – 59 year olds in London over the same time period. This has the advantage that this age group would have been influenced by all other interventions put in place in London over the same timeframe (e.g. road user charging), but were assumed not affected by the free bus fares policy for 12 – 17 year olds. The implication is that where a statistically significant difference between the groups is observed this difference can be attributed to the intervention. Where data was available additional counterfactuals have been calculated for certain outcomes.

A number of potential outcomes of this intervention were identified by the study and reported in previous chapters. Those that are included in the economic evaluation are described in Table 9.1. A cost benefit analysis (CBA) framework was developed to allow a range of different impacts of the intervention, to be included and so to determine whether the intervention represents good value for

money. Using well established literatures on the monetary values of key inputs we compared the net monetised benefits of the intervention with the costs of implementation.

Table 9.1: Outcomes

Outcomes	Description
Safety	Changes in casualties due to the intervention
User Benefits	Changes in consumer surplus due to reduced cost of travel
Revenue	Changes in revenue as a results of free fares
Physical Activity	Changes in walking and cycling
Crime: Intentional Injury	Changes in crime rates as a result of free fares
Decongestion Benefits (including carbon dioxide (CO_2) emissions)	Changes in vehicle km as a result of free fares
Costs	Description
Administrative Costs	Due to the intervention, e.g. creating and posting Zip cards
Bus Operating Costs	Due to changes in the number of bus passengers

There are some limitations associated with the use of CBA as an organising framework, which are addressed in Section 9.12. Nevertheless, CBA is a useful tool for combining outcomes across a number of government departments/areas of public service (122).

9.2 Timeframe and evaluation framework

The outcomes and costs in Table 9.1 have been calculated for a representative year (2009) and for the intervention applied to the target age group (12-17 year olds). An annual appraisal is feasible because the costs arise on a recurring, annual basis. To use any longer appraisal period would introduce unnecessary speculation about the duration of the policy. The evaluation framework used is shown in Table 9.2. In the following sections, the individual elements of this table are described in

detail. The report summarises the results of the monetisation of the outcomes in section 9.11, and then discusses limitations and implications for future research in section 9.12.

Table 9.2 Economic Evaluation – CBA framework

Outcomes	Costs	Benefits
Safety		X
User Benefits		X
Physical Activity		X
Decongestion: including Noise, CO_2 emissions, Local Air Quality.		X
Crime		X
Revenue[l]		X
Administrative Costs	X	
Bus Operating Costs	X	
Net Social Benefit (NSB)	X	
Benefit Cost Ratio (BCR)	X	

X = included in CBA methodology

9.3. Safety

[l] Note: revenues to TfL are treated in CBA as a benefit - they can be used for investment, to distribute among other users, or for other purposes. Of course the impact on the Users is already included (in User Benefits), so that a fare rise, for example, would create a disbenefit to Users in this framework – whether it created a benefit to operators would depend on the demand response.

The study hypothesised that there will be a change in casualties as a result of the introduction of free bus passes for 12-17 year olds (see Chapter 6). This section uses data from Chapter 6 to estimate the benefits from changes in casualties.

Methodology

To determine the change in casualties as a result of the intervention two calculations are required:

1. Scenario 1: with intervention – this has been calculated based on the observed casualties as recorded by the STATS19 data average over the period 2006-2009 (see Table 9.3);
2. Scenario 2: without intervention – this has been calculated using two different methods to determine a counterfactual.

Table 9.3 Scenario 1: Recorded number of casualties among young people, 12-17 in London (STATS19)

Severity	**2006**	**2007**	**2008**	**2009**	**Annual average**
Fatal	16	14	13	9	13
Serious	202	168	155	144	167
Slight	506	481	490	502	495
Total	724	663	658	655	675

Two counterfactuals were calculated to assess what would have happened over the same timeframe in the absence of the intervention.

- *Counterfactual 2a:* assumes that in the absence of the intervention that the pre-post change in injuries in young people 12-17 in London would be similar to the pre-post change in adults in the 25-59 years age group in London (see Table 9.4).
- *Counterfactual 2b:* assumes that in the absence of the intervention the pre-post change in injuries in young people 12-17 in London would be similar to the pre-post change in injuries in young people in the same age group in the rest of England (see Table 9.5)

In both cases the counterfactuals make use of the number of injuries to 12-17 year olds in the pre period (2001-2004) (A) and the observed number of injuries to 12-17 year olds in the post period (2006-2009) (B). For counterfactual 2a, evidence on the pre-post ratio of adult injuries (C) over the same period is used to determine what could have happened in the do nothing scenario and this is then multiplied by (A) to get expected number of injuries under the counterfactual. For counterfactual 2b the same process is used but in this case the pre-post ratio of injuries for 12-17 year olds in the rest of England is used to determine the expected number of injuries.

Table 9.4 Safety – Counterfactual 2a; using adult injuries in London as the control

	No. of 12 – 17 year old casualties in the pre period (A)	Observed number of 12 – 17 year old casualties in the post period (B)	Counterfactual: pre – post ratio of adult casualties (C)	Expected No. of 12 – 17 year old casualties under counterfactual (AxC)	Change in 12 – 17 year old casualties attributable to the intervention: Observed – Expected (B-(AxC)) (2006 – 2009)
Fatal	74	54	0.78 (0.68, 0.89)	58.0 (50.3, 65.9)	-4 (-11.9, 3.7)
Serious	1753	987	0.67 (0.65 , 0.69)	1175 (1140 , 1210)	-188 (-223, -12)
Slight	9394	5616	0.71 (0.70, 0.71)	6670 (6576, 6670)	-1054 (-1054, -960)

Table 9.5 Safety – Counterfactual 2b; using 12-17 year old injuries outside London as the control

	No. of 12 – 17 year old casualties in the pre period (A)	Observed number of casualties in the post period (B)	Counterfactual: pre – post ratio of 12 – 17 year old casualties rest of England (C)	Expected No. of casualties under counterfactual (AxC)	Change in casualties attributable to the intervention: Observed – Expected (B-(AxC)) (2006 – 2009)
Fatal	74	54	0.80 (0.72, 0.89)	59 (53, 66)	-5 (-12, 1)
Serious	1753	987	0.82 (0.79, 0.84)	1437 (1385, 1473)	-450 (-486, -398)
Slight	9394	5616	0.84 (0.84, 0.85)	7891 (7891, 7985)	-2275 (-2369, -2275)

The results from using the two counterfactuals indicate that over the period 2006 to 2009 the policy has had an impact on the number of casualties in the 12-17 age groups. With the exception of fatal casualties all the 95% confidence intervals exclude zero, indicating that the reduction in casualties is unlikely to be due to chance.

Monetary Values

Transport collisions impose a range of impacts on people and organisations including through lost economic output, pain, grief and suffering and health and medical and ambulance costs. Through a range of methods (as described in 123, and 124) values to society for these impacts have been determined by severity of collision. The values for casualties are provided in Table 9.6, in 2009 prices.

Table 9.6 Average value of prevention of casualty by severity and element of cost (£ June 2009 prices)

Injury severity	Lost Output	Human Costs	Medical and Ambulance	TOTAL
Fatal	545,040	1,039,530	940	1,585,510
Serious	21,000	144,450	12,720	178,160
Slight	2,220	10,570	940	13,740

Source: DfT (123)

Calculations

For the year 2009, the values in Table 9.6 have been applied to the results in Tables 9.4&9.5 (which have been converted into a number per year). For example for every fatal casualty prevented the value applied from Table 9.6 is £1,585,510.

Table 9.7 Calculation of the value to society from reductions in road traffic casualties as a result of the intervention

	Values			Change In Casualties			Present Value of Benefits
	Fatal	*Serious*	*Slight*	*Fatal*	*Serious*	*Slight*	
	(A)	*(B)*	*(C)*	*(D)*	*(E)*	*(F)*	*((A*D) + (B*E) + (C*F))*
Counterfactual 2a. 25 - 59 year olds in London							
	1,585,510	178,160	13,740	1.0	47.0	263.5	**13,579,520**
Confidence	1,585,510	178,160	13,740	-0.93	38.11	240.00	8,621,126
Interval	1,585,510	178,160	13,740	2.97	55.64	263.50	18,234,795
Counterfactual 2b. 12 - 17 year olds in England							
	1,585,510	178,160	13,740	1.25	113	569	**29,839,513**
Confidence	1,585,510	178,160	13,740	-0.25	99.50	568.75	25,145,168
Interval	1,585,510	178,160	13,740	**3.00**	**121.50**	**592.25**	34,540,485

In summary, the results using counterfactual 2a are a benefit to society of £13,579,520 in 2009 (within a 95% confidence interval of £8.2m to £18.6m). The results using counterfactual 2b (Table 9.5) are included in the sensitivity tests in Section 9.11 and Table 9.7.

9.4 User benefits

The study has hypothesised that there will be user benefits of the scheme , namely a welfare gain for individuals who currently travel for free and previously had to pay and an increase in accessibility (see Chapter 7), as a result of removing bus fares for 12-17 year olds. This section uses data from TfL to estimate those user benefits.

Methodology

The methodology that will be used to determine the change in user benefits involves calculating the change in consumer surplus as a measure of welfare change, using the user benefits approach described in DfT (125). The user benefit measure is designed to capture the benefits from an accessibility gain as measured by the generalised cost (GC) function including accessibility gains from reductions in cost, reductions in travel time, improvements in journey quality and benefits to any new users who travel more due to the reduction in generalised cost.

Measuring generalised cost from *i* to *j* will usually follow the structure below

$$GC_{ij} = \text{Fare}_{ij} + \text{Time Cost}_{ij} + \text{Other Disutility}_{ij}$$

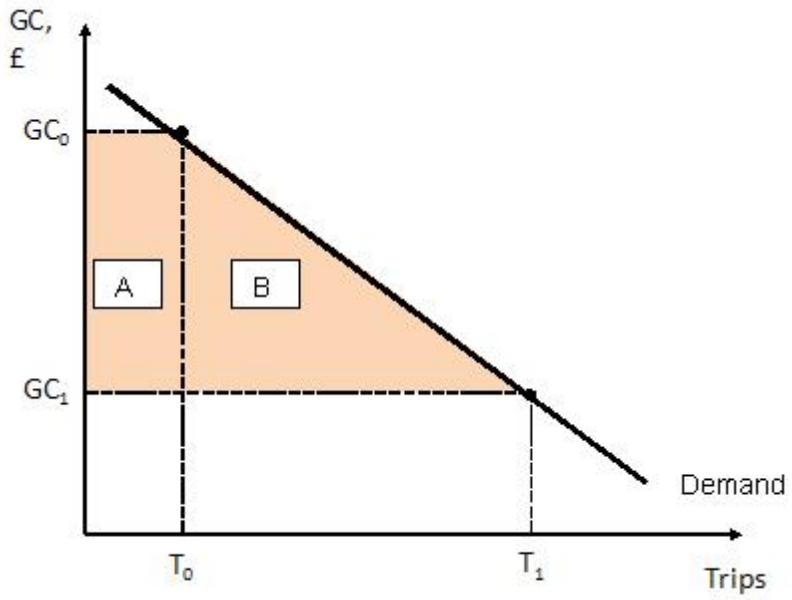
where:

- Fare is the money cost of a trip – e.g. the bus fare;
- Time Cost is an amount calculated using 'values of time' which represent the inconvenience of time spent travelling;
- Other Disutility is a term which includes the individual's valuation of any other trip characteristics which are relevant (e.g. inconvenience of a high floor to a bus user).

