

WestminsterResearch

<http://www.westminster.ac.uk/westminsterresearch>

**Mediating mobility at the school gate: interpreting London's
School Street schemes
Henry Patrick Thomas, Asa**

This is a PhD thesis awarded by the University of Westminster.

© Mr Asa Henry Patrick Thomas, 2024.

<https://doi.org/10.34737/ww759>

The WestminsterResearch online digital archive at the University of Westminster aims to make the research output of the University available to a wider audience. Copyright and Moral Rights remain with the authors and/or copyright owners.

Mediating mobility at the school gate: interpreting London's
School Street schemes

Asa Thomas

A thesis submitted in partial fulfilment of the requirements of the University of Westminster
for the degree of Doctor of Philosophy

This research has been funded by Cross River Partnership

August 2023

Abstract

Following the Covid-19 pandemic, local authorities in London introduced numerous daily time-limited closures to streets in front of schools, known as 'School Streets'. Nearly a third of the city's primary schools now have School Streets, with their rapid implementation as emergency measures marking an acceleration of state-led 'tactical urbanism' in London. However, despite a stated motivation for School Streets being to increase active travel to school, evidence for their effectiveness in changing travel behaviour lags their widespread adoption.

Responding to this gap, the research has two primary aims. First, to understand the contribution of School Streets to children's mobility in London, asking if and how a small street-level intervention might lead to wider behavioural changes – a growing policy approach with inconsistent evidence in the academic literature. Second, it seeks to investigate the dynamics of this novel 'tactical' mode of policy implementation, assessing whether the rapidity of this change has led to fair outcomes. The dissertation draws on qualitative and quantitative research methods; with practitioner interviews complemented by datasets on the spatial distribution of these schemes and school travel surveys.

The research finds that although practitioners disagree on the mechanism of change, School Streets are associated with increased active travel to school and decreases in private motor vehicle use. However, although policymakers have rapidly introduced a widespread programme of schemes, almost all of which remain in place, equity issues remain, with little evidence of prioritisation of schools facing the worst air pollution at the city-scale. For practitioners, these findings provide evidence that School Streets can change travel behaviour but highlight a need for greater attention to the fairness of outcomes. This research also contributes to emerging literature investigating travel behaviour through the study of interventions, and to debates on the use of 'tactical urbanism' by city governments.

Table of Contents

Figures	7
Tables.....	10
Acknowledgements	14
Abbreviations and Definitions	16
1. Opening statements.....	17
1.1. Synopsis.....	17
1.2. Themes, research questions, and the organisation of the document	19
1.2.1. Theme 1 – The policy process.....	19
1.2.2. Theme 2 – Modifying transport behaviour.....	20
1.3. Research aims	20
1.4. The context for and organisation of the dissertation.....	21
1.4.1. The chapters	23
2. Streets and the mobility of children in research, policy, and practice	24
2.1. Introduction and linking concepts	24
2.1.1. Automobility, children’s independent mobility, and their experience of urban space	24
2.2. The problematic of children’s (auto)mobility	27
2.2.1. The auto-centric built environment.....	27
2.2.2. Traffic and children’s experience of public space	30
2.2.3. Non-communicable disease.....	31
2.2.4. Covid-19 and its impact on structure of auto-space	33
2.2.5. Equity and a changing climate	35
2.3. Policy and practice	36
2.3.1. Residential streetscapes: from Home Zones to Play Streets	36
2.3.2. Governing school travel in England: changing policy perspectives from New Labour onwards	38
2.3.3. Transport planning in London: Healthy Streets and the new mobile public realm	41
2.3.4. Trends across policy and practice	44
2.4. Conclusion	45
3. Introducing the School Street	46
3.1. What is a School Street?	46
3.1.1. The basic premise	47
3.1.2. Purported benefits of a School Street	48
3.1.3. The materiality of School Streets and modes of enforcement.....	50
3.1.4. Beyond the temporary closure	52
3.1.5. International variations.....	54
3.1.6. Summary	58
3.2. Current state of the knowledge on School Streets	58
3.2.1. Overview	58
3.2.2. Mobility impacts	59
3.2.3. Air quality.....	60
3.2.4. Traffic dynamics	61

3.2.5.	The limitations of research to date.....	65
4.	<i>Research Design</i>	66
4.1.	Introduction	66
4.2.	Researching in a pandemic: an account of an adaptable research practice	67
4.3.	New writing on research resilience and innovation in Covid-19	70
4.4.	Mixed Methods research and Covid-19 adaptability	72
4.5.	Mixed methods and the pragmatist research paradigm	74
4.6.	Bricolage and the researcher as bricoleur	76
4.7.	Contextualising this research approach	77
5.	<i>Interpreting School Streets through state-led tactical urbanism</i>	81
5.1.	Introduction	81
5.2.	Current debates in tactical urbanism	84
5.2.1.	Varied understandings of the state and citizen in tactical urbanism.....	84
5.2.2.	State Tactics	87
5.2.3.	Bridging tactics to wider change.....	89
5.2.4.	Tactical urbanism and the neoliberal state.....	90
5.3.	London School Streets as state-led tactical urbanism	91
5.3.1.	Early School Streets and pre-pandemic tactical urbanism in London	92
5.3.2.	Tactical urbanism and the early stages of Covid-19	97
5.3.3.	Shifting rationales for and materiality of a School Street.....	100
5.3.4.	School prioritisation as tactic.....	101
5.3.5.	Changing approaches to community engagement.....	103
5.4.	Discussion	105
5.5.	Conclusion	108
6.	<i>Achieving a ‘minimum standard’ of equity in the distribution of London’s Covid-19 School Streets</i>	110
6.1.	Introduction	110
6.2.	Literature Review	111
6.2.1.	(Active) Transport Equity	112
6.2.2.	Children and Transport Equity	113
6.2.3.	School Travel Interventions.....	113
6.3.	Methods and data	115
6.3.1.	Measuring Transport Equity for School Streets	115
6.3.2.	Identifying School Streets	116
6.3.3.	Data and Variables	116
6.3.4.	A Composite Index of Equity.....	119
6.3.5.	Statistical Modelling.....	120
6.4.	Results	120
6.4.1.	Overall Equity: A Composite Index of Equity	120
6.4.2.	Spatial Equity: District Borough Distribution	122
6.4.3.	Socioeconomic Equity	124

6.4.4.	Ethnic Equity	128
6.4.5.	Environmental Equity	131
6.4.6.	Summary of Models	134
6.5.	Discussion	137
6.5.1.	Overview	137
6.5.2.	Barriers and Potential Solutions to Achieving School Street Equity	139
6.6.	Conclusion	141
7.	<i>Theories of behaviour (change) in School Street implementation</i>	143
7.1.	Introduction	143
7.2.	Literature Review	146
7.2.1.	Health promotion and the role of theory in interventions.....	147
7.2.2.	The theoretical basis for choice promotion and its critique.....	148
7.2.3.	Theories of change and the co-production of theory and policy	151
7.2.4.	School Streets and Behaviour Change	155
7.3.	Study Design and Methods	156
7.3.1.	Developing a topic guide and question list.....	156
7.3.2.	Conducting interviews	158
7.3.3.	Analysing data with Template Analysis.....	159
7.4.	Results	162
7.4.1.	Formal models of behaviour change	162
7.4.2.	Tacit theories of behaviour change	164
7.4.3.	School Streets as distinct from behaviour change.....	167
7.4.4.	Achieving mode shift	168
7.5.	Discussion	171
7.6.	Conclusion	175
8.	<i>School Streets and modal shift on the trip to school</i>	177
8.1.	Introduction	177
8.2.	Evidence on the determinants of and interventions for AST	179
8.2.1.	Wider determinants of active travel and AST	180
8.2.2.	The case for studying interventions to understand travel behaviour	183
8.2.3.	Studying interventions to promote AST	185
8.2.4.	Intervention studies and researching the School Street	187
8.3.	Methodology	188
8.3.1.	Study structure	188
8.3.2.	Survey method, its limitations and sample characteristics	189
8.3.3.	Survey data cleaning process.....	192
8.3.4.	Analysis	196
8.4.	Results	198
8.4.1.	Background Trends	198
8.4.2.	Descriptive Statistics	200
8.4.3.	Difference in Differences.....	201
8.4.4.	Two-step Difference in Differences with staggered intervention times	204
8.5.	Discussion	206