The relationship between GC and user benefits is shown schematically in Figure 1. Before a scheme is introduced the generalised cost to the user is GC_0 and at this cost level T_0 trips are made. If for example the fare cost is removed (as is the case in this scheme) this reduces the GC by ($GC_0 – GC_1$). The result of this reduction in GC per trip is an increase in trips made from T_0 to T_1. The user benefit

resulting from the introduction of the scheme equates to shaded area A for current users and shaded area B for new users (increased travel or accessibility). The demand curve is shown as a straight-line which is consistent with a common assumption in transport appraisal known as the 'rule of a half' which is a rule of thumb used to interpolate between two known points when the rest of the demand curve is unknown.

Figure 9.1 New user and current users' benefits from the introduction/ enhancement of a scheme that reduces generalised costs



If all the required data points are known then the value of both of these areas can be calculated and the impact on accessibility determined. The calculation to determine the user benefits for areas A and B is completed using the following formula:

User Benefits (A+B) = $0.5*(GC_0-GC_1)(T_0+T_1)$

Data was collected from TfL on the number of free journeys in the age group 12-17 years, in the year 2009. There were 247,297,000 free journeys (T_1). The single bus fare in 2009 was £1 (if paid using an Oyster Card) (126)[m]. It is assumed for this analysis that young people would have been charged half this fare (50p) in the absence of the intervention. Therefore the difference between GC_0 and GC_1 is £0.50. The key input that needs to be determined to allow the user benefits to be calculated

[m] It should be noted that the data used to populate the number of trips for 12 – 17 year olds in 2009 were taken from data collected by TfL through Zip card use. This is a different data set from that used in Chapter 3, which drew on travel diary data relating to term time (Monday to Friday) only. The TfL datset was not available for the 'before' period of the intervention, prior to data collection via Zip card use.

is T_0. This is the trips that would have happened in the absence of the introduction of free fares (the counterfactual).

Two counterfactuals were calculated to assess what would have happened over the same timeframe in the absence of the intervention.

- Counterfactual 2a: assumes that expected bus travel is based on a statistical analysis of what happened in the same period to adults in the 25-59 age groups in London
- Counterfactual 2c: assumes that expected bus travel is based on demand elasticities and trip generation factor.

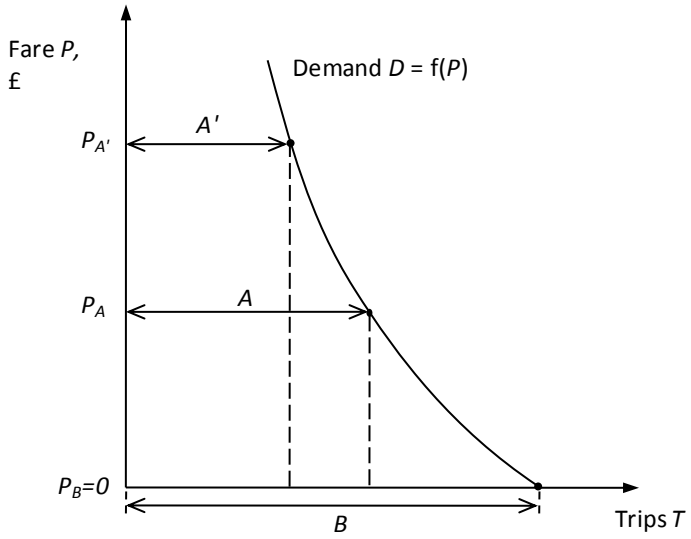
Counterfactual 2a assumes that in the absence of the intervention the pre-post change in bus use would be similar to the pre-post change in bus use in adults in the 25-59 age group. Data from the London Area Travel Survey (LATS) were used to determine the change and are reported in Chapter 3. It should be noted that the LATS survey data only included data from term time weekday trips. It is therefore likely that this has underestimated the change in trips for 12 – 17 year olds, if an increase in trips (outside the journey to school) takes place at weekends and out of term time. The pre-post ratio of adults trips was 1.36 (95% confidence interval of 1.25-1.46). This indicates that over the same period bus trips for adults increased by 36% (25%-46%). The number of bus trips made by the 12-17 age group was not collected in the pre period. Instead, the 'before' trips have been derived from the LATS and are provided in Table 9.8. The resulting change in bus trips for the 12-17 age group is 22m within a 95% confidence interval of between 15 million and 40 million bus journeys.

Table 9.8 Counterfactual 2a: Expected bus journeys based on a statistical analysis of what happened in the same period to adults in the 25 – 59 age group in London

	12-17 year old trips in the pre period (A)	12-17 year old trips in the post period (B) (2009)	Counterfactual: pre-post ratio of adult trips (C)	Expected 12-17 year old trips under counterfactual (AxC)	Change in 12-17 year old trips attributable to the intervention: Observed - Expected (B-(AxC))
Bus Trips	165,754,820	247,497,000	1.36 (1.25,1.46)	225,426,555 (207,193,525, 232,056,748)	22,070,445 (15,440,272, 40,303,475)

Counterfactual 2c[n] uses the data reported in Balcombe et al (72) to estimate the change in trips associated with the price elasticities of demand and implied trip generation rates from the change from a half fare charge per trip to a zero charge per trip. Figure 9.2 shows the demand curve given the price levels. $P_{A'}$ is the full fare that an adult would pay, P_A is the half fare that a young person would pay. P_B is the zero fare. Balcombe et al (72) provides data on expected changes in trips as a result of changing from a half fare to a zero fare and the difference in elasticity of demand associated with a child compared to an adult.

Figure 9.2 Trip generation factor



For a reduction in child fares from a flat (or half) fare P_A to free fare P_B , 'trip generation factor' (TGF) = B/A. Given a trip generation factors for the reduction from Full Fare to Flat Fare, and from Full Fare to Free Fare, the TGF of interest can be deduced:

$$TGF_{FullFare \rightarrow FlatFare} = \frac{A}{A'} \quad (1)$$

- $$TGF_{FullFare \rightarrow FreeFare} = \frac{B}{A'} \quad (2)$$
- $$\Rightarrow TGF_{FlatFare \rightarrow FreeFare} = \frac{B}{A} \quad (3)$$

[n] This scenario does not use LATS data results from Chapter 3. It is based on what is expected to happen when there is a price change using price elasticities.

Given values of 1.33 and 1.60 for (1) and (2) in general demand, we infer (3)=1.20 (72), TGF=B/A for child =1.20. This should be considered a broad-brush estimate. Therefore it should be expected that a reduction from half fare to zero fare for a child would generate 20% more trips. It would imply that the whole change in number of 12-17 year old bus trips could be attributed to the intervention. Under counterfactual 2c., T_1 is 247,497,000 and T_0 would be 197,997,600, with the increase in trips due to reducing from half fare to zero being 49,499,400.

Calculations

Applying the following formula (User Benefits (A+B) = $0.5*(GC_0-GC_1)(T_0+T_1)$) to the trips associated with the intervention in counterfactual 2a. and 2c. produces the following results. It was assumed that the half fare of 50p would be applied for both the counterfactual scenarios. The results are provided in Table 9.9, which indicates that benefits to users from reduced fares and increased access to the bus network have generated user benefits to society of the order of £118m.

Table 9.9 User Benefit Results

	Change in Fare $(GC_0 – GC_1)$ (A)	$T_0 + T_1$ (B)	User benefits = 0.5*A*B
Counterfactual 2a	£0.5	472,923,555	£118,230,888
Counterfactual 2c	£0.5	445,494,600	£111,373,700

In summary, both of the methods used to determine the user benefits of the intervention estimated that there would be considerable positive user benefits. The majority of these benefits are the result of the population group (12- 17 year olds) that were using the bus prior to the intervention now not having to pay. In the absence of a true counterfactual, both the scenarios tested have generated similar levels of user benefits as shown in Table 9.9. Whilst the quantitative analysis (Chapter 3) did not identify a statistically significant change in bus use for 12-17 year olds, it should be noted that this data was based on LATS, which only includes weekday term time travel, which has a greater potential to underestimate the changes in bus travel for the population group. By contrast, counterfactual 2c in Table 9.9 used the full TfL trip dataset for 2009, and with elasticities to estimate

trip generation, indicated that there was an additional 49.5 million trips annually as a result of this intervention.

9.5 Decongestion benefits

The study hypothesized that one of the benefits to society from the introduction of free bus travel would be a reduction in congestion, as there would be a switch away from using the car. Consequently, there would be a reduction in the negative impacts of congestion (e.g. air pollution, noise, CO_2 emissions etc) which have been identified by the literature as having an impact on public health (20). This section assesses the benefits from decongestion of the free bus travel scheme.

Methodology

The methodology used to determine the impact of decongestion benefits has been to estimate the change in kilometres (km) travelled by car (for those aged 12 – 17 years old) as a result of the intervention and apply values from DfT (127) which provide unit costs in pence per vehicle km applicable to either reduced or additional vehicle km. These unit costs are provided in Table 9.12. It should be noted that this study has calculated directly the change in injury costs in the section on Safety using the STATS19 data. Therefore the ''Accidents" element of the decongestion benefit has been omitted to avoid double counting.

The LATS data has been used to determine the change in car km (for the target age group) following the intervention. The following counterfactual was used to represent the absence of the free bus travel:

- Counterfactual 2a: assumes that expected car km (for the target age group) is based on a statistical analysis of what happened in the same period to adults in the 25-59 age groups in London

One of the key issues with the LATS data is that it only includes weekday and term time travel. This potentially has the impact of underestimating the impact of the change in decongestion from the intervention, as it does not include holiday and weekend travel. For this reason decongestion benefits have only been included in the CBA framework analysis as a sensitivity test.

Table 9.10 Expected car km Counterfactual 2a.: Using adults aged 25- 59 in London as the control.

	12-17 year old car km	12-17 year old car km in	Counterfactual: pre-post ratio of	Expected 12-17 year old car	Change in 12-17 year old car km

	in the pre period (A)	the post period (B) (2009)	adult trips (C)	km under counterfactual (AxC)	attributable to the intervention: Observed - Expected (B – (AxC))
Car km	1,757,566	1,253,077	0.89 (0.84, 0.94)	1,564,233 (1,313,955, 1,652,112)	193,333 (105,454, 443,611)

In order to determine the value to society of the reduced vehicle km, the change in vehicle km identified in Table 9.10 has been assigned to the different road types in Table 9.11, based on the percentage of vehicles experiencing congestion on each of the three different road types in London.

Table 9.11 Proportion of traffic in London by road type

	London		
	Motorways	*A roads*	*Other Roads*
Congestion (Proportion of traffic)	*4.76%*	*55.56%*	*39.68%*
Traffic Vehicle km: Mean	*8,313.3*	*106,333*	*78,687*
CI : (Maximum)	*21,114.9*	*246,470*	*176,024*
CI : (Minimum)	*5,019.6*	*58,000*	*41,844*

Source: Adapted from DfT (127) and Table 9.10

Monetary Values

Congestion imposes large costs on society. Through a range of research methods the cost of an additional car km on the road has been estimated and presented in DfT (127), (Table 9.12). These values are applied to the number of vehicle km saved in Table 9.11 to obtain an estimate of the decongestion benefits.

Table 9.12 Marginal external costs for cars (pence/km)

	Motorways	*A Roads*	*Other Roads*
Congestion (Average)	*0.1*	*69.2*	*48.4*

Infrastructure	*0.0*	*0.1*	*0.1*
Accidents	*0.0*	*3.0*	*3.0*
Local Air Quality	*0.3*	*0.3*	*0.3*
Noise	*0.2*	*0.2*	*0.2*
Greenhouse Gases	*0.9*	*1.0*	*1.2*
Indirect Taxation	*-5.3*	*-5.6*	*-7.1*
Total	*-3.8*	*68.1*	*46.1*

Source: DfT (127)

Calculations

Using the monetary values in Table 9.12 and the changes in vehicle km in Table 9.11, the estimated decongestion benefits are as presented in

Table 9.13. This indicates that the expected benefits are of the order of £10m (within a 95% confidence interval of £23m and £5m). It should be noted that these results are only representative of the benefit from changes in term time weekday travel.

Table 9.13 Sensitivity Test: Decongestion Benefits from the reduction in car km

	Motorways	A Road	Other Roads	Total
Total (excluding accident costs) mean	-£ 29,927	£6,922,278	£3,391,409	£10,283,760
CI (maximum)	-£111,908	£16,045,197	£7,586,634	£23,519,923
CI (minimum)	-£19,074	£3,557,800	£1,803,476	£5,342202
Using the mean				
Greenhouse Gases	*£7,482*	*£106,333*	*£94,424*	*£208,239*
Noise	*£1,663*	*£21,267*	*£15,737*	*£38,667*
Local Air Quality	*£2,494*	*£31,900*	*£23,606*	*£58,000*

In summary, using the results of vehicle kms (calculated using LATS) indicates that there are potentially positive benefits to decongestion as a result of the intervention with reductions in car travel.

9.6 Active travel and physical activity

The study hypothesised that there would be a change in levels of active travel (walking and cycling) as a result of the intervention of free bus fares for young people (see Chapter 4) which may lead to a change in physical activity. This section examines whether we can estimate the benefits from a change in physical activity as a result of the scheme.

Methodology

Chapter 4 of this study used data from the LATS and LTDS to determine the current levels of walking and cycling in London following the introduction of free bus fares. As with the previous outcomes we determined a counterfactual case using a comparison with the walking and cycling levels in the 25–59 age group over the same period. The research identified that there was no significant change

in the total distance walked following the introduction of the free bus fares (Chapter 4). The study identified a small decline in the amount of cycling that the age group 12–17 were undertaking. Combined together (walking and cycling changes) there was no significant change in the amount of physical activity for the 12–17 year old age group as a result of the policy, so no monetary value is included in the CBA framework.

One of the key methodologies that are available to determine the monetary value to society from changes in physical activity levels is the WHO (128) HEAT methodology. In the documentation it states that:

> "HEAT should not be applied to populations of children, very young adults or older people since the available evidence was not sufficient to derive a relative risk for these age groups" (p20).

Given this finding in HEAT's application, it should be noted that more research is required to allow an assessment of the monetary benefit to society of increases in walking and cycling for children as a result of an intervention. The current methodology as applied to adults can be found at WHO (128) and DfT (129).

9.7 Crime

The study hypothesised that there would be a change in assaults as a result of the intervention [see chapter 6]. This section uses data from TfL and Chapter 6 to estimate the benefits from changes in assaults.

Methodology

Evidence from TfL indicates that crime rates on London's transport network have declined over the period in which the intervention was implemented (see Table 9.14), despite increasing numbers of bus trips. It has not been possible to split this data into crime type or to determine a counterfactual from this data. For example, it has not been possible to identify the age of the crime victims and so compare 12-17 year olds with 25-59 year olds.

Table 9.14 Volumes of crime on the London transport network

Total Crime (notifiable)	2005/06	2006/07	2007/08	2008/09	2009/10

Bus	39,142	38,482	33,125	27,170	24,976
Tram	428	418	402	411	403
LU/DLR	18,987	18,818	16,609	15,351	14,825
London Overground	490	553	447	535	517

Source: Transport for London (130)

Analysis was also carried out within the project using the Hospital Episodes Statistics (HES) data to determine whether there was a change in assaults associated with the intervention. It was hypothesized that an increase in bus trips could lead to an increase in assaults. The HES data was analysed using the assault rates in the same period to adults (25-59 years old) in London as the basis for the counterfactual. As shown in Table 9.15 this analysis resulted in the identification of an increase in assaults per year. However, the impact pathway is complex and it is difficult to prove causality (see Chapter 6). For this reason, this increase in assaults has only been included in the CBA framework as a sensitivity test.

Table 9.15 Counterfactual 2a: Expected assault rates based on a statistical analysis of what happened in the same period to adults in the 25-59 age group in London

No of 12-17 year old assaults (A) (2001 – 2004)	Observed No of assaults post period (B) (2006 –2009)	Counterfactual: Pre – post ratio of adult injuries (C)	Expected No. of assaults under counterfactual (A * C)	Change in assaults attributable to the intervention: Observed – Expected (B-(A*C))	Change in assaults per year
2321	3322	1.19 (1.16, 1.22)	2762 (2692.3, 2831.6)	560 (490.4, 629.7)	140 (122, 157)

Monetary values

The best estimate of the social costs of assaults on buses in England is provided by Home Office 'social costs of crime' evidence, adapted to public transport for DfT (131). A weighted average value of £13,592 per assault on buses and trams has been used, at 2009/10 prices. For the derivation see Table 9.16.

Table 9.16 Derivation of a weighted average value per assault

Crime type	Number of incidents	Weighting by number of incidents	Estimated unit cost, £ (2006/7 prices)		
			Costs of consequences of crime	Costs in response to crime	Total
Violence against a person (passengers)	39,390	0.85	3,267	9,923	
Sexual offences	7,004	0.15	6,196	3,556	
Average (2006/7 prices)			3,709	8,962	12,671
Average (2009/10 prices)					13,592

Sources: DfT (131); HM Treasury (132).

Note: number of incidents includes multipliers for under-reporting.

A proposal early in the study was to use the value for Serious Injury from DfT advice (123), noting that the definition of Serious Injury by DfT (123) is: "Serious injury: records casualties who require hospital treatment and have lasting injuries, but who do not die within the recording period for a fatality". Using the serious injury value, it was found that results would be an order of magnitude higher (>10 times higher), however the rationale for the assaults value is much stronger because it is much more specific to the outcome that has been measured. Therefore the results including the assaults value (Table 9.16) only are provided as a sensitivity test.

Calculations

Using the monetary values in Table 9.16 and the change in assaults in Table 9.15 the results for inclusion in the sensitivity test are provided in Table 9.17. It indicates that the change in benefit to society is of the order of -£1.9m (mean) within a 95% confidence interval of -£1.7m and -£2.1m.

Table 9.17 Sensitivity test: inclusion of social cost of assaults

Crime type	Change in assaults (Table 9.11)	Estimated unit cost, £ (2009/10 prices)	Benefit of change in assaults, £ (2009/10 prices)
Mean	140	13,592	-1,902,900
CI minimum	122	13,592	-1,658,241
CI maximum	157	13,592	-2,133,966

In summary, the project explored the inclusion of changes in assaults as a result of the intervention. Unlike road safety, the major impact pathway is complex for crime, and it is difficult to demonstrate causality, as data were not directly linked to bus use, but admission to hospital. For this reason, the increase in crime observed after the intervention was introduced has been included as a sensitivity test.

9.8 Revenue

One of the consequences of the intervention is that those 12 – 17 year olds who would have previously paid half fare in 2009 are now travelling for free. This reduces the revenue that would be received by TfL. The methodology used to calculate the change in revenue is described next.

Methodology

In the 'do something' scenario TfL will receive a revenue of £0 as those in the age group 12-17 who previously paid to travel by bus now are exempt from paying. In order to determine the level of revenue in the 'do-nothing' scenario two counterfactuals were tested based on the results from the user benefit calculations.[o]

- *Counterfactual 2a: Expected bus travel based on a statistical analysis of what happened in the same period to adults in the 25 – 59 age groups in London (Source: Chapter 3)*
- *Counterfactual 2c: Expected bus travel based on demand elasticities and trip generation factor (Source: Balcombe et al (72))*

The calculations indicate that in the absence of the free fare, approximately 225m journeys (netting £113m) would have been made by the age group 12-17 year olds within a 95% confidence interval of £104m - £116m. Using counterfactual 2c this number is reduced to a loss of £99m.

Table 9.18 Revenue calculations

	Expected trips in the counterfactual (A)	Child Half Fare (B)	Revenue (A*B)
Counterfactual 2a	225,426,555 (207,193,525, 232,056,748)	0.50	Mean £113m CI Minimum £104m CI Maximum £116m

[o] For details on the calculation of the number of trips see User Benefit Section.

Counterfactual 2c	197,997,600	0.50	£99m

Calculations

The results of this analysis are provided in Table 9.18. Using counterfactual 2a it is indicated that had the intervention not been in place that revenue of the order of £113m (within a 95% confidence interval of £104m and £116m) could have been realised in 2009.

Note that the results below on Bus Operating Costs include a sensitivity test which incorporates both Bus Operating Cost and Revenue changes.

9.9 Administrative costs

The introduction of free bus fares resulted in additional administrative costs for TfL. One element of this is the issuing of travel cards to allow 12- 17 year olds to be able to travel for free[p].

Methodology and calculations

Based on data collected from TfL it was estimated in the period of time 2006-2009 that they issued the following number of cards per year and the following cost of issuing each card:

- <16 130,000 1st Issue cards (cost of £7.26 per card) = £943,800; 150,000 replacement cards = £1,089,000
- ≥16 180,000 1st issue cards (cost of £7.16 per card) = £1,288,800; 40,000 replacement cards = £286,400

For the CBA framework we have included the cost to TfL for producing the cards. The total costs to be included in the CBA are £3,608,000.

9.10 Bus operating costs

It was hypothesized that the introduction of free bus fares to the 12-17 age group would lead to additional marginal operating costs for the operator. This section provides the methodology for calculating these.

[p] Since 2011 this policy has been changed and 12 – 17 year olds are now charged £10 per card to cover these costs. This was not the case in 2009 and has not been included in the CBA.

Methodology

In general, the additional costs of providing for an increase in concessionary travel may include:

- additional marginal operating costs, due to carrying more passengers on existing bus services; and
- potentially, additional marginal capacity costs, if there is an increase in the number of services operated.

A bottom-up analysis of *marginal operating costs* shows that these comprise the following items (133):

- fuel, tyre wear and oil consumption,
- maintenance and cleaning,
- insurance,
- information provided to passengers,
- additional vehicle time due to changes in changes in boarding and alighting.

The impact of a policy which increases bus travel will be to increase total bus operating costs by the amount of the marginal operating cost, for each additional passenger due to the policy. Evidence and calculations are given below.

Marginal capacity costs are conditional on how the operator chooses to respond to an increase in passenger demand. If the operator can absorb the additional demand without running additional services, the marginal capacity cost will be zero. In the case of London, where bus services are tendered by TfL, the question is the extent to which the set of bus services tendered by TfL has changed as a consequence of the policy. Since modelling of the network was ruled out for this study, the primary source of information is TfL's advice on the tender agreements with operators. These tender agreements are usually renewed on a five yearly basis, on a rolling cycle across the network, sometimes with a two year extension if performance is satisfactory. The agreements do not identify any capacity increase specifically to accommodate additional travel by under 18s due to the free travel policy. The initial 'with policy' scenario (Scenario 1) therefore assumes zero marginal capacity cost. As a sensitivity test, we also draw parallels between the cost of providing the Freedom Pass for older and disabled travellers in London, and the cost of providing the 12-17 year olds' concession, which leads to some substantial additional costs.