8.5.1.	Strengths and Limitations	208
9.	Conclusion	211
9.1.	Tactical urbanism and health intervention design	211
9.2.	Mode-shift and its mechanisms	214
9.2.1.	Limitations	214
9.2.2.	Mechanisms and the study of interventions	215
9.3.	The future of School Streets.....	215
9.3.1.	Comber Grove.....	216
9.4.	Final thoughts	219
10.	Appendices.....	220
10.1.	Appendix A – District Borough Distribution.....	220
10.2.	Appendix B – Socioeconomic Equity	226
10.3.	Appendix C – Ethnic Equity.....	230
10.4.	Appendix D – Environmental Equity	232
10.5.	Appendix E – Model Predictions	235
10.6.	Appendix F – Additional models	236
10.7.	Appendix G – Sample Interview Question Script	237
10.8.	Appendix H – Topic Guide Summary Tables.....	239
10.9.	Appendix I – Sensitivity Analysis	241
	References.....	244

Figures

Figure 1 – A typical School Street in London. Source: Catherine Kenyon	18
Figure 2 – Children in the London Borough of Tower Hamlet protest the removal of the School Street at their school. Source: Martin Godwin/The Guardian.....	26
Figure 3 – A map of London's 33 local authorities and the primary road network managed by London's transport agency. Boundaries: Office for National Statistics (2013), Roads: Transport for London (2020).	42
Figure 4 – The 10 Healthy Streets Indicators (Transport for London, 2017c)	43
Figure 5 – The conditions under which a School Street is typically feasible in the UK. Source: Hopkinson et al. (2021).....	48
Figure 6 – London's first School Street on Macklin Street in Covent Garden with the closure in operation. Source: Camden Council (2016).....	49
Figure 7 – Flow chart showing the typical impacts of a School Street and the potential benefits. PMV = Private Motor Vehicle, AT = Active Travel.	50
Figure 8 – Signs marking the entrance to a camera-enforced School Street in London. Unsupervised temporary barrier in place to calm traffic. Source: Author.....	52
Figure 9 – Bridget Joyce Square in Hammersmith and Fulham. Source: Greater London Authority	53
Figure 10 – A School Street in London that is in place at all times. This short closure to does not include resident access so no exemptions are required. Source: Author.....	54
Figure 11 – A Paris School Street with an example of permanent swinging gates installed. Source: Mairie de Paris https://mairie13.paris.fr/pages/rues-aux-ecoles-13083	55
Figure 12 – Two protected schools schemes in Barcelona, reclaiming street space in front of two schools. Source: Ajuntament de Barcelona https://ajuntament.barcelona.cat/ecologiaurbana/ca/que-fem-i-per-que/urbanisme-per-als-barris/protegim-escoles	57
Figure 13 – In Leuven, Belgium a permanent flexible barrier installation is used to temporarily close the School Street. Source: https://www.standaard.be/cnt/dmf20201202_98018169 , Copyright Kristof Vadino	58

Figure 14 - A graphical representation of the research process, showing initial plans, primary research ideas, adaptations, secondary data that became available, and how they relate to the different project outputs.	70
Figure 15 – The model of tactical urbanist change as proposed by Lydon and Garcia (source: Streets Plan Collaborative in Lydon and Garcia 2015).....	87
Figure 16 – Parklet on a School Street in Hackney, East London. Source: Author.	93
Figure 17 – Diagram showing the different documentation produced to inform the implementation of School Streets	95
Figure 18 – Map of School Street schemes installed before and after March 2020, with inner and outer London boroughs highlighted. School Street location data accurate to April 2022.	96
Figure 19 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by equity index	121
Figure 20 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by equity index (inner and outer London)	122
Figure 21 – A map showing the proportion of state primary schools with School Streets (implemented post-March 2020) across Greater London boroughs (April 2022).....	123
Figure 22 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by percent of pupils eligible for FSM	125
Figure 23 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by IMD score of surrounding area.....	127
Figure 24 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by IMD score of surrounding area (inner and outer London)	128
Figure 25 – Distribution of pupils by ethnicity across schools with School Streets and without School Streets in Greater London (inner and outer London)	130
Figure 26 – Proportion of roads in the local environment surrounding a school by road classification and School Street/non-School Street school	132

Figure 27 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by NOx level from motor vehicles.....	133
Figure 28 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by NOx level from motor vehicles (inner and outer London).....	134
Figure 29 – Confidence intervals of residual error for London's district boroughs.....	136
Figure 30 – A sign designed by primary school children outlining the benefits of School Streets - including the uptake of active modes of travel. Source: Transport for London	144
Figure 31 – Summary of the role of the topic guide and question list in the research preparation process.	158
Figure 32 – Chart showing the number of School Streets installed per month from September 2017 onwards, yellow dashed line indicates the beginning of the first Covid-19 lockdowns in the UK.	193
Figure 33 – Histogram showing the frequency of different response rates. Yellow vertical lines indicate the 75-125% inclusion threshold, teal lines indicate the 50-150% inclusion threshold.....	194
Figure 34 – Number of valid surveys by Academic Year after data cleaning	195
Figure 35 – Background trends in rates of active modes of travel to School, split by whether a School Street was eventually installed at a school or not. Dashed vertical lines highlight the 2019-20 initial Covid-19 year where due to low response rate (Figure 3) data has been imputed to demonstrate the longer trend.	199
Figure 36 – Background trends in rates of non-active modes of travel to School, split by whether a School Street was eventually installed at a school or not. Dashed vertical lines highlight the 2019-20 initial Covid-19 year where due to low response rate (figure 3) data has been imputed to demonstrate the longer trend.	200
Figure 37 – A Difference in Differences plot for changes in private motor vehicle mode share before and after the introduction of a School Street.	202
Figure 38 – A Difference in Differences plot for changes in Active Travel mode share before and after the introduction of a School Street.....	202

Figure 39 – Event study with staggered treatment, average effect of School Street by year on Private Motor Vehicle mode share	206
Figure 40 – Event study with staggered treatment, average effect of School Street by year on Active Travel mode share	206
Figure 41 - Comber Grove in transition. Source: Author	218
Figure 42 – The distribution of population density in LSOAs surrounding School Street and non-School Street schools	224
Figure 43 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by population density of the surrounding LSOA.....	225
Figure 44 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by IMD score of surrounding area (inner and outer London)	228
Figure 45 – Proportion of population with degree-level qualifications in LSOA around School Street and non-School Street schools.....	229
Figure 46 – Breakdown of pupils by ethnic group by school status	230
Figure 47 – Breakdown of pupils by ethnic group by school status and district borough	231
Figure 48 – Road classification of roads within 500m of School Street and non-School Street schools (inner and outer London).....	232
Figure 49 – Road classification of roads within 500m of School Street and non-School Street schools by district boroughs	233
Figure 50 – Distribution of NOx levels from motor vehicles by school status	234
Figure 51 – Partial effects plots from the GAM model.....	237

Tables

Table 1 – Summary of the existing research on School Streets as of May 2023, organised chronologically. Note: published research Thomas, Furlong, and Aldred (2022) is not included here as it has been adapted for inclusion in this dissertation (Chapter 6)	62
Table 2 – A summary of the methods used in each chapter of the dissertation	66
Table 3 – Interviewees segmented by sector of employer	68

Table 4 – The breakdown of schools with School Streets (implemented since March 2020) by school type in Greater London	116
Table 5 – A summary of the data used in this equity analysis.....	118
Table 6 – A summary of the variables used to create the equity index	119
Table 7 – Distribution of School Streets (state primary) by inner and outer London	123
Table 8 – Total and percent of pupils eligible for FSM by school status	124
Table 9 – Total and percent of pupils eligible for FSM by school status and geography	125
Table 10 – Summary statistics of IMD score by School Street status.....	126
Table 11 – Distribution of pupils by ethnicity across schools with School Streets and without School Streets in Greater London	129
Table 12 – Distribution of ethnic groups across state primary school LSOAs with and without School Streets by inner/outer London.....	131
Table 13 – Summary statistics of NO _x air pollution values (µg/m ³) from motor vehicles by School status	132
Table 14 – Regression summaries from three models predicting School Street presence at state-funded primary schools in Greater London	135
Table 15 – Interviewees segmented by sector of employer	158
Table 16 – The evolution of the code book through Template Analysis. Top level codes are left justified with a darker background, and their constitutive lower-level codes are indented below them.	161
Table 17 – Tacit models of change described by interviewees	166
Table 18 – Comparison of survey and non-survey schools as well as intervention and comparator schools by several school and socio-demographic characteristics. All figures refer to state-funded primary schools.....	191
Table 19 – Description of dataset used in analysis.....	195
Table 20 – Average rates of different modes of travel to school in the different survey groups.	201
Table 21 – Regression output for canonical difference in differences analysis.	203
Table 22 – Regression output from two stage difference in difference panel study, showing estimated treatment effects per year distance from intervention year.	204

Table 23 – The distribution of School Street and non-School Street state primary schools across Greater London's boroughs (April 2022)	220
Table 24 – The difference between the counts and proportions of actual School Street schools and an equitable distribution of the same number of School Street schools in different district boroughs (based on the Index of Equity)	222
Table 25 – The counts and proportions of predicted schools with School Streets (according to an equitable distribution) that are actual schools with School Streets in different district boroughs	223
Table 26 – Summary statistics: population density by school status	224
Table 27 – Total and proportion of pupils eligible for FSM by school status (inner and outer London)	226
Table 28 – Total and proportion of pupils eligible for FSM by school status and district borough.....	227
Table 29 – Breakdown of pupils by ethnic group by school status (inner and outer London)	230
Table 30 – Road classification of roads in surrounding area of School Street and non-School Street schools.....	232
Table 31 – Road classification of roads within 500m of School Street and non-School Street schools (inner and outer London).....	233
Table 32 – Distribution of NOx levels from motor vehicles by school status (inner and outer London)	234
Table 33 – Predicted probability of schools having a School Street based on their hypothetical location in different district boroughs.....	235
Table 34 – Regression summary of models using normalised explanatory variables.....	236
Table 35 – GAM model summary	236
Table 36 – A concept guide of models of behaviour elaborated for review.	239
Table 37 – Summary of the cross-relationships between the ideal type and formal models	241
Table 38 – Description of data for analysis using stricter threshold for acceptable response-rate deviation from stated headcount.	241
Table 39 – Descriptive statistics using stricter response-rate thresholds.....	242

Table 40 – Regression output of the canonical difference in difference analysis using stricter response-rate thresholds.....	242
--	-----

Acknowledgements

Many colleagues, friends, family members, and cats had a role in nudging me along this path. To truly do justice to them all would really put the formatting out of whack on this document. I will start with my wonderful supervisors Rachel Aldred, Tom Cohen, Jamie Furlong, and also Andrew Smith who helped set me off. You have all helped in different ways and I could not imagine a wiser set of voices to help guide this project. I am also incredibly grateful for the support and freedom you gave me to interpret this subject in my own way, even when it might not have been the most sensible thing to do. Rachel's enthusiasm for this research and all our projects has been a driving force to which I'm deeply indebted. Many other colleagues at the ATA also had hand in this and I would be remiss not to thank Ersilia, Harrie, Lorna, Athena, Dawn and everyone else for their insights, company, and humour.

I would like to thank the team at Cross River Partnership (particularly Susannah and Fiona) for funding the studentship that made this research possible, but also for being a wonderful partner in the project – taking genuine interest my work and helping to open doors and new lines of enquiry.

To Mum and Helen, thank you for being there for me when it was easy for none of us. To Al, thank you for taking me in and putting up with me. To Boots, rest easy. And to Dad, to whom this is ultimately dedicated, thank you for picking me up from school.

I declare that all the material contained in this thesis is my own work, unless indicated otherwise.

Abbreviations and Definitions

ANPR	Automatic Numberplate Recognition
AST	Active School Travel
DfE	Department for Education
DfT	Department for Transport
FSM	Free School Meals
GAM	Generalised Additive Model
GHG	Greenhouse Gas
IMD	Index of Multiple Deprivation
LSOA	Lower Super Output Area
LTN	Low Traffic Neighbourhood – Filtered permeability scheme using modal filters to block through-traffic across a cell of streets.
MMR	Mixed Methods Research
Modal Filter	Traffic restriction that either physically prevents a motor vehicle from passing a street or issues a fine if the restriction is transgressed. Pedestrians and cyclists retain access.
ONS	Office for National Statistics
PMV	Private Motor Vehicle
SMOTS	Sustainable Mode of Travel Strategy
STP	School Travel plan/school travel planning
TfL	Transport for London
TTSI	Travelling to School Initiative
URN	Unique Reference Number
VIF	Variance Inflation Factor

Opening statements

1.1. Synopsis

This dissertation focuses on a single intervention in urban space. Although their characteristics vary, the term School Street refers to a daily, time-limited, and recurring closure to the streets directly outside of a school. Typically, they exclude motor vehicles from the street for an hour in the morning and an hour in the afternoon. Over recent years (2020-2022 in particular) the School Street has rapidly become a recognisable part of London's urban vernacular and the city's approach to traffic management. In January 2020 they were a relatively marginal policy but have since expanded dramatically and at the time of writing cover roughly 30% of the city's 1800-odd state-funded primary schools. Other cities have adopted similar schemes, but none to the extent that London has. Here London has served as a testbed for the widespread adoption of this new approach to improving the urban environment for children. The novelty of the scheme itself draws interest. There has been increasing awareness of the exclusion of children's voices from the planning process and the design of the cities they live in (Davis and Jones, 1996). Despite requirements for the provision of schools and play spaces being an essential feature of most spatial plans, adult-centric planning, and transportation planning in particular has left the urban environment outside of these spaces hostile to the mobility and autonomy of children (Villanueva *et al.*, 2016). As well as being a protected characteristic under the Equality Act 2010, age (for both young and old) is increasingly also understood within concepts of spatial justice and alongside race, gender, sexuality, disability, and income as a vector along which inequality in cities is experienced. Representing a new investment in planning the everyday urban environment for the needs of children – beyond simply the provision of services or institutions – the School Street serves as a novel and worthwhile topic of research in its own right. This dissertation takes the School Street as its object of study, considering it across different themes, research questions, and disciplinary boundaries.



Figure 1 – A typical School Street in London. Source: Catherine Kenyon

In more pragmatic terms, the rapid adoption of these schemes – in part as a response to the Covid-19 pandemic – has raised a number of wider questions. Their acceptance into the practice of transport planning, particularly within London, has to some extent preceded the evidence base for their benefits. For some time, their positive impacts have been intuitive and anecdotal, and although this is changing, the grey literature research produced to date leaves several key questions unanswered. For example, there is currently limited understanding of what effect if any these schemes have on travel behaviour. With a pressing societal need for the widespread adoption of sustainable and active modes of travel (more on this later), a growing literature in transportation research has sought to understand the dynamics of travel behaviour through the study of interventions that aim to instigate modal shift (Aldred, 2019). The School Street represents an opportunity to consider these questions in terms of a novel intervention (the temporary closure) and within a specific trip-type (the school journey). However, the study of how these closures contribute to the wider transformation of children’s space and mobility also demands scrutiny of the policy processes through which they have become part of the city. The ‘how’ as well as the ‘why’. Despite more pragmatic goals around the improvement of health and environment, intervening in urban

space remains complex, and a street closure both practically and symbolically disrupts common understandings of what these spaces are for. The feasibility of schemes, and thus the realisation of their benefits, in part depends on the acceptance of both the school community and local residents. The rapidity of their introduction using temporary legislative provision potentially disrupts this process with wider lessons for the fair and equitable transformation of space and mobility.

This dissertation considers these questions of travel behaviour, policy process, and the nature of intervention in greater depth. The policy rationales, design iterations, urban contexts, and potential impacts of these schemes will be covered much more extensively in the following introductory chapters. But first the guiding themes and research questions are outlined, and the wider organisation and structure of the thesis considered.

1.2. Themes, research questions, and the organisation of the document

1.2.1. Theme 1 – The policy process

This research is organised around two main themes that have already been hinted at. The first of these themes concerns the policy processes that have underpinned the proliferation of these schemes in London. Academic research on sustainability transitions have documented how city authorities have embraced experimentation as a mode of policy formation (Bertolini, 2020; Smeds, 2021). Similarly, urban studies scholars have charted the rise of the slightly more anarchic practice of tactical urbanism, a mode of urban transformation increasingly accepted and even actively adopted by local governments. The use of these flexible, iterative, and dynamic methods of policy implementation have accelerated during the pandemic, with School Streets a primary example in London. However, the pragmatic and expedient use of these ‘experimental’ or ‘tactical’ approaches in this emergency context presents potential trade-offs around the role of community participation and co-creation typically implied by such modes of intervention. The rapid, distributed, and provisional nature of this process also raises concerns around the equity of the outcomes of the School Street policy. As these schemes reach a critical mass within the city, it is not enough to consider their contribution to spatial justice only in terms of the age of those who benefit, but also in terms of how they interact within existing urban inequities. With the motivations, resources, and local demands spread unevenly across the patchwork of local governments in the city, this pragmatic mode

of implementation may inadvertently reinforce existing disparities in the amenability of the urban environment.