Monetary values

The *marginal operating cost* for an additional concessionary passenger is estimated to be £0.061 at 2009/10 prices (134). These costs vary with average journey length and using the results of Dargay and Liu (135, Table 5) average journey length is 2.9 miles in London versus 3.9 miles in England, hence a revised value for London including a distance-based adjustment is given by:

Marginal operating cost (distance weighted) = 0.055 + 0.006*(2.9/3.9) = £0.0595

Conversely, costs of inputs such as labour and land are higher in London. In the absence of a direct cost comparison, the South East weighting of 1.314 from recent bus profitability research was used (136):

Marginal operating cost (distance and regional cost weighted) = 0.0595*1.314 = £0.0781

A measure of the overall loss to bus operators is the amount of compensation they require to accept a concessionary scheme, and a comparator in London is offered by the Freedom Pass. The total negotiated payment to TfL for Freedom Pass (and National Scheme) bus travel in 2009/10 was £188.6 million (137). This is understood to correspond to 307.7 million bus trips using Freedom pass in that year. Hence the cost per bus trip, including revenue forgone and additional operating costs, is approximately £0.61 on average.

Results

Given the increase in trips by 12-17 year olds due to the policy under different counterfactual assumptions, the estimated additional *marginal operating costs* are shown in Table 9.19. In Scenario 2a the expected amount is £1,718,200 per annum.

Table 9.19 : Additional marginal operating costs (existing service pattern)[q]

Counterfactual scenario	Δ12-17 year old bus trips, million per annum, compared with Do-Something	ΔCost, £million per annum
2a. Based on London adults as the control		

[q] Note the change in 12- 17 year old bus trips are taken from section 9.4 and table 8

Mean	22.1	1.72
CI minimum	40.3	3.15
CI maximum	15.4	1.21
2c. Elasticity approach	49.5	3.87

The comparison with Freedom Pass suggests that the total of additional operating costs and revenue forgone may be much more substantial, equal to £0.61*247.5 million = £152 million. Given the results for revenue alone (Table 9.18), the additional operating costs may be of the order of £39 million. However, this figure should be treated as highly uncertain because: 12-17 year olds' trip-making patterns and timing differ from those of over-60s or disabled people; hence the scheme's impact on peak vehicle requirements and capacity generally is different; and 12-17 year olds may be especially capable of making full use of upper-deck space and standing room aboard buses (see Chapter 8) – in this respect their impact on capacity requirements may be reduced.

9.11 Evaluation framework results

The framework initially set up in Table 9.2 can now be populated with the costs and benefit results, so giving the Net Present Value (NPV) and Benefit: Cost Ratio (BCR) of the intervention (Table 9.20 & Table 9.22) The results for the counterfactual where all the inputs are based on a comparison with the change in 25-59 year olds (counterfactual 2a) are shown in Table 9.20.. The benefits from the intervention to society as a whole are found to be greater than the costs incurred: at £13.5million (confidence interval £11.5-£17.3million) the NPV is substantially greater than zero. Moreover, the value for money offered by the intervention appears to be high. DfT (138) provides a value for money rating scheme for transport interventions for BCR (Table 9.21) – based on this the intervention exhibits high value for money and would have a high chance of funding (BCR between 2 and 5).

Table 9.20 NPV and BCR, with Main Outcomes (Base Case)[r]

		Counterfactual based on 25-59 year olds in London		
		Scenario 1 vs Scenario 2a.		
Benefits		**Mean**	C.I. min	C.I. max
	Safety	**13.6**	*8.6*	*18.2*
	User Benefits	**118.2**	*113.7*	*119.9*
	Revenue	**-113.0**	*-104.0*	*-116.0*
	Physical Activity	**~**	~	~
	Crime			
	Decongestion			
Costs				
	Administrative Costs	**3.6**		
	Bus Operating Costs	**1.7**	*3.2*	*1.2*
PVB		**18.8**	*18.3*	*22.1*
PVC		**5.3**	*6.8*	*4.8*
NPV		**13.5**	*11.5*	*17.3*
BCR		**3.5**	*2.7*	*4.6*

Table 9.21 Value for money – BCR ratings and funding expectation

BCR range	Rating	Funding expectation
<1	Poor	'No projects' funded
1.0 to 1.4	Low	'Very few projects'
1.5 to 1.9	Medium	'Some, but by no means all projects'
2.0 to 4.0	High	'Most, if not all, projects'
>4	Very High	

Source: DfT (2009)

[r] Note following abbreviations – Benefit Cost Ratio (BCR), Net Present Value (NPV), Present Value of Benefits (PVB), Present Value of Costs (PVC).

Alongside the main results using counterfactual 2a, a set of sensitivity tests were conducted to examine how changes in the assumptions would alter the results, and to assess the robustness of the results (Table 9.22). These include alternative counterfactuals and additional outcomes. To interpret the table, numbers in italics should be treated as alternatives to the entries in the first three columns, or as additional where there is no entry in the first three columns.

Two alternative counterfactuals are shown. The first substitutes the base case safety outcome values with the counterfactual based on a comparison with 12-17 year olds outside of London. This leads to a substantial increase in NPV and BCR of the project (BCR ranges from 5.7 to 7.5 with a mean of 6.6), and although this is judged to be a less likely outcome than the base case result, (given that it is not based on a London setting) it does add to confidence that the true BCR is >2.

The second alternative counterfactual uses an estimate of changes in trips based on demand elasticities, rather than using the 25-59 age group as a control. This alters the user benefits, revenue and bus operating costs. The results again imply a high value BCR (3.5), which is encouraging from a value for money perspective.

The second set of tests deal with additional outcomes. These were carried out to explore the implications of including costs and benefits which had been excluded from the main results (Table 9.20) because of limited confidence in validity or attributing causality.

- The study identified an increase in assaults, although there remains a question over causality and hence the usefulness of the results for policy analysis. Including the estimated disbenefits associated with assaults would marginally reduce the BCR (to 3.2) but not threaten the high value for money rating.
- Decongestion benefits, including reduced delay, CO_2 emissions, noise and local air pollution, would add further to overall benefits of the policy. An additional £10million (range £5.3-23.5 million) would be added to the NPV, and the expected BCR would be increased from 3.5 to 5.5.
- Finally, an attempt was made to estimate the potential marginal capacity costs to bus operators by comparison with the Freedom Pass scheme for older and disabled users. The results were found to be highly uncertain; nevertheless if they are included, they act to reduce the NPV to – £23.8 million and the BCR to 0.4. Hence the finding is that the results of the evaluation are sensitive to the treatment of bus operator costs.

In all bar one of these sensitivity tests the analysis has resulted in a positive 'high value' BCR, indicating that the intervention (given the outcomes considered) has represented good value for money taking into account the impact on public health. It also implies that there would have to be significant negative outcomes *not* already represented in the framework, to result in a negative NPV and BCR <1. Connecting this result with the qualitative findings it can be identified that there were additional positive benefits such as fostering social inclusion (Chapter 7) which if presented alongside have the potential to make the results stronger in favour of the intervention.

Table 9.22 Counterfactual Scenarios and Sensitivity Tests (2009, and 2009 prices)

		Counterfactuals							Sensitiviy Tests							
		Counterfactual based on 25-59 year olds in London			Counterfactual based on 12-17 year olds outside London			Conterfactual based on elasticity	Include Assaults (S1. vs S2a.)			Include Decongestion Benefits (S1. vs S2a.)			Include additional capacity costs	Include all
		Scenario 1 vs Scenario 2a.			Scenario 1 vs Scenario 2b.			Scenario 1 vs Scenario 2c.								
Benefits		**Mean**	C.I. min	C.I. max	Mean	C.I. min	C.I. max		Mean	C.I. min	C.I. max	Mean	C.I. min	C.I. max	Mean	Mean
	Safety	**13.6**	*8.6*	*18.2*	*29.8*	*25.1*	*34.5*									*13.6*
	User Benefits	**118.2**	*113.7*	*119.9*				*111.4*								*118.2*
	Revenue	**-113.0**	*-104.0*	*-116.0*				*-99.0*								*-113.0*
	Physical Activity	**~**	~	~												~
	Crime								*-1.9*	*-1.7*	*-2.1*					*-1.9*
	Decongestion											*10.3*	*5.3*	*23.5*		*10.3*
Costs																
	Administrative Costs	**3.6**														*3.6*
	Bus Operating Costs	**1.7**	*3.2*	*1.2*				*3.9*							*39*	*39*
PVB		**18.8**	*18.3*	*22.1*	*35.1*	*30.4*	*39.8*	*26.0*	*16.9*	*17.2*	*16.7*	*29.1*	*24.1*	*42.3*	*18.8*	*27.2*
PVC		**5.3**	*6.8*	*4.8*	*5.3*	*5.3*	*5.3*	*7.5*	*5.3*	*5.3*	*5.3*	*5.3*	*5.3*	*5.3*	*42.6*	*42.6*
NPV		**13.5**	*11.5*	*17.3*	*29.7*	*25.1*	*34.5*	*18.5*	*11.6*	*11.8*	*11.3*	*23.8*	*18.8*	*37.0*	*-23.8*	*-15.4*
BCR		**3.5**	*2.7*	*4.6*	*6.6*	*5.7*	*7.5*	*3.5*	*3.2*	*3.2*	*3.1*	*5.5*	*4.5*	*8.0*	*0.4*	*0.6*

9.12 Limitations

This study has sought to develop an economic evaluation of the public health impacts of the intervention, focusing on the costs and benefits for one year (2009) following the implementation of the scheme in 2005. The evaluation is based on the quantitative research within this study plus available secondary data and valuation evidence. The evaluation is wide-ranging compared with most transport policy evaluations, however it does have some limitations which are worthy of discussion.

One limitation is that the study has focused on available data for the immediate *ex post* period 2006-2009, rather than seeking to forecast into the future the longer-term health impacts that the intervention might bring. More research is needed in both public health and economics to translate an increased used of bus travel into longer-term public health impacts, particularly with respect to outcomes such as physical activity, which are expected to have most of their benefits in the future.

Similarly, the long-term impact on life chances and independent living, as a result of increased mobility between the ages of 12-17, has not been possible to quantify and hence to include in the economic evaluation. There are some hints of it in the qualitative assessment. This topic would also benefit from targeted research.

Another limitation that was raised during the research was the impact of using values that were designed to be applied to adults to the context of young people aged 12–17. This was highlighted in the context of the WHO (128) evidence for changes in physical activity, but is also relevant for the change in safety and intentional assault, whereby the value of statistical life calculated based on an adult has been applied. Further research is required to determine if this value should be different and what values could be applied to children.

Particular challenges in attributing causality arose with assaults. The question is whether the policy impact is swamped by background trends (e.g. in youth crime) which are not picked up in the counterfactual, hence they appear as 'effects of the policy' when in reality they are not. Particularly in the case of assaults, there is a need for: better data linking the hospital episodes to bus travel; or a wider-ranging analysis of assaults in which 12-17 year olds' mobility is set alongside other factors and trends. Conversely it is easier accept the findings on mode shift and trip generation based on well understood relationships in transport demand. In general, the authors take the view that the counterfactuals do serve the intended purpose, however in the case of assaults there is a case for further investigation. Having said this, the magnitude of the 'change in assaults' that was found

makes it doubtful whether any changes to the analysis of assaults would materially affect the case for the policy.

Wider economic impacts are another difficult area, linked to the increased access to employment and training provided by the policy. A more detailed understanding of trip purposes for 12-17s, starting with data gathering, would be helpful in providing a more concrete assessment of these impacts. Moreover, WebTAG has some limitations for application in economic evaluation of public transport and public health interventions, where there are intended and unintended public health consequences. Further work is needed to resolve this issue.

Finally, whilst a CBA framework has enabled the range of outcomes considered in the quantitative work to be valued and included in overall NPV and BCR, one of the key weaknesses of a CBA framework is that it excludes those outcomes that cannot be monetised. The qualitative research [Chapter 7] identified that there were other potential outcomes from the intervention that this approach has not been able to capture. For example, the universal availability of free travel seems to be particularly valued (Chapter 3), since young people can be confident that any and all peer group members can travel in that way. It was not possible to monetise that effect within the scope of this study, and additional survey work would be require to attempt to capture it. That evidence would then need to be considered alongside the results of the current CBA to provide a more comprehensive description of the intervention. For the moment, it remains necessary for the person using the evaluation results to weigh the CBA against the qualitative and unmonetised impacts.

9.13 Conclusions

From the perspective of the CBA framework, there is a body of evidence indicating that the policy has reduced road traffic injury, increased bus travel, and reduced car travel, whilst not reducing levels of active travel in the city. **In the base case the benefits have substantially outweighed the costs, providing what the Department for Transport considers 'high' value for money. Sensitivity testing was conducted, and most of these tests do not overturn this conclusion, Only a sensitivity test with substantial additional capacity costs of bus operation threatens the positive NPV of the policy, and there is no firm evidence that this was the case.**

Chapter 10 Discussion and conclusions

10.1 Introduction

Many policy and infrastructural interventions, among them educational, housing and transport measures, have had a significant influence on public health despite their not having an explicit public health brief. As public health in the UK moves to a new context, with a base in local authorities, understanding the positive and negative effects of such interventions, and their potential to widen or narrow inequalities in health, becomes increasingly important. This study explores the effect of such an intervention, using qualitative and quantitative methods. It evaluates the public health impact of a transport intervention which was not designed with public health improvement as an aim, but which was likely to have a range of effects, positive and negative, on the immediate and future health of young people (the target population) and the wider population in London. At a time when universal benefits in general and concessionary fares in particular are under scrutiny, evidence on these putative health effects are important in informing decision-making. This study therefore aimed to provide evidence on the public health effects that could be attributed to the introduction of free bus travel for young people, and to conduct a cost-benefit evaluation which takes these health effects into consideration.

10.2 Main findings

Our study provides empirical evidence on key questions in the debates around whether such schemes are worth investment, and their effects on outcomes such as active travel, injury rates, social inclusion and sustainability. We first outline the main findings, in terms of the causal pathways hypothesised in Chapter 2 (see Figure 2.1).

Increase in bus use by young people In the context of rising levels of bus use in London, there was no quantitative evidence that the scheme itself had increased the number of journeys with the bus as the primary mode, or the number of kilometres travelled by bus by young people compared with adults during term time weekdays. However, these had gone up overall for both groups. There was evidence that the number of short journeys had risen. The qualitative data provided some evidence that the universal scheme, cost free to young people at the point of use, contributed to this, and also potentially to discretionary journeys not identified in travel diary data. The qualitative data also

described how bus travel had become the default mode of transport for many journeys, because it enabled young people to travel together.

Decrease in active travel Although the number of journeys with walking as a main mode decreased, there was little evidence that overall levels of active travel had reduced, in part because bus travel entails some walking, and (qualitative evidence suggested that) the scheme had generated additional journeys. Few journey are made by bicycle in London, and compared with adults (for whom cycling rates had gone up), young people were cycling less after the introduction of free travel. Young people's accounts of travel suggested that cycling was not, in general, considered a candidate transport mode, but we do not know whether this has changed since the introduction of free travel. On balance, then, it is difficult to attribute changes in cycling to the introduction of free bus travel, although reasonable to suggest that free bus travel for all would militate against other attempts to increase cycling rates.

Impact on health and wellbeing from changes in modes of transport We could not assess this directly in this study. A systematic review of the literature (87) (See Appendix 8) found little evidence that increasing the amount of active transport has a direct effect on health outcomes, but these are difficult to measure given the long timescales for benefits to accrue. The qualitative data suggested a number of benefits from increased access to transport for young people, including increased ability to be independently mobile, increased control over their travel, and fostering a feeling of 'belonging' to London. These are difficult to quantify, but confidence, independence and a sense of belonging make an important contribution to young people's wellbeing.

A reduction in car use Journeys by car declined in both adults and children, but it is difficult to attribute these changes to the scheme rather than other interventions over the same period. Qualitative evidence suggests that in outer London in particular, free bus use had displaced some car journeys.

Decreased future dependence on car travel The qualitative data suggested that although young people still expected to learn to drive as a rite of passage to adulthood, bus use had been 'normalised' by the intervention such that it was not seen as a transport mode of last resort.

A reduction in bus use, especially in school hours, by older citizens aged 60+ There was no evidence that young people's free travel had displaced older citizens from the buses in general, or

specifically during the afternoon peak school journey times[s]. The qualitative data suggests that older citizens often preferred to travel outside school and commuter times for reasons of comfort and convenience.

A reduction in road traffic injuries in young people We identified a relative reduction in injuries which was consistent with the mode changes observed, i.e., a reduction in car occupancy and in cycling. Against a background decline in road injury rates, the decline in 12-17 year olds was faster, primarily reflecting declines in car and cycling casualties.

An increase in the incidence of assault injuries Assaults in young people had risen compared with adults and with the national population. However, the increase predated the introduction of free bus travel. For most young people, the risks associated with travel were to some extent mitigated by free bus travel, which allowed: 'practice journeys'; a contingency plan for avoiding getting stranded; and (for girls) a perceived safer alternative to walking.

Increased access to training, education, independent travel We found no evidence of a flattening of the socio-economic gradient of travel for educational purposes after the scheme was introduced. However, qualitative data suggest that financial barriers do not contribute to transport exclusion for young people in London. For those able to use the bus service, the scheme has ensured that all can access education, training and the social opportunities essential for social inclusion.

Has the scheme represented value for money? From the perspective of the CBA framework and representative year 2009, the policy has reduced road traffic injuries, increased bus travel and reduced car travel whilst not reducing levels of active travel. In the base case, the monetised benefits have substantially outweighed the costs, providing what the Department for Transport considers 'high' value for money.

10.3 Assessing the evidence and revising the logic model

We have presented the quantitative and qualitative evidence for the pathways hypothesised as potentially linking the intervention (free bus travel) to outcomes related to the determinants of health. We can now revisit the logic model proposed in Chapter 2, to summarise the impact of free bus travel on public health in a graphic way, using a revised logic model (see Figure 10.1).

[s] Until January 2009, older citizens were ineligible to use their pass before 9.30am. Since then, London Freedom pass users have been able to use their passes 24 hours a day should they wish to. We therefore conservatively restricted analysis to the after school hours.

First, we now clarify the meaning of the intervention. The key elements of the intervention were that it provided free bus travel for all young people in the context of broader policies that improved the bus system in London. What we evaluated was 'universal free bus travel in the context of a good bus service'. Our findings relate to this, and we have specified the intervention (access to universal free bus travel for young people) and major elements of the context (efficient, accessible, bus network) which are preconditions for the effects we have identified from the intervention.

This general context also had some effects which interacted with the effects of the free bus scheme, such as the increasing the use of bus travel for the whole population, contributing to normalising bus travel, so we have added lines indicating this.

The context also has effects that act on the study outcomes of interest, independently of the free bus scheme. One we have included here, as data were generated as part of the research on older people's use of bus services, is a positive impact on the wellbeing of older citizens in London (121).

The quantitative elements of this study attempted to control for this context to some extent by identifying specific effects of the intervention on the target population of the scheme itself. Evidence for these links (e.g. for an increase in short trips by bus) is indicated by black lines.

Our revised model indicates where there was no evidence found from the quantitative or qualitative analysis for an impact on public health (displacement of older people from the bus network; increase in assaults), and where there was weak evidence, such as suggestive evidence from the qualitative component only (future dependence on cars). This model is not an exhaustive description of the many pathways that link free bus travel to the public health, or an attempt to evaluate whether the scheme overall has been 'good' or 'bad'. The outcomes on the right of the model are diverse, and adjudicating between them both value-laden and often linked to disciplinary, occupational or lifecycle priorities. For example, physical activity outcomes are prioritised by public health researchers, while road engineers tend to prioritise injury outcomes, and young people themselves prioritise social inclusion. We have mapped outcomes that were of interest to stakeholders and were theoretically and plausibly related to determinants of health and present a summary of the available evidence from this study for these.

In summary, this model suggests that where free bus travel is offered to all young people in the context of a good bus transport system, then there will be public health gains in terms of young people's social inclusion and ability to travel independently; there will be minimal impact on the overall amount of active travel young people do; some indication that dependence on car travel is reduced and no evidence that there is a consequent impact on older citizens' use of bus transport.

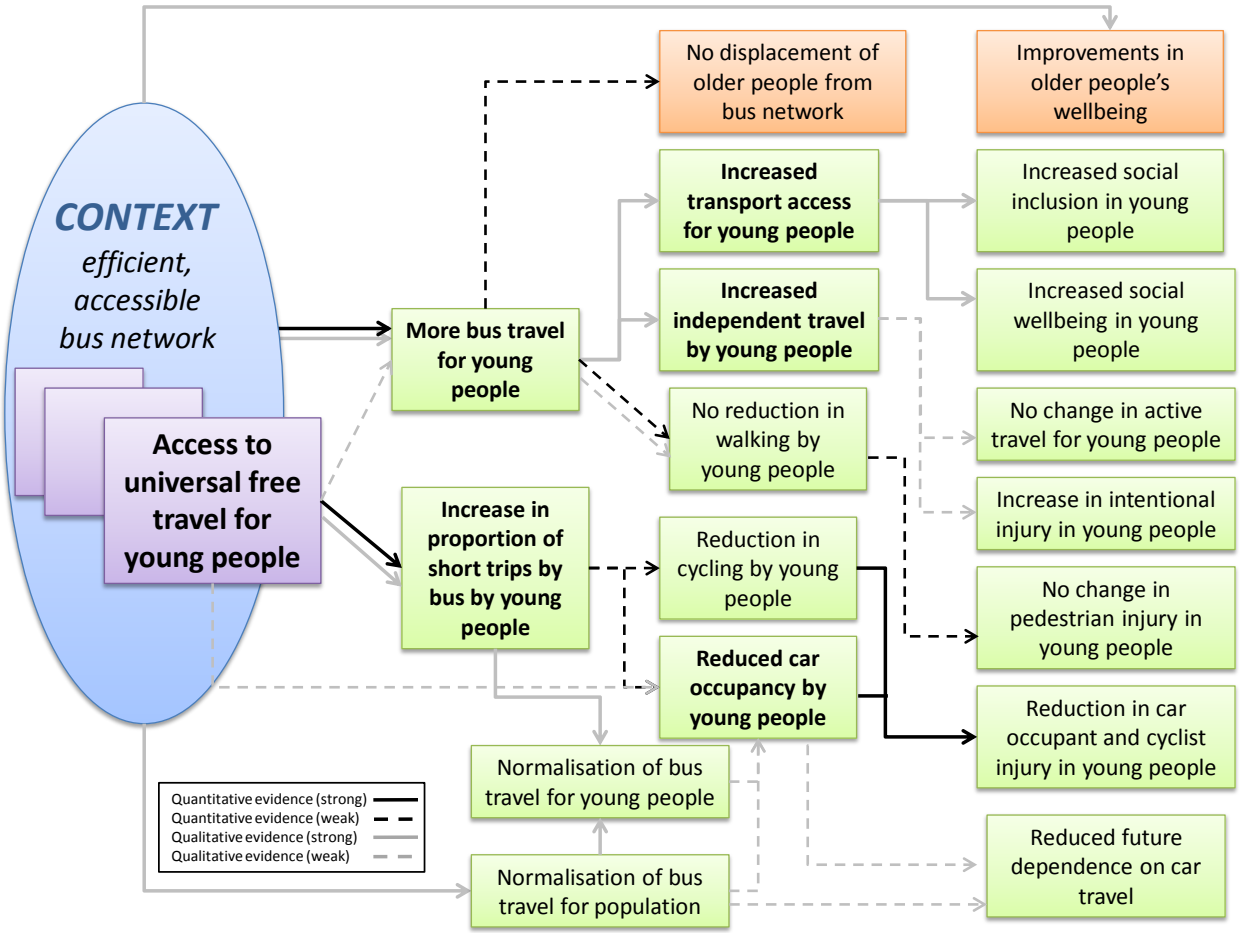


Figure 10.1 Revised model of pathways between intervention and determinants of health