1.2.2. Theme 2 – Modifying transport behaviour

The second major theme focuses more on the potential impact of these schemes on travel behaviour. One of the key claims made about School Streets is that they lead to the uptake of active travel to school and reductions in private motor vehicle use. However, to date there is little high-quality evidence to support it. In pragmatic terms, this represents a key evidence gap for practitioners and politicians considering these schemes, one that this research aims to fill. These questions also intervene in a varied academic discourse on the topic of transport behaviour, how it changes, and how best to study it. Modifying the transport behaviour of children and their parents/carers on the trip to school has been a policy priority in the UK since the mid-2000s, but School Streets represent a departure from past approaches, which when taken in total, have had little impact on the national trend towards the motorisation of the school journey. As a quasi-regulatory, quasi-infrastructure intervention focused on the quality of the urban environment they move away from a suite of approaches broadly informed by the behavioural sciences and focused on addressing individual motivations and competencies (Barr and Prillwitz, 2014). In contrast to these more psychologically informed interventions, it is less clear what the theorised mechanism for change in a School Street might actually be. In addition to attempting to understand *whether* London's schemes have led to behavioural change in school travel, this theme also considers how these street closures relate to dominant understandings of transport behaviour, the role of theory in transport policy, and the wider ethics and politics of behavioural change.

1.3. Research aims

Although each chapter engages in more specific research questions, these more general aims guide each section:

Policy Process Aims:

1. To explore how School Streets were implemented so rapidly during the early stages of the Covid-19 pandemic, in part through a critical appraisal of the concept of 'tactical urbanism'.
2. To evaluate the outcome of this process in terms of the contribution of School Streets to wider goals of transport equity in London.

Behavioural Change Aims:

1. To investigate how practitioners comprehend the mechanisms through which a School Street instigates behavioural change, the forms of knowledge that they draw on to do so, and wider implications for the use of theory in intervention development.
2. To establish whether School Streets do in fact lead to behavioural change on the trip to school.

Overall, this dissertation sets out to understand the contribution of School Streets to the mobility of children in London and to examine what this approach means for wider transportation and urban policy.

1.4. The context for and organisation of the dissertation

This research project began in February 2020, at the onset of the Covid-19 pandemic. As outlined already the pandemic significantly impacted the object of study and thus features as an important thematic element of the research. However, it also had a critical impact on the way in which the research was conducted and ultimately on the final form of the thesis. This is dealt with much more extensively in Chapter 4 which concerns the research design and methods, nevertheless these issues are also important to touch on here as the structure of the thesis and the somewhat unconventional synthesis of the research findings all ultimately flow from this unique context.

Researching during 2020 and 2021 had several notable impacts on the way this research was conducted and written-up. Foremost among these was the restrictions on available research methods and lines of enquiry that accompanied the Covid-19 response by governments, universities, and schools. Projects involving face-to-face research were not granted ethical approval for a considerable portion of the study period, and even if allowed, schools had even stricter constraints on who could access their sites during this time. Equally important was that this period also precipitated the rapid proliferation of School Streets in *response* to the Covid-19 pandemic, in course presenting its own research problems. While generating new and important research questions and as well as an opportunity to widen the scope of the research, this also presented a 'moving target' which made settling on a single carefully calibrated research approach both challenging but also potentially undesirable as an overly rigid approach could have made capturing the unique character of this moment more difficult.

These challenges have ultimately been overcome by the use of research bricolage, which in short, involves the adoption of multiple overlapping research methods to investigate

aspects of a single phenomenon¹. Differing subtly from mixed methods approaches, bricolage de-emphasises the need for a linear relationship between different methods in a study (or indeed the need to pick only one method), instead allowing for connections to develop more organically and out of the unique insights derived from each method when pursued in their own right and according to their own rules.

Adopting bricolage as an approach allowed research questions to be answered somewhat sequentially through this research process, with new methods adopted to adapt to new constraints, to encompass broadening analytical scales, and to embrace emerging data sources. The resulting thesis is therefore centred around 4 core chapters (3 of which are conventionally empirical) which each draw on their own data sources, methods, and literatures to answer proximate but distinct research questions centred on the topic of School Streets in London and their recent proliferation. Although all draw from a common object of research they are intended to each stand alone as intellectually independent contributions with discrete findings that are interpretable and novel outside of the broader structure of the thesis. As they generally draw on independent methods and diverging literatures, each has its own literature review, methodology section,² and discussion. Each chapter does contain references to other chapters, particularly those that share one of the two themes already mentioned. Synthesis across the thesis as a whole is saved for the concluding section at the end of the document.

In addition to responding to a challenging research context, this structure helps to resolve – perhaps imperfectly – another core tension that arose from centring a specific policy intervention (introduced at a specific time) as the organising logic of a large piece of research. Namely that generating critical academic insights can sit uneasily with attempts to answer the pressing research gaps that are most relevant to policymakers and practitioners – the behavioural impacts of these schemes being an example of this. Within this semi fragmented structure, the balance of academic engagement to policy-relevance varies across the empirical work, with some sections generating much clearer evaluative evidence and advice to policy makers, while others engage in debates more relevant to an academic audience. Thus, this slightly unconventional structure also serves to nudge the thesis towards its

¹ This topic is dealt with much more extensively in chapter 4.

² With the exception of Chapter 5

aspiration to be both a critical academic text contributing to contemporary scholarly debates and as a work with direct applicability practitioners seeking to build policy for the mobility of children in cities.

1.4.1. The chapters

The dissertation is organised into three primary sections. The opening chapters provide the necessary academic and contextual background for the study. Chapter 2 situates School Streets within several urban problems and existing planning and policy formations. Chapter 3 reviews the concept of a School Street and its various permutations and outlines the existing body of grey literature research on the topic. As mentioned already, Chapter 4 concerns the research design, setting out the overarching research process that led to the creation of this document in total as well as establishing the paradigm within which this research operates. After this point, the four major chapters that contain the empirical research follow. Chapters 5 and 6 are concerned with the first theme on policy processes. Chapter 5 provides further review of the concept of tactical urbanism and draws on qualitative data from practitioner interviews, while Chapter 6 is a quantitative and spatial analysis of the distribution of the schemes in the city, assessing its equity. Chapters 7 and 8 cover the second theme on transport behaviour. Chapter 7 again draws on practitioner interviews, looking closely on how behaviour change is conceived of by those that have implemented these schemes, while through a quantitative analysis of travel survey data Chapter 8 directly addresses the question of whether these schemes have succeeded in altering transport behaviour. The conclusion (Chapter 9) actively synthesises the connections between the chapters and across the two themes, commenting on the wider implications of these findings when taken together.

In total this research explores the interplay between how an intervention in urban space comes to exist, and the actual change that it produces. This reveals a dynamic and changing understanding of how the central problem of children's travel to school should be understood, and how it should be approached. This intersects with wider shifts in transportation policy that increasingly emphasise the experience of the urban environment and the importance of place in modifying behaviour, as well as wider calls for a more equitable transportation system.

Streets and the mobility of children in research, policy, and practice

2.1. Introduction and linking concepts

The purpose of this section is to provide background context to the introduction of School Streets in London. It does this first by attempting to articulate the complex of intersecting problems that currently impact the lives of children in public space generally, and on their local residential streets and trips to school more specifically. Although these problems are discussed to varying degrees in the later chapters, this section takes a wider view, aiming to draw connections between different domains and research areas. It then seeks to examine how this complex of problems has been tackled by practitioners and policymakers, with a focus on the UK. Again, although other interventions to encourage Active School Travel (AST), are discussed elsewhere, this section focuses on examples that connect more directly to the current School Streets approach. These examples help explain how thinking has changed on ameliorating the complex of problems outlined in the first section, and where School Streets sit within this wider discourse.

2.1.1. Automobility, children's independent mobility, and their experience of urban space

Discussions of children's mobility and life outside the home often draw attention to the UN Convention on the Rights of the Child (Shaw *et al.*, 2015; Mayor of London, 2019; Russell, 2020). This document covers a wide range of rights, many of which focus on the fundamental harms of child labour and exploitation. However, key provisions in Articles 31 and 27 set out the child's right to rest and play, as well as the right to a standard of living necessary to meet their basic physical, mental, and social needs (United Nations, 1989). What exactly those needs are remains a subject of ongoing research in the study of child development. However, the basic conditions of many urban environments arguably impinge on these rights in quite fundamental ways. If the conditions in their local environment mean that children cannot play without the constant supervision of a parent, or if on their walk to school they are exposed to significant air pollution such that it affects their long-term physical health, it could be argued that these rights are not being fulfilled. Extending this language of rights Russell (2020) makes the case that Henri Lefebvre's concept of 'the right to the city' should be help guide our understanding of the need to transform urban environments to better serve the needs of children. The argument is that Lefebvre's concept, which asserts of a right of urban citizens

to access and create the socially meaningful webs of public life as a bulwark against the alienation of the capitalist city, can be extended to conceive a child's right to participate in their own "cultures of playing" (p. 17) and on their own terms.