10.4 Strengths and weaknesses of the study

The design

If the aim of an evaluation is interpreted as one of attributing causal effects between the intervention and outcomes, our design has a number of weaknesses that result from the inability to control for confounders. We mitigated this in so far as we were able by our design for the quantitative elements drawing on best practice for designing studies of natural experiments (79). In particular we published a protocol for the quantitative component of the study (89) (See Appendix 7), specifying hypotheses and the sub group analyses planned. We identified secondary data sets that provided before and after data (for travel modes), and some time series data (for injuries and assaults). Our use of comparisons with adults in London provided proxy 'non-exposed' controls, as changes in young people relative to adults are unlikely to be the result of general changes in, say, bus provision in the capital unless these other changes specifically affect young people disproportionately. We have also used proxy 'dose-response' measures, such as comparisons between inner and outer London and between boroughs with greater or lesser uptake of free bus travel, where possible. Finally, we developed a logic model to help understand the underlying causal pathways between intervention and outcomes.

In line with MRC guidance on complex interventions (84), we included an economic evaluation to assess the costs and benefits of this intervention, from a societal perspective. This is inevitably limited in that not all costs and benefits can be monetised, and many (such as reduced future dependence on private car travel) are too far in the future to include. However, in the context of increased scrutiny of concessionary fare policies, in almost all scenarios the benefits outweigh the costs – the only exception is a sensitivity test for a hypothetical case in which the additional capacity costs of bus operation were assumed to have increased substantially.

There are of course unknown confounders, and the more general problem of picking up 'signal from noise' when looking in isolation at individual changes within complex systems. To offset these weaknesses and build a fuller picture of the impact of the intervention on public health as a whole, we have utilised a multi-method approach which has built up an assessment of public health impacts in an iterative way. To link process measures (transport mode change) to health outcomes, we conducted a systematic review of prospective studies on active travel to assess the strength of evidence on whether increasing the amount of active travel in the population was likely to benefit health.

Using secondary data sets

The use of secondary data sets made a before and after evaluation feasible, given that there were existing data sets relating to key outcomes of interest. However, there are always limitations in using data for purposes other than that for which they were designed. Here, the travel diary data available for London, although more detailed and extensive than National Travel Survey data, only related to term-time week day travel for our pre-intervention period. Given that young people's travel behaviour differs across the year and week (56) we may have therefore underestimated both positive and negative effects of the scheme on outcomes relating to mode change. The use of qualitative data allowed us to offset these weaknesses to some extent by providing some data on other journeys.

The data set on road traffic injuries, STATS19, has some well documented limitations in terms of completeness due to the under-reporting and under-recording of traffic collisions (139). However, this only presents a threat to validity of our results if data completeness has changed over time *disproportionately* for the target group in relation to our comparator groups, which is unlikely.

Hospital Episode Statistics (HES) data, available at a national level, enabled a comparison to made between the incidence of assault injuries in London and those occurring elsewhere in England. HES data record the age of the patient and therefore allowed age-specific rates to be derived. Furthermore, HES data are more likely to be complete over time and so the chance of reporting bias is reduced, unlike data collected on crime occurring on the transport system (e.g. bus incident reports). However, the coding of *location* within the external cause of injury code is not complete for a substantial proportion of records. This meant that a detailed analysis of assaults according to the place of occurrence (e.g. on the bus, in the street) was not possible. As the hypothesised pathway between the intervention and incidence of assaults did not specifically refer to assaults on the buses, but rather that young people's increased travel would leave them vulnerable to assaults in general, the lack of location was not a major limitation.

The population: 'young people'

Our analysis largely addressed the implications for public health of 'young people' as a whole, rather than attempting to differentiate the effects by gender, deprivation, or other variables. In London, there are, for instance, known differences in road injury rates by gender, deprivation (140), and

ethnicity (41), and on the likelihood of walking for different kinds of journey by ethnicity (56). It is plausible that these demographic factors will therefore modify the effects of the scheme on outcomes such as transport mode change and RTI. Our focus in this study was on the health effects at a population level, and we used sub-group analyses for sensitivity tests and for estimating dose-response proxies only. That is, our aim has been to use these sub-group analyses to strengthen the credibility of claims made about the population as a whole, rather than to identify sub-group differences *per se*. A similar approach was taken to the qualitative data, which we have largely treated as referring to single population of 'young people' and 'older citizens', except where location (e.g. inner or outer London) or gender has relevance for the interpretation of our findings. We sampled for heterogeneity in terms of residence, gender, ethnicity, age, and transport modes available, in order to ensure that our sample was not representative of only a narrow sample of the population, but have not sought to analyse our qualitative data comparatively across these characteristics, and a larger sample would be needed to explore differential impacts of the scheme across populations. We are aware that there are likely to be large differences in how issues such as 'independence' or 'risk' are discussed across gender (141) or age, with those aged 12 likely to differ from the older age groups included. Our aim in this study was not to add to the literature on these differences, but more research is needed on how effects likely to be important for the public health are distributed across populations.

The comparator: adults 25-60

To ensure an adequately powered comparison, we have included all adults aged 25-60 as the main comparator group (i.e., those 'non-exposed' to the intervention). Although this is a pragmatic choice, including only those with no direct experience of free travel as young people, it does have some limitations in that it includes a larger range of ages than the intervention group. Additionally, as a 'control' group, there are limitations in that adults aged 25-60 have been subject to some interventions which are likely to have affected their travel choices disproportionately compared with the 'intervention' group (such as schemes to encourage cycling to work). We have also been unable to assess whether the intervention has shifted bus travel by adults to underground train services, which is one hypothetical outcome of higher bus use by young people.

Strengths of natural experiments

One difficulty facing researchers evaluating complex social interventions is that the intervention effects are moderated by the context (88). We therefore provided details of the context of this intervention and have described how this affects the study findings.

We suggest, for instance, that the general context of improved bus provision, which also affects adult bus use, and is thus 'controlled for' to some extent in our design, is also an important precondition for the effects we see from the intervention. This is because it 'normalises' bus transport for the wider population, whilst also making it viable for young people to exercise peer-based preferences for travel. Without good transport provision, even if all young people had free travel, bus travel would not necessarily be experienced as a 'normal' and reasonable way to travel, as this also required that other Londoners were using buses, and that buses were relatively accessible and efficient. This was evident in the accounts of young people with disabilities: free travel was not, *in the absence* of accessible and good transport, a contributor to social inclusion. However, the fact that most young people were making frequent use of the bus service also has some (if marginal) consequent effects on bus use by adults, as reported in the occasional stories in groups of family outings that are now possible because young members get free travel. This in turn reinforces the normalisation of bus travel as a mode of transport for the whole population. A natural experiment enables a description of what happens in 'realistic' policy environments, i.e., ones in which a mix of interventions is likely to be implemented simultaneously.

Finally, an important strength of a natural experiment is that the importance of the system as a whole can be appreciated. One key finding of this study may not have been identified with a randomised controlled design, should this have been theoretically possible. This is that the structural properties of this transport system have effects which are not simply 'additive' at an individual level. Specifically, many of the effects of the scheme which have been identified in the qualitative findings arise not from the fact that bus travel is free, but from the fact that it is *universally* free for young people (142). This is what is sometimes termed an 'emergent property' of the system i.e. a property of the system as a whole that arises from the interaction of individual parts but cannot be predicted simply by summing the activity of those individual parts (143) (144). Had the scheme been restricted to particular types of journeys (e.g. the journey to school) or specific groups (e.g. low-income families), many of the effects evident in young people's accounts may not have been realised. We have described in detail how the effects of the scheme are in part a result of the fact that it is available in principle to all young Londoners, and can both accommodate the social, peer-oriented nature of young people's travel choices and become the default mode. The exceptions demonstrate that these effects only hold when transport is both available and accessible (as young people with disabilities do not enjoy them) and suggest that free bus travel, rather than improvements in general in the bus service, are responsible (as those who have no Oyster card did not benefit).

An evaluation of a design which focused on the individual benefits of free travel (for instance by only offering the scheme in some boroughs, or to some income groups) may not have identified this.

10.5 Methodological findings: using mixed methods to strengthen internal and external validity

In Figure 10.1, many of the claims made are reliant on qualitative data. In terms of assessing the credibility of causal claims made, this is problematic from the perspective of current guidance on evaluating natural experiments (79), which is largely concerned with statistical methods for defending non-randomised designs from the threats to confounding discussed in the section above. However, these guidelines do not currently include other ways of strengthening credibility. Our approach was to use a pragmatic, iterative and inductive design which drew on mixed methods, primarily secondary analysis of existing data sets, analysis of primary qualitative interview data and a systematic review. Rather than taking an epidemiological approach of assessing *effectiveness* as the primary aim of an evaluation, our approach integrated epidemiological questions of effectiveness within a more inductive mapping of 'what is going on', utilising the best available methods and designs for each element of the evaluation(145).

Our final study aim was to contribute to methods for strengthening causal inference, and we turn now to our methodological findings on the challenges of integrating different research designs within one evaluation.

A number of models have been proposed for integrating data in mixed methods studies (146). We integrated qualitative data with findings from quantitative data sets using an inductive approach, in addition to a thematic content analysis, to enable an analysis not just of what young people said about the intervention, but also how their accounts of travelling in London reflected tacit knowledge and taken-for granted-understandings. This analysis was used in four ways:

- To refine our understanding of the concepts (active travel) and the indicators we have chosen (walking, cycling), and of the intervention itself;
- To assess the credibility of causal attribution through delineating mechanisms by which the intervention may have influenced young people's behaviour;
- To provide some insight into important health and wellbeing outcomes that cannot, currently, be measured or monetised;
- To understand the context within which the scheme was provided, to help elucidate the necessary and sufficient conditions for its potential effects.

A major challenge with this iterative approach is that the logic of good epidemiological design, with published protocols specifying the hypotheses and analysis plans, sits uneasily with the logic of a more inductive qualitative design, where good practice suggests developing plans for further sampling, data generation and analysis plans as hypotheses emerge from ongoing analysis (94). An example from this study is the decision to use a change-on-change analysis using adults as a 'non-exposed' control. Although this provides some control for broader changes in the transport system which also influence young people's travel, ongoing qualitative work suggested some limitations of some of the comparisons we had specified. For example, qualitative interviews shed light on the importance of discretionary travel, and suggested that this had implications for the uptake of free bus travel that might be inadequately captured by available travel diary data (which was restricted to term time weekdays for our 'pre' period). Further quantitative analysis is possible, and we did conduct a follow up study of the different correlates of young people's travel throughout the week (see Steinbach et al 2012). To make sense of the evaluation, we would want to take seriously the implications of (see Steinbach et al 2012)the qualitative work that the scheme did increase young people's tendency to use the bus as a 'default' mode. However, our predefined protocol specified that the change on change analysis (comparing bus travel before and after in adults and young people) would be used to identify whether the scheme had 'caused' an increase in bus travel. Taking other sources of data into account risks being perceived as introducing the biases from 'data dredging' that pre-published protocols are designed to avoid, yet not to do so risks eliminating useful information from the evaluation.