A key barrier to the provision of the child's right to the city are urban environments that make children's independent access to a life outside of the home more difficult. A great deal of this is driven by car centric environments and practices of mobility. Lefebvre's conception of the right to the city has been connected to the way that transportation systems both facilitate and restrict the ability of urban citizens to access and inhabit public space (Henderson, 2006; Scott, 2013). However, for children, the much higher threshold of what constitutes a safe environment as well as their more limited access to different modes of travel create added complexities. Although as Russell (2020) argues the idea of a child's right to the city helps to point us in the right direction, unpicking the multiple ways in which transportation systems and the environments they create can impact the independence, health, and development of children as a 'complex' of interrelated problems requires a broader approach. Researchers from transport studies, human geography, sociology, environmental psychology, and public health among others have contributed to our understanding of these problems. Indeed, the study of mobility has been characterised as an inherently interdisciplinary endeavour (Rau and Scheiner, 2020), with multiple domains of knowledge necessary to fully articulate its status as a constitutive practice of modern life. Critical to this are efforts made to understand the linkages between mobility and space in the structure of urban environments and its impact on children.



Figure 2 – Children in the London Borough of Tower Hamlet protest the removal of the School Street at their school. Source: Martin Godwin/The Guardian

One such contribution from sociology is Sheller and Urry's (2000) description of the formation of the 'system of automobility' during the 20th century. This is a process which necessitated the creation of a network of physical, legal, and commercial infrastructures, and for human settlements to undergo widespread changes to accommodate the private car as the dominant mode of mobility. For Urry and Sheller the way in which automobile travel compresses the time-distance relationship allows for the reformulation of urban space around a more distributed organisation of the "territorialities of home, work, business and leisure that have historically been closely integrated" (Sheller and Urry, 2000, p. 744). This both facilitates and necessitates a newly spatially dispersed and time-compressed modern lifestyle, inevitably foreclosing on the possibility of using other modes of mobility. Evoking the concept of space-time compression which Harvey (1990) identified as central to the spatial dynamics of urban capitalism, they argue that "mobility is as constitutive of modernity as is urbanity". This intensifying effect, whereby automobility both requires and is necessitated by a distributed physical environment and socio-spatial configuration of people and places (the 'structure of auto space' as Freund puts it (1993, quoted in Sheller and Urry 2000, p744)), provides a helpful linking theory for understanding the present problems of the mobility of children. Automobility highlights the way in which the various tangible outcomes of present crises are

linked by the co-formation of our urban environments and dominant modes of mobility. These outcomes, which are considered in the next section, include the negative environmental health impacts of air pollution, noise, road danger, and the increasingly sedentary lifestyles associated with car-centric environments; the severance of communities by road infrastructure and other impacts on social cohesion, sociality, and the life of the street; as well as the impact on climate change of road-transport associated greenhouse gas (GHG) emissions, among others.

2.2. The problematic of children's (auto)mobility

2.2.1. The auto-centric built environment

Societies have embraced automobility to differing degrees. Nonetheless, even in urban environments where in numeric terms car travel is comparatively marginal, the spatial fact of vehicle movement often still dominates the structure of public space. In London, for example, although walking is the most popular mode of travel and most primary-aged children walk to school, the built environment through which they travel to get to get there is for the most part one shaped by the system of automobility. This can be conceptualised both in terms of the actual infrastructure and the intensity of its use. Official figures estimate that 12% of London's surface area is taken up by road infrastructure, compared with 1.1% for rail infrastructure, and 0.8% for pedestrian paths (Ministry of Housing Communities and Local Government, 2005), in other words motor vehicles use 85% of the land area dedicated to transport. Sheller and Urry cite an even higher figure of 25% for 'car only spaces' in the city³ (2000) and although it is unclear how much this overlaps, a recent report by the Centre for London estimated that 14km² of the city is taken up by on-street parking – an area equivalent to the size of Hyde Park (Barrett, Willis and Washington-Ihime, 2020). In addition to the spatial dominance of this infrastructure, its use has also intensified. This is particularly stark when viewed over the latter half of the 20th century, but more recent trends also show a sizeable increase in the volume of motor vehicle traffic on roads. In the UK nationally, vehicle miles driven has increased steadily, from around 30 billion in 1949 to nearly 380 billion in 2019 (Department for Transport, 2022). Over this time, this increase has been used to justify

³ Much lower than the comparative figure of 50% quoted for Los Angeles

the creation of new roads and the intensification and augmentation of the existing early 20th century road network, which in turn has likely induced further traffic increases.

In addition to these more dispassionate metrics, another way in which automobility can be viewed is through the declining rates of children's independent mobility. Rates of injuries and fatalities to children on UK roads has decreased significantly since the 1970s, and as of the early 2000s ranked as one of the best in the OECD (Cairns, 2005). However, according to the landmark report on children's independent mobility *One False Move* (Hillman, Adams and Whitelegg, 1990), this progress has primarily been a function of the reduction in their unsupervised exposure to trafficked environments. In 1971 86% of children ages 7-11 in England walked home from school unsupervised, in 1990 this was reduced to 35%, and in 2010 this had decreased further to 25% (Shaw *et al.*, 2015). There are numerous factors in this trend but among these, parents regularly cite traffic levels and perceived road danger as a reason for chauffeuring their children (Faulkner *et al.*, 2010; Carver, Timperio and Crawford, 2013; Rothman *et al.*, 2015a), and higher objectively measured levels of local-area traffic have been negatively associated with rates of independent travel to school (Buliung *et al.*, 2017). This likely has local dimensions. Research comparing the UK to the Netherlands and France found that much of the relative shortfall in the UK's child road safety record was explainable by the additional amount time children had to spend on or crossing roads with high volumes of high-speed traffic as a result of the differing structures of the built environment (MVA, 2004).

The mobility of children in general and their travel to school more specifically also demonstrates this intensifying logic of automobility. Declines in independent and active mobility in children have led to a cycle wherein children are increasingly accompanied by their parents or carers on routine journeys that they once may have completed on their own. The accompaniment of adults means more of these trips are now completed by car with consequent increases in traffic (Black, Collins and Snell, 2001). Given the centrality of road safety in parental decision making around their children's mobility, this process in turn makes the conditions for independent walking and cycling worse. In the context of the school journey, which itself has been the subject of extensive research, these effects are particularly profound. With movement concentrated at specific times of day and in specific places the effects of motorised school travel on congestion can be significant. Transport for London (2018) estimates that 20% of peak time motor traffic in the city is associated with the school

run. This is even more surprising when considered within an international context as London has one of the lowest mode shares of motor vehicle use for the journey to school in the country, and England as a whole has a relatively high rates of walking compared to many other countries in the Global North. In 2014 the national average motor vehicle mode share for primary age children was 46% compared to 37% in London (Department for Transport, 2014), for context, in Italy around 65% of children are driven to school (Shaw *et al.*, 2015). However, despite increased walking in London (Mayor of London, 2022), the direction of travel in England is clearly towards increased motor vehicle use, with 2014 the first year in which more primary age children were driven then walked (Department for Transport, 2014). With traffic a key barrier to parents or carers allowing children to travel actively to school (Lu *et al.*, 2014a), this cycle of increasing congestion is likely to lead to decreased active and independent mobility to school, with wider downstream impacts and perhaps further motorisation.

These increases in school-derived traffic are intertwined with wider societal shifts. For one the restructuring of settlements and shifting education policies under the assumption of automobility have increased the physical distance between schools and homes, part of what Whitelegg has characterised as the creation of a “distance intensive world” (p. 60). Particularly in North America, decreasing housing density and the siting of new schools on cheaper land on the outskirts of settlements have contributed to the motorisation of school travel (Rothman, Macpherson, *et al.*, 2018). However, the rise of policies allowing for greater choice in school preference – which have been a feature in the UK – also increase daily travel distances (Wilson *et al.*, 2010; van Ristell *et al.*, 2013; Mandic *et al.*, 2017). Following reform by several governments, largely with the aim of fostering social mobility, in 2009 only 42.5% in the UK of children (both primary and secondary phases) attended their nearest school, with significant impacts on car use and mode share in general⁴ (van Ristell *et al.*, 2013). In the UK distance travelled to school increased by 13% between the 2000 and 2010 (Ferrari and Green,

⁴ The impact on mode share is however varied, and depends greatly on the extent of bussing provision. In some North American contexts attending the nearest school is associated with *more* private motor vehicle (PMV) use as bus provision is not provided for those closer by (Wilson *et. al.* 2010). There are also interesting questions of equity that are raised by the transport implications of school choice policies which are touched on in Chapter 7.

2013) and Allen (2007) estimates that taken together, secondary school pupils travel over 5 million km further per day than they would if attending their nearest school. Ferrari and Green (2013) discuss how this ‘excess commuting’ is driven by the highly complex dynamics of housing markets, urban form, and school quality. Here the potential benefits to social mobility of school choice are partially eroded as the ability to absorb the additional costs of greater travel is itself socially stratified. These spatial dynamics are critically important. As will be discussed more in Chapter 8, above parental perceptions of safety, distance between home and school is one of the most significant determinants of the use of active modes of travel and independent mobility.

If children do not travel independently, then they are tied to the parental mode of travel which is itself often determined by employment. Children of families in which both parents work are less likely to travel actively. With 75% of school run trips (all ages) undertaken by women (National Travel Survey 2014-2019), this also has a gendered dimension. As Jain et al. (2011) argue, for many working mothers this balancing of the “time-space challenge” (p. 1611) of employment and escorting children is often enabled by automobile use, especially when distances are greater⁵ and growing. In this context Whitelegg highlights the way car manufacturers in the 1990s framed car-ownership as liberatory for women, with automobility facilitating participation in the workforce (1997). Thus, the interplay between school mobility and the gendered dynamics of the labour market presents an additional layer of complexity to the question of travel to school.

2.2.2. Traffic and children’s experience of public space

Another oft-cited factor in the declines in independent mobility are fears over public safety. Although these are informed by a variety of societal factors, they can also be interpreted within the declining public life of the streets. Jane Jacobs’ well-known description of her Greenwich Village neighbourhood theorised the public safety effect of the ‘eyes on the street’ that are feature of busy and pedestrian-centric streetscapes (Jacobs, 1961). Perhaps the best-known description of the impact of traffic on urban lives is from Donald Appleyard’s *Livable Streets* (Appleyard, Gerson and Lintell, 1981). Appleyard studied a collection of streets in San Francisco with differing levels of traffic, interviewing residents about their experiences but

⁵ An intriguing question for further research is what if any increasing rates of working from home may have on these trips.

also recording the use of space and crucially the social networks between neighbours. With a famous visual representation, Appleyard observed how neighbourly sociality declined significantly with increasing traffic levels. Residents on the busy streets had a third of the neighbourly social relations to those on quieter streets (ibid). These studies have since been repeated in the contemporary UK context (Hart and Parkhurst, 2011), and elsewhere (Sauter and Huettenmoser, 2008) with broadly similar findings. These effects have also been described in terms of community severance, highlighting how in addition to traffic the actual infrastructures of automobility, including motorways, roundabouts etc, can also limit social interconnection on even larger neighbourhood scales (Mindell and Karlsen, 2012; Anciaes *et al.*, 2016).

This impacts not only social density for adults but also the affordances given to children for independent mobility and playing out (Appleyard, Gerson and Lintell, 1981; Mindell and Karlsen, 2012; Lambert *et al.*, 2019). Research has found a positive relationship between the presence children playing on neighbourhood streets and the strength of a 'sense of community' among adults (Ross, Wood and Searle, 2020), but also the impact that adult social interaction has on parents' willingness to allow children to play out (Handy, Cao and Mokhtarian, 2008). There have also been wider shifts in conceptions of what constitutes an appropriate space for children's play in the context of rising automobile use, with the development of formal playgrounds part of a well-intentioned effort to discourage street play in the name of public safety (Cowman, 2017). This has accompanied a wider privatisation and formalisation of children's play with the rise of indoor soft play a more recent development (Holloway and Valentine, 2000). Thus, improvements in children's safety, when viewed through the wider lens of automobility are intertwined with changing levels of independence and informal use of urban space. Thus, both the infrastructure and intensified practice of automobility interact with multiple dimensions of the social basis children's life outside of the home.

2.2.3. Non-communicable disease

The overall health impacts of the rise of automobility, not just on children but on all urban residents, is part of a wider burden of non-communicable disease (Cohen, Boniface and Watkins, 2014; Nieuwenhuijsen, 2016; Glazener *et al.*, 2021). One aspect of this is the declines in incidental physical activity that accompany increased car use. Rising rates of childhood obesity is a topic of concern in public health discourse both in London (Greater London

Authority, 2011) and across cities in the Global North. Although physical activity is but one factor in this, only around half of children aged 6 in the UK achieve their recommended rate of 60 minutes moderate or vigorous physical activity a day (NHS, 2021; Hesketh *et al.*, 2022), a slight decrease from a similar study in 2002 (Pate *et al.*). Four in ten of London's 11-year olds are overweight or obese (Plowden, 2020). Levels of physical activity are determined by several different domains of a child's lifestyle (Mitra, 2013), not least recreational activities and independent play. However, incidental activity is also important and active mobility can also facilitate access to these other domains. Children, particularly boys, who are able or allowed to travel independently have higher rates of overall physical activity, in part due to this access to other domains of outdoor play and recreation (Schoeppe *et al.*, 2013; Page *et al.*, 2010). The trip to school also represents an opportunity for daily physical activity and perhaps unsurprisingly Active School Travel (AST) has been associated with greater levels of physical activity in general (Cooper *et al.*, 2003), Some of these benefits are even greater in children from lower incomes (Laverty *et al.*, 2021), suggesting that increasing rates of AST could help improve socio-economic health disparities in children.

In addition to the health impacts of reduced physical activity, the negative externalities of motor vehicle use also include air pollution, traffic noise, and road danger. Despite improvements on a longer-historical scale (Fouquet, 2011), concentrations of NO₂ and PM in London regularly exceed the UK legal limits and are well above WHO guideline 'safe amounts' in almost all parts of the city (Foster, 2023). Estimates vary, but air pollution in London is thought to cause between 4000 and 9000 premature deaths annually (London Councils, 2018; Dajnak *et al.*, 2021) and the negative health impacts of air pollution are particularly stark for children. This is not only a consequence of the susceptibility associated with their developmental stage but also their higher levels of exposure (Sack and Kaufman, 2016) in part due to their tendency to breathe more deeply and rapidly than adults and to spend more time exercising outside. Exposure to worse air quality has been associated with higher rates of asthma, cancers, slower lung development, and smaller brain size (Fuller, Friedman and Mudway, 2023). Issues of children's exposure to air pollution in London reached a new level of public consciousness with the death of Ella Kissi-Debrah, a 9 year old girl who lived next to the South Circular; a busy road in South London (Laville, 2020). The coroner's inquest deemed severe exposure to air pollution to be a material cause in her death, the first time such a cause has been given. However, even prior to this, concerns about

children's exposure to air pollution in the city had prompted a significant programme of air quality monitoring at schools (Mayor of London, 2018b). Campaign groups such as Mums for Lungs have emerged around this concern, with anti-idling legislation and the introduction of School Streets key parts of their demands.

2.2.4. Covid-19 and its impact on structure of auto-space

These crises of urban public health, and particularly concerns over children's exposure to air pollution provide important context for the implementation of the first initial School Street schemes in London. However, their transition from marginal policy to fixture of London's residential streetscape is inextricably connected to the Covid-19 pandemic. As with wider understandings of children's mobility, these dynamics can be productively narrated through the uneven ways in which the pandemic interacted with the system of automobility in urban environments. The closure of schools – which had a number of complex effects on the lives of children – and rapid restrictions on mobility in wider society also led to the most precipitous decline in motor traffic in recent memory. At its lowest point demand on the Transport for London Road Network (see Figure 3) was 65% of the same point the previous year (Transport for London, 2020d). For some, activities in public space that may have previously felt dangerous or unpleasant in car dominated neighbourhoods flourished under these conditions (Ghanem, Ahmad and Aboualy, 2021). However, the overall impact of these changes was highly varied, not least for children. Outcomes depended in part on the nature of local restrictions, but in general studies have found that physical activity over this period declined for most children – especially for those who participated in organised recreational exercise prior to the pandemic (Yomoda and Kurita, 2021). These disparities also varied across different built environments. Children in rural areas had higher physical activity rates than those in cities (*ibid*), those who live in houses tended to get more outdoor exercise than those in apartments, and the presence of busy roads remained a key obstacle to accessing outdoor spaces despite reduced traffic levels (Mitra *et al.*, 2020).

The interruption to normal daily life also brought a greater focus on the conditions of local neighbourhoods. As proximity and congregation became a potential vector of disease the narrow spaces left to pedestrians in automobile-centric built environments carried with them a new danger. Researchers at UCL have estimated that roughly a third of London's pavements were not wide enough to allow for people to pass 2 metres apart, the initial recommend safe physical distance (Palominos and Smith, 2019). For urban authorities, the

basic spatial fact of disease transmission had profound implications for the functioning of dense urban locations, requiring new policies, public communication techniques, and technical guidance to facilitate emerging physical distancing requirements (Ministry of Housing Communities and Local Government, 2020; NACTO, 2020; Transport for London, 2020c). As already discussed in relation to the intensifying nature of children's (auto)mobility, these issues were of even greater concern at locations like schools which serve as trip-attractors, and spatial-temporal points of congregation where crowding was highly likely. In London as with other UK cities many primary-phase schools are located on smaller residential streets characterised by narrow footways and roads cramped with resident parking, all limiting the space available for physical distancing. Early in the pandemic this was acknowledged as a key issue, and School Streets were quickly identified as a potential solution alongside more easily implemented demand management measures like staggered start times.