This is not an issue unique to natural experiments. Similar issues have been raised in relation to social science research within RCTs (147), in which trial protocols and procedures designed to maximise intervention fidelity preclude the incorporation of insights from ongoing qualitative research on issues such as how best to operationalise outcome variables in in trial questionnaires, or how to collect data. The challenge is not integrating qualitative and quantitative evidence, but integrating the rather different overarching questions that the two methods relate to: respectively (in our case) 'how has free bus travel affected the public health?' and 'how confident are we that free bus travel brought about this range of outcomes?'.

One potential solution to this tension is to utilise a 'capacity approach' to evaluating programmes, changing our question from does 'X causes Y?' to 'how *stable* is X's capacity to effect a change in Y?' as suggested by Cartwright and Munro (148). A focus on the 'stability' of the capacities of phenomena (such as policies or programmes) does not preclude attention also to the causal effects

of those phenomena, but does mean we are asking a somewhat broader question about 'what happens' when a policy is introduced. This requires marshalling a broader range of evidence to develop a credible argument about the likely limits and possibilities of transferability.

Given that the criteria for assessing the stability of capacities are not as well developed as those for assessing the causal claims in RCTs, the claims made from such an approach are likely to be more contentious. There is consequently more reliance on demonstrating *how* X causes a change in Y rather than just that it does (i.e. the 'mechanisms' in epidemiological terms), and on evidence to delineate what other factors can promote, inhibit or otherwise affect the ability of X to affect Y (148). Thus, suggest Cartwright and Munro (2010), an evaluation might usefully ask a set of questions such as: how does X operate to promote Y?; What is needed for X to promote Y?; What can stop/inhibit the operation of X?; What other capacities promote/inhibit Y?; What happens when capacities interact?

Whilst our evaluation was not designed with this approach in mind, we have used elements of this logic. One particularly important element for external validity (especially with regard to the transferability of evaluations) is the need for greater attention to the theoretical links between concepts (such as between using public transport and active travel), rather than simply the links between indicators (such as the relationship between travel diary reports of bus travel and diary reports of walking and cycling). The indicators for the variables in our causal pathway model in Figure 2.1 were inevitably chosen pragmatically, from data sets available from before and after the intervention. Indicators such as 'number of kilometres walked' as recorded in travel diaries can only ever be partial measures of complex concepts such 'active travel'. Methods for RCTs have largely been developed in the context of well understood biological mechanisms, and where reasonable consensus exists around how to judge the reliability and validity of indicators.. Extending the logic of these methods to natural experiments of poorly understood and under-theorised systems such as transport carries a risk of focusing our attention on the causal pathways between low level indicators, rather than on the links between concepts and indicators, or between concepts themselves.

This is where qualitative analysis can make an important contribution. Here, we have used the qualitative analysis to shed light on the relationships between concepts and indicators (in, for instance, exploring whether bus travel is properly identified as a 'passive' mode); on the limitations of current indicators (in, for instance, shedding light on the limitations of using our only available data set, on term time week day travel, as an indicator for mode shift); and on the plausibility of

causal attribution (in, for instance, the finding that the scheme itself is likely to have increased bus use among young people) .

In developing the methodologies needed for evaluations of natural experiments, we suggest a 'capacities' approach might be a fruitful avenue for designing studies which maximise both internal and external validity. Where mechanisms are complex, contested and poorly theorised (which applies to most up-stream determinants of health), more attention to adequate theorisation of the conceptual links between determinants of health and health behaviours or outcomes, and the links between concepts and indicators, is essential. The challenge is that this will develop incrementally throughout an evaluation. It is not simply a matter of qualitative work informing the research questions and illuminating quantitative findings, or early quantitative results informing the qualitative interviews. Insights and understanding will inevitably emerge in an incremental way. Developing the evidence base on the structural determinants of health may require rethinking our reliance on models of research deriving from evaluations of effectiveness. In particular, it will entail taking more seriously judgements about the capabilities of interventions, and drawing on a range of research designs (145) and sources of evidence (both qualitative and quantitative), rather than relying solely on research designed test hypotheses about 'what works'.

10.6 The implications of our findings for public health

Young people's wellbeing

The most significant implications of the free travel scheme for the public health of young people and London as a whole may be those that are most difficult to measure. Like previous research with children at younger ages (149-151), we found that socialising with peers was a pervasive aspect of, and influence on, young people's mobility. This emphasis on sociability was fundamental to understanding the impact of the scheme for the wellbeing of young Londoners, for a number of reasons. First, it provided a context for other criteria for decisions, such as the perceived 'riskiness' or 'boringness' of particular modes. That is, walking, or taking the bus, were not necessarily chosen because they were intrinsically more or less risky, but because they offer different possibilities for travelling together. Second, because free travel was a universal, rather than a targeted, benefit, it could be used by all in a peer group. This, as much as the cost implications, was important to it becoming the 'default' mode of travel.

An important implication for the wellbeing of young people was thus the opening up of the bus network as a space in itself for socialising, as well as opening up the city as a whole. At a time when many commentators have argued that the 'in-between' public spaces of cities are becoming increasingly inhospitable to sections of the population such as young people (152), the free bus travel scheme enabled a whole network of familiar, mobile spaces to be used, independently, by young people. As Cattell and colleagues (62) note, 'ordinary spaces' in urban environments are important sites for fostering social interaction, a collective sense of belonging and encounters with a cosmopolitan range of others. Buses provide a rare such space for young Londoners, enabling not just interaction with peers but, importantly, experiences of managing social engagement with a large cross section of London's diverse communities. As Russell (153) suggests, 'travel time' has a number of contributions to social wellbeing for travellers apart from merely 'getting somewhere': providing potential means for social interaction; information exchange; time to do pleasurable activities such as reading, listening to music or enjoying routine; and socialising travellers as part of their neighbourhood. These benefits were evident in young people's accounts of their bus journeys, but impossible to capture in travel diary data, or in data on health outcomes.

It is important to also recognise that some such encounters of course may be risky. At the extreme, using transport puts young people at risk of assaults, and we identified a rising rate of intentional injury to young people, although this predated the free bus pass. However, from young people's perspectives, the free bus pass (on balance) reduced the risks of travel.

The free bus pass also enabled both opportunities to enact 'independence' and opportunities to develop skills in independent travel. Independent travel has been identified as an important element for young people's development, and as being potentially curtailed by road danger (65-68), parental fears and the marginalisation of young people in urban environments (154). Here, we have identified a number of ways in which universal free bus travel facilitated young people's growing confidence with managing travel, because it enabled rehearsals of mobility with no financial costs and in the company of peers.

Active travel: implications for physical exercise

For public health researchers, the implications of the scheme for active travel are perhaps the most important (155). Here, there are mixed implications. We identified no strong evidence for the anticipated negative effects on distances walked, given that the scheme appeared to generate new trips, which involved some walking, and some replacement of more 'passive' car travel. This is in line with recent findings on the implications of free bus travel for older citizens (73, 74). As in other European settings (156), there may be significant amounts of physical activity within the transport

system itself, much of which is not captured by travel diary data. Our qualitative data suggest that treating bus travel purely as a 'passive' mode, in contrast to 'active' modes of walking and cycling, may underestimate the amount of active travel undertaken (157)

Unlike reports from the USA, however, where public transport interventions may lead to significant increases in active transport (54), in London (where private car use is low), there was no evidence of a beneficial effect. Indeed for cycling, rates had declined from a low base: young people have not shared the benefits of increased uptake of cycling in London seen for adults. Suggestions of similar disincentives from concessionary fares come from the Netherlands, where Welleman argues that annual season tickets for public transport for students have reduced cycling trips in this group (158). What is encouraging from a public health perspective is that young people report enjoying walking and cycling (for leisure) and perceived these modes as 'healthier'. However, in the context of everyday lives, other wellbeing benefits are prioritised in the choice of travel mode. Criteria such as 'physical health' only outweigh others (such as maximising sociability or inclusion, or minimising risk) for a relatively small number of young people, and for only some journeys.

It is important to note that the mode shifts associated with this intervention represent relatively small amounts of activity: there is a difference between distances walked before the intervention and after the intervention of only 0.01km, for instance (See Table A9.1). The likely impact of such small changes in active transport on the public health is difficult to assess. The rationale for intervening at a population level is to make incremental shifts in the amount of physical exercise people are taking, and to reduce energy imbalance from increasing levels of food consumption in tandem with decreasing levels of exercise. At an individual level, it is not clear 'how much' exercise is needed to improve health outcomes such as reduction of cardio-vascular risks. There is some evidence of a dose-response relationship between total physical activity and cardiovascular (CV) risk in men (159, 160), and that small differences in walking would be significant at a population level (161), but for low intensity activity such as walking, there is also evidence suggestive of a 'threshold' below which walking confers little benefit in terms of CV risk factors (162, 163). However, this evidence is derived from relatively active, and adult, populations – the long term health effects of small changes in children's active travel are difficult to predict. There is some recent evidence that children who do walk/cycle were more active (164, 165). However, there is also evidence that, for younger children at least, adding small distances of walking to children's exercise does not significantly affect overall activity rates (166), given that distances to school may be very short. A systematic review found little evidence that active transport to school was related to a healthy

weight (167), and more research from prospective studies is needed to identify whether associations between likelihood and amount of active travel and physical activity overall are causal.

In terms of secondary school children, who may be relatively inactive (compared, for instance, to the primary school age children who are the focus of many 'walk to school' interventions and evaluations), we know even less about the relationships between walking and cycling for transport and other sources of physical activity: whether, for instance, more walking leads to more physical activity overall, or whether some kind of 'activity compensation' occurs, with active travel replacing other sources of activity. There is an urgent need for more robust evidence about the likely immediate and future impacts of increasing levels of active transport on the health of adolescents and children.

Implications for sustainability

Further, given that one incentive for many policy interventions (including to some extent this one) is to foster sustainable and healthy habits into the future, we know little to date about how far habits adopted in childhood or adolescence are maintained into adulthood. Our qualitative data suggested that bus transport had been 'normalised' for young people, and not considered a 'mode of last resort', or stigmatised as being largely for those with no access to other options. This shift in attitude to public transport is important, as it has been identified as an essential precondition for moving transport systems away from car dependency towards mass public transport (168, 169). More research is needed on how far these attitudes do change future propensities to drive.

Our findings suggest that although young people (and young men in particular) still largely view driving as an anticipated rite of passage to adulthood, for those in older adolescence, who are more likely to have had experience of driving, its attractions had diminished. Our data are not extensive enough to comment on how far this may delay learning to drive, or car ownership. In the light of debate around the declines in driving in young adults, both in the UK and other European countries (170-172) further research on how young people view driving, and what role local public transport provision has in their orientations to driving and car ownership, is urgently needed.

The implications for social and health inequalities

Theoretically, transport systems can create, reinforce, mitigate or remove causes of health inequality through a number of pathways. At the most fundamental level, access to transport is essential in most settings to access the determinants of health: goods, services and social interaction. The scheme has removed one important contributor to social exclusion for young people: transport costs. This was evident in both the absence of financial considerations in young

people's accounts of travelling for school and other purposes, and in the reported limitations that were experienced when Zip cards were lost, stolen or rescinded.