Demand management was also a key concern in city-scale transport planning. With the initial pause to many economic activities and a move towards working from home, public transport use saw significant declines in the Spring of 2020. In London ridership of the underground at one point declined to 3% of the equivalent day in 2019. At the time there was concern from transport planners that as in-person activities slowly returned, lingering fear of disease transmission would lead to people avoiding public transportation and defaulting to motor-vehicle use. In the short term, it was thought that this scenario of a 'car-based recovery' from Covid-19, would increase congestion within cities, exacerbating many of the pre-existing health and mobility issues already mentioned. Although on the national scale this scenario ultimately did not fully come to pass (Anable *et al.*, 2022), and although public transport only represents a small fraction of the modal split for primary-phase school travel, given the constrained environments of many school sites, the addition of a small number of cars at pick up or drop-off times could cause significant disruption and road safety issues. This issue of mode choice and its changes during the pandemic is a central concern of Chapter 8 and is dealt with in greater detail there. As Chapter 5 examines, the policy response to Covid-19 was not only framed in terms of fear of increased traffic, but also in terms of a 'window of opportunity' to transform mobility. School Streets and other interventions like Low Traffic Neighbourhoods (LTNs) were actively interpreted as steppingstones to more permanent changes.

2.2.5. Equity and a changing climate

Covid-19 and the urban crisis of (non) communicable disease provide an important orientation for the base conditions and overarching rationale behind the introduction of School Streets in London. However, other key ‘problematics’ should be mentioned here. Perhaps most profoundly is that all of this is to say little of the climate-related impacts of automobility. Although school travel is only one small part of the wider transportation impact on the climate, it is also a trip-type with high potential to be decarbonised, and in a sector that to date has been slow to change – in recent years transport has overtaken energy as the largest sectoral contributor to GHG emissions (Department for Business Energy and Industrial Strategy, 2023). Active travel forms a key part of plans to decarbonise transport in the UK and particular attention is given to shorter length urban trips, with a government goal of 50% of these to be conducted by active modes by 2030 (Department for Transport, 2020a). Many school trips fit firmly within this category. Furthermore, the effect of climate change is already placing and will continue to place new demands on urban streetscapes, increasing the need for canopy cover to mitigate heat-island effects as well as sustainable urban drainage systems to attenuate the impacts of run-off from increasingly violent rain fall (Jones and Somper, 2014). Although not the norm in London’s School Streets projects, as we will see in Chapter 3, some are incorporating rain gardens and new planting into their schemes bringing them into the wider conversation around urban resilience to climate change.

What cuts across all of this are the ways in which the benefits and disbenefits of an automobile-centric mobility system are unevenly distributed in society. Studies on environmental justice have articulated how air quality and road danger are often concentrated in more deprived and ethnically diverse parts of cities (Mitchell and Dorling, 2003; Nantulya and Reich, 2003; Goodman *et al.*, 2011; Ferencak and Marshall, 2019), with similar principles present in the distribution of the negative impacts of climate change (Campbell-Lendrum and Corvalán, 2007). This justice dimension is dealt with in more detail in Chapter 6, which examines how School Streets are distributed in London. But it also forms an essential framing in the more general context of the ‘problematics’ of children’s (auto)mobility in that the inequitable treatment of children in the planning of cities intersects with wider inequalities in cities and in society.

2.3. Policy and practice

This section aims to situate the School Street within wider trends in urban design, transport planning and public policy. It looks at how the problematic of children's (auto)mobility has been approached, with particular focus on travel to school and the re-design or re-appropriation of residential streetscapes in the UK. The introduction of School Streets follows on from long-standing attempts to increase the use of active and sustainable modes of travel on the trip to school as well as design and planning approaches that have aimed to improve the safety and conviviality of residential streets – often with specific reference to the safety and independence of children. Although these strands of practice have been conceived of somewhat separately, School Streets can be interpreted as a partial convergence of these trends and are indicative of an increasing emphasis on the relationship between the public realm and mobility typified by London's Healthy Streets approach.

2.3.1. Residential streetscapes: from Home Zones to Play Streets

As will be outlined more in Chapters 3 and 5, to date School Streets schemes in the UK have focused primarily on quieter residential streets. From an international perspective, a key development in the design of child-friendly residential streets is the *woonerf* in the Netherlands. Roughly translated as 'living street' or 'living yard', the *woonerf* relies on the concept of shared space, where the division between the carriageway and pedestrian space is removed, and instead changed into an expanse of brick or slab paving – distinguishing them visually from nearby major roads. There are often obstacles in the roadway in the form of planting, echelon parking bays, or demarcated play or social space that require a car to manoeuvre at slower speeds and with care through the environment. The origin of these schemes in the Netherlands in the 1970s is often attributed to Colin Buchanan's writing on the future of Britain's streets in the 1963 report *Traffic in Towns* (Ben-Joseph, 1995; Clayden, McKoy and Wild, 2006; Karndacharuk, Wilson and Dunn, 2014). The report suggested that the removal of through traffic in residential areas within a broader road hierarchy was necessary to fully facilitate cars as the dominant form of transport in urban areas without disastrous effects on urban environmental quality. In the Netherlands these principles of restricted vehicle circulation in residential areas, referred to as 'unbundling' (Schepers *et al.*, 2013) and not dissimilar to the Low Traffic Neighbourhoods (LTNs) implemented more recently in London, also included significant focus on the design features of residential streets through

the inclusion of woonerven. The introduction of the woonerf was also contemporaneous with and connected to many of the pro-child planning shifts in the Netherlands in the 1970s that following the *stop de kindermoord* social movement (Bruno, Dekker and Lemos, 2021), instigating a political effort to protect residential streets for benefit of children. There is some evidence that these schemes have been successful in their goals of increasing sociality (Biddulph, 2010) and especially children's play (Eubank-Ahrens, 1985).

The success of the woonerf concept abroad has led to a somewhat deferred (re)introduction of these ideas to the UK through the Home Zones concept in the early 2000s. This was instigated through a change in legislation which provided formal legal designation for use of shared space in residential street designs and later funding for a tranche of woonerf-style schemes (Gill, 2006). In 2007 this was further enshrined in the Department for Transport's *Manual for Streets* (Department for Transport, 2007) which set out the official guidance for residential street design. Again, children's use of residential street space was central to the rationale for these schemes (The Institute of Highway Incorporated Engineers, 2002; Barrell and Whitehouse, 2004; Department for Transport, 2005). Evaluations of the handful of Home Zones initiatives that were introduced (Biddulph, 2010, 2012b, 2012a) report a quietly positive picture with schemes seeing decreased vehicle speeds, improved perceptions of safety, and increases in children playing out. In spite of these successes, widespread adoption of Home Zones never materialised, and the schemes remain a curiosity in the built environment of UK towns and cities. The significant resources associated with the complete redesign of a street presented a barrier to their scalability, with government unwilling to provide long-term funding for further schemes (Biddulph, 2008). However, the central problems Home Zones sought to address remained salient and while hopes for sweeping changes to residential built environments as seen in the Netherlands faded, more flexible, community-initiated approaches also emerged. For example, Sustrans developed the 'DIY streets' initiative which sought to introduce similar traffic calming principles on residential streets but with much cheaper materials, aiming for faster and more widespread uptake (Biddulph, 2008; Jones, Pykett and Whitehead, 2013). While these too have not made a lasting impact on the built environment of the UK, the more bottom-up or 'tactical urbanist' orientation of this approach has had continuing influence.

Perhaps most notable in this vein has been the reintroduction of play streets in UK towns and cities. Once common, these designations of safe residential streets for play largely

faded from memory with the changing expectation of children's use of space and the more widespread introduction of formal playgrounds (Cowman, 2017). In 2009 – and unaware of this history – a group of parents in Bristol began regular temporary closures of their residential streets to facilitate children's play (Ferguson, 2019). Using temporary barriers and parental stewards, these occasional weekend closures aimed to provide an opportunity for children to play safely in what would usually be a car-dominated environment, meeting other children who live in close proximity. The establishment of the organisation 'Playing Out' aided in the spread of these schemes by helping local authorities and parents navigate starting their own play streets as well as undertaking efforts promote the concept more widely. In 2018 around 800 Play Streets were in operation in the UK and more abroad. As a temporary street closure there are obvious parallels with the more recent proliferation of School Streets. In fact, prior to the more widespread use of School Streets following Covid-19, Sustrans had undertaken a project aimed at introducing play streets at schools at the end of the school day, in part to include children who might not have such an initiative on their own home street (Sustrans and Playing Out, 2019).