A system which ensures that all young people are financially able to access transport may therefore be an important necessary condition for a socially equitable transport system, but it is not in itself a sufficient condition. The accounts of young people with disabilities demonstrated that free travel on its own was not enough to provide equitable access. For them, bus services were a source of exclusion and marginalisation. The transport mode itself also has to be physically accessible and available, which was not the case for many young people with disabilities.

Beyond removing lack of ability to pay for transport, an additional important consideration for equity is what effects the intervention had on the meaning of bus travel. If concessionary fares merely offer access to a mode of transport that is socially low status, then removing financial barriers for some groups may inadvertently increase inequalities, through further stigmatising those who (have to) use it. Given the literature on the relative status of car driving in many parts of the UK compared with bus travel (see e.g. 168), offering free bus travel to some population groups (such as the young and older citizens) may simply reinforce the stigma attached to bus t(142)ravel: that it is for those who can afford no other, more prestigious, way of travelling. Here, an important condition for the effects we have noted of the free travel scheme was the universality of the scheme, which made it (unlike other more targeted benefits such as free school meals) (142) a non-stigmatised entitlement in the context of these general increases in the efficiency and availability of bus services in London which made them more attractive to a wide range of travellers.

If universal free bus travel for young people removed one theoretical cause of inequalities (i.e. transport exclusion as a barrier to education and training), we might expect a greater take up of bus travel, or a flattening of the social deprivation gradient for trips for education purposes after the intervention. However, we found no evidence that the intervention had a different uptake across deprivation quintiles, or that there was a flattening of the gradient of trips for educational purposes. What is also important for equity, though, is the ability to participate in socially valued activities such as leisure trips, and bus journeys as outings in themselves. Discretionary journeys, such as for shopping or just 'hanging out' are vital for young people's social inclusion, and the (weak) evidence for some flattening of the social gradient in these journeys is encouraging.

10.7 Generalisability

In terms of adding to the public health evidence base, to what extent is credible evidence linking the introduction of free bus travel to health outcomes in London generalisable beyond one (atypical) setting? London has relatively good public transport networks, and there are indications that, for instance, there is less attachment to car transport as a socially prestigious mode than in other parts of the country (38). Here, a randomised controlled design, even if such a study were theoretically possible, would not necessarily be a 'stronger' design. As Cartwright argues (148, 173), there are inherent weaknesses in terms of external validity from the focus on overly refined causal chains which are insufficiently theorised in terms of links between more abstract concepts. In this setting, the risk would lie in making a link between, say, 'free bus travel' and 'fewer miles walked' with insufficient conceptualisation of what those links actually mean in this context. Is 'free bus travel' an empirical indicator of: a financial saving, a plastic card bearing a photo, the ability to travel across London, or the status that derives from an entitlement as a citizen of London? Our qualitative work has mitigated this threat to generalisability to some extent, through unpacking what the various indicators in our model (Figure 10.1) might mean.

The public health implications of transport planning in London are typical of those in many cities across the world. Transport systems which foster ever increasing car dependency are not sustainable (104) and a growing public health literature identifies the short, medium and long term implications for health of not addressing this dependency. We have evaluated a scheme which, as part of a broader raft of policies that encouraged public transport use, had promising implications for mitigating some of these effects. Specifically, we identified evidence that the scheme played a role in 'normalising' bus transport for young people, an important precondition of reducing future car dependency, and one faced in other urban environments in which car drivers typically have negative views of public transport deriving from lack of experience using it (174). London may be unique in its transport system and the governance of that system, but we have outlined the key features of this 'uniqueness' that contribute to the effects identified of the scheme: that it was introduced in the context of general improvements in the bus service and other policies to reduce private car use. However, in a UK context, a key question is the generalisability of the scheme overall to settings with deregulated bus services, where levers for improving public transport lie primarily with operating companies rather than transport authorities. A recent Passenger Transport Executive Group report (175) addressed bus transport for young people in urban areas outside London, noting the importance of good bus provision for their current access to activities necessary for wellbeing and to ensure that they continue to see public transport as a viable option in adulthood. Citing a number of concessionary schemes that have achieved gains in bus ridership and acceptability to young people, the report suggests that simplicity in fare structures and developing

services in tandem with young people are key factors. Detailed comparisons of the London free bus scheme with the outcomes of schemes in other settings, particularly those in which there are Integrated Transport Authorities, will help elucidate what can be gained in terms of 'normalising' bus use in urban centres with varying transport governance arrangements. In the case study described here, there is no reason to suppose that many of the benefits reported would not be replicable in other metropolitan contexts where public transport is de-stigmatised. While London is unusual in that public transport tends to be used right across the social spectrum, in a different context, Baker and White (176) found that those with access to cars were also making significant use of buses following the introduction of concessionary travel. This, they point out, may have implications for wider policies aimed at traffic reduction. In a global context where the need to introduce measures to address carbon emissions are largely recognised in high and middle income countries, there may also be wider benefits to extending concessionary schemes in differing social, economic and political contexts. Debates about how to not only 'normalise' but to privilege public transport are now gaining international policy traction with, for instance, a Delhi High Court judgement rejecting a proposal to abolish the Delhi Bus Rapid Transit System with the words: "A developed country is not one where the poor owns cars but it is one where the rich use public transport"[t]

We have presented evidence of the effects, mechanisms and influences at work when free travel is offered to young people in the context of a good bus network, used by the broader population. Future users of this evidence can use it to help assess whether those mechanisms and influences are similar enough to their own setting to predict likely effects.

10.8 Implications for further research

We have identified a number of areas where more evidence would be useful to inform policy.

1) The effects of 'active travel' on health

There are plausible grounds for encouraging active transport as a way to increase the levels of physical activity in the population, but our literature review (87) (See Appendix 8) identified a lack of robust studies which demonstrate the health benefits of this. A considerable amount of cross sectional research identifies health gains in those who are active, but to date there is a dearth of studies which demonstrate that changing the amounts of active transport individuals undertake will result in health benefits. Given uncertainties around activity synergy and compensation, and the

[t]See Times of India report: http://articles.timesofindia.indiatimes.com/2012-10-19/delhi/34583123_1_brt-corridor-crri-brt-projects Accessed on 12th Dec 2012

debate around how much additional activity is needed to produce health gain, particularly for young people, intervention studies are urgently needed to address health outcomes of changes in behaviour. Additionally, given the population differences in transport mode choice, we need more information about how such interventions are likely to affect different groups in the population.

2) The effects of different transport modes on the determinants of health

The qualitative data suggested a number of benefits for young people of universal free bus travel that could not be captured through current quantitative measures, including fostering independent travel, fostering a sense of 'belonging', facilitating social inclusion and providing a rare space to socialise. We have, however, no comparative data on what other modes might provide. Being driven, for example, although having costs in terms of active transport, may be a rare opportunity to talk with parents in a busy day, and walking can provide young people with opportunities for private discussions with friends. Any full assessment of the health effects of transport mode choice for young people would need to incorporate these broader implications of transport mode choice for health, requiring more research on the meaning of transport and wellbeing in the lives of young people, particularly adolescents who have been relatively under-researched.

This may well require the development of novel methodologies. Travel diary data provide feasible sources for assessing large scale changes in transport mode, but have limitations in capturing the 'non-travel' activity related to transport mode use, as illustrate in Chapter 3, where bus travel that is undertaken for the 'fun' of the journey may be under-recorded in travel diary time. More direct measures of young people's activity (such as GPS or activity monitors) have their own problems: Mackett and colleagues (177) report the difficulties in collecting data from large numbers of young people at a time; managing the large number of data points in analysis and the pragmatic demands on participants of managing the devices.

3) Maintenance of transport mode change

One causal pathway for which we had limited evidence was that leading to reduced car dependence. The likely impact of transport interventions on sustainability is a crucial issue, and this policy aimed to reduce future car dependency. In general, we found little literature on how far habits changed in adolescence (or indeed later) are maintained in the medium and long term. Despite promising modelling (178, 179) suggesting that it is possible to change travel habits through changes in environment or policy, and intervention studies with promising results on the possibilities of increasing public transport use (180, 181), there is little evidence on which to base estimations of future gains. Specifically, there is little evidence on how far attitudes to or experience of public

transport in adolescence might translate into adult behaviour. Robust cohort studies are needed that track changes in behaviour (and ideally, as above, health outcomes), particularly for young people, over time. Transport interventions (e.g. the introduction of hire bikes) or workplace or school health promotion programmes would provide an ideal setting from which to recruit cohorts to explore the effects of changing travel patterns on health.

4) Transport as social practice

This raises a more general question about the cultural meaning of different transport modes, and how these change. It has been suggested that a key element of reducing car dependence will be to improve perceptions of public transport such that it is no longer seen as low status compared with car travel (108, 179). A small social science literature now addresses the ways in which transport mode choices can be interpreted as *social practice*, in that they reflect not just individual decisions (based on, say, barriers and facilitators), but are embedded in cultural and material fields (182-184). There has been less research on how these change. In this study, we suggested that the 'normalisation' of bus travel has changed the meaning this mode has in London. We also suggested that 'cycling' continues to be invisible to most young people as a candidate mode of transport. Research from sociology or anthropology that addressed 'bus travel' or 'cycling' as social practice, and how their meanings change in relation to changing environments and policies, would generate useful information for informing interventions and promotional materials for those interested in increasing the modal share for either 'active' or public transport. One particularly urgent need is for research on driving as social practice, to understand better the role of driving for young adults, and to explore the noted declines in driving and car ownership in some groups of young adults. This would provide invaluable base line information for future evaluations of schemes such as graduated driving licences.

5) Road Traffic Injury rates for young adults

This study was not powered to look specifically at the impact of change in travel modes on road traffic injury in young adults. Any future evaluation of the impact of reduced driving rates in young adults could usefully address the question of whether mode change (e.g., from car travel to public transport) is associated with reduced injury rates for young adults. The proposed introduction of Graduated Drivers' Licenses in Northern Ireland would be a timely opportunity to address this.

6) Value of a statistical life for young people

The need for further research on the health impacts of active transport for young people raises the issue of whether monetary values that have been determined based on an adult population could be applied without change to the age group (12–17 years) in this study to determine the monetary benefits from changes to levels of physical activity, assaults and casualties. Whilst there has been a growing body of research that focus on this issue (and 128, e.g. 185), indicating that differing values should be applied to children, Alberini et al (186) conclude "that there is no single ratio which can capture differences in risk preferences for children and adults, [but] there is some evidence that the VSL [value of statistical life] for a child is greater than that of an adult".

Theoretically, an individual's own value of statistical life (VOSL) is driven by life expectancy – decreasing with age – tempered to some extent by the level of risk – which increases with age (187). Other factors are important, however. Firstly, young people's health and safety is valued not only by themselves but by their family and friends, and there is evidence that parental VOSL for children exceeds VOSL for adults (e.g. 188, 189, 190). Secondly, in policy evaluation, there is a tradition of equal treatment, using social values based on political and ethical judgements, not only individual or familial VOSL. Thus, for example, the values used for road casualties in transport CBA are set equal for all ages (123), and values of travel time are set equal across regions with very different household income and ability to pay (191, 192). So, for example if we were to propose differentiated VOSL for children and adults (higher for children) based on an individual or familial valuation, we would need to consider the implications for other groups (older people or adults in middle age) for whom individual/familial VOSL may be lower than the mean.

Further research is needed to definitively show how these differences in risk preferences translate into changes in values. In this study we have applied the adult values to the 12–17 age group; hence based on the available research on adult versus child values the benefits are conservatively estimated.

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