This emphasis on more flexible and time-limited techniques for facilitating children's play reflects wider shifts in planning towards 'tactical urbanism', a topic covered at greater length in Chapter 5. Although the more radical vision for residential streets proposed by the woonerf designs have not been widely pursued in the UK (despite their partial enshrinement in *Manual for Streets*) there is a strong precedent for using time-limited closures to create space for children, with play streets representing an important precursor to the current focus on School Streets (Davis, 2020). However, these efforts to improve the quality of streets were much less focused on the problem of children's mobility to school, with a number of parallel policy efforts over the same period attending to this more directly.

2.3.2. Governing school travel in England: changing policy perspectives from New Labour onwards

A key marker in these past approaches is the 'Travelling to School Initiative' (TTSI) which was introduced at the central government level by the Department for Transport (DfT) and the former (and now defunct) Department for Children, Schools and Families in 2003. This initiated a concerted policy effort to promote active travel to school under the New Labour governments (1997-2010). Serving as a response to the declining rates of walking to school, the TTSI involved a range of measures but with a particular focus on School Travel Planning

(STP), including a stated goal of every school in England having a School Travel Plan by 2010 (Atkins, 2010). This was to be facilitated by a new network of school travel advisers on the local and regional level. Curriculum initiatives and capital investment in school facilities and surrounding areas also formed part of the project. Over its life course (until 2010) the initiative received £120m in capital investment which mostly focused on School Travel Planning (ibid). However, the TTSI was also supported by other parallel initiatives like the curriculum-based Bike It scheme and the National Standard Cycle Training both provided by the now-defunct government body Cycling England; the Walking to School Initiative Grant Scheme which largely supported the establishment of walking school busses; and a number of wider sustainable transportation policies like the Sustainable Travel Towns Demonstration projects (Atkins, 2010).

In all the TTSI and associated projects represented a period of significant investment and policy attention towards school travel. The development of STPs often served as a prior step to more significant capital projects, frequently funded in part by local authorities. These included schemes like the Links to School project (Department for Transport, 2006) which created safe walking and cycling links between schools and the emerging National Cycle Network, as well as traffic calming and safer crossings (Newson, Cairns and Davis, 2010). New traffic restrictions also formed part of these projects with the introduction of School Safety Zones, often marked by 20mph speed limits and parking restrictions (Cairns, 2005). However, it is unclear how extensive the infrastructural investment was as compared with 'softer' educational and capacity building activities which formed a key plank of the project. Another crucial element of this approach was the addition of a question to the School Census around each pupil's usual mode of travel to school⁶ (Atkins, 2010), the purpose of which was to monitor the impacts of these efforts and provide more accurate visibility on changing school travel patterns – insights only previously visible through the more general National Travel Survey or isolated surveys conducted by local authorities. This period also saw the introduction of the Education and Inspection Act of 2006 which placed a duty on local authorities to promote sustainable travel to school as well as requiring them to create a Sustainable Modes of Travel Strategy (SMOTS) for schools, increasing the role of local

⁶ An unfortunate casualty of the deregulation undertaken by the conservative Cameron administration in 2010 making further research on school travel trends, including for this research, much more difficult.

government in planning for school travel (Newson, Cairns and Davis, 2010). Aside from updated guidance to local authorities in 2014 (Department for Education, 2014), after the end of the TTSI which coincided with a change in government in 2010 there has been less significant central-government involvement in sustainable school travel policy – with local authorities generally taking the initiative to fulfil their relatively new statutory obligations in this area. The TTSI lives on in part in the accreditation scheme Modeshift STARS which was established by the DfT in 2008, operating as a private company providing travel planning to schools, albeit through voluntary participation.

The TTSI and the introduction of new statutory duties for local authorities set the scene for the introduction of School Streets in the 2010s. The TTSI's emphasis on capacity building and educational initiatives to encourage behaviour change is typical of wider approaches to environmental and health policy in this period. As Chapter 7 looks at more closely, although many of the activities associated with the TTSI continue to be conducted in schools on a local level, School Streets represent a partial departure from these initiatives, instead focusing almost exclusively on the quality and safety of the street itself through direct traffic reduction as opposed to traffic management. An evaluation of the TTSI in 2010 found that although these schemes had introduced the principles of sustainable and active modes of travel to many schools in England the headline policy of an STP for all schools was not achieved (Atkins, 2010). Additionally, on the national level the policy had not noticeably changed travel behaviour, and school travel planning had not significantly improved the sustainable mode share in the schools that did create plans (*ibid*). However, in the official evaluation there was no attempt to distinguish between schools with higher and lower levels of capital investment in infrastructure. Several case-studies showed that in some schools where more intensive work was done significant changes in behaviour were achieved (Newson, Cairns and Davis, 2010), and in London where over 90% of schools implemented an STP, a figure of a 6.5% reduction in private motor vehicle (PMV) use is quoted as the average impact at these schools (The London Assembly, 2011). Nonetheless, the official evaluation of the scheme concluded that in general the TTSI did not represent good value for money (Atkins, 2010). Although not directly attributable to the findings of this report, as Chapter 7 examines, scepticism around travel planning and 'softer' measures more generally provides an important context for the implementation of School Streets (Möser and Bamberg, 2008; Bonsall, 2009). In a vacuum of central government intervention on the topic in the 2010s local

authorities continued to develop approaches fulfil their statutory duties around sustainable school travel, with School Streets emerging in part from this process.

2.3.3. Transport planning in London: Healthy Streets and the new mobile public realm

In London the planning and design of local residential streets are controlled by the 33 local authorities. As with an increasing number of metropolitan areas of the country, there is an additional (primarily strategic) regional level of government called the Greater London Authority (GLA). The GLA oversees a separate transport agency called Transport for London (TfL) which is responsible for London's public transportation and the primary road network (the TLRN which consists of about 5% of London's total road length, see Figure 3) as well as serving as a strategic body for transport policy among the local borough authorities. Although School Streets did not feature in the GLA's 2018 transport strategy⁷ (Mayor of London, 2018a), they have since been integrated significantly into wider TfL and GLA strategies. Most recently the Mayor of London hailed School Streets as a critical intervention in a wider goal of having 60% of primary age children in the city walking to school as their main mode by 2024, a stretch target as the previous goal of 57% set out in 2018 had already been reached (Transport for London, 2018b; Mayor of London, 2022). School Streets also feature prominently in the GLA's *Making London Child-Friendly* strategy (Mayor of London, 2019) which sets out a design-centred approach to improving the built environment to foster independent mobility. However, the most pertinent policy context for School Streets in London is arguably TfL's adoption of the 'Healthy Streets Approach', in which they are also cited directly. This serves as a rubric to aid in the design of London's streets and was first formally articulated in 2017 (Transport for London, 2017c, 2017b; Plowden, 2020) and enshrined as a central plank of the city's 2018 Transport Strategy.

⁷ Although it did feature in TfL's Walking Action Plan (Transport for London, 2018b)



Figure 3 – A map of London's 33 local authorities and the primary road network managed by London's transport agency. Boundaries: Office for National Statistics (2013), Roads: Transport for London (2020).

The framework designates 10 indicators, many of which are concerned with what could be construed as subjective and objective measures the quality of the street (Figure 4). These include the how loud the street is, how relaxed people feel on it, whether there is shelter, and how interesting the street is to look at (Transport for London, 2017c, 2017b). These are anchored by two main indicators, the first being that “people choose to walk, cycle, and use public transport”, and the second that there are “pedestrians from all walks of life” (Aldred and Croft, 2019). The indicators are also intended as a tool for appraising schemes as well as a rubric for designers and highways engineers working on public realm improvements and road redesigns. Although the starting place for the Healthy Streets approach is very much at the level of small scale-built environment features – benches, cross walks, planting etc, it does take a wider view of the quality of the street. Indicators like clean air and not too noisy also imply significant reductions in traffic while others like ‘things to see and do’ recall more long-standing attempts to better balance the ‘place’ and ‘movement’ functions of streets recommended by *Manual for Streets* among other design guides. What is interesting in these different emphases is the connection made between people’s experiences of a street and

their likelihood of adopting different mobility practices. The intention in the Healthy Streets approach is in part to attract people to walking and cycling through the improvement of the quality of the built environment and a changed emphasis in its use. Alongside schemes with much greater intervention in the public realm, School Streets are explicitly cited in the documentation and specifically in reference to facilitating different transport choices. As Chapter 5 explores this is also part of a wider acceptance of more ‘tactical’ and time limited interventions on streets in London.



Figure 4 – The 10 Healthy Streets Indicators (Transport for London, 2017c)

These indicators have been reinterpreted in Public Health England’s guidance on creating *Healthy High Streets* (Public Health England, 2018), as well as Homes England’s *Streets for a Healthy Life* (Homes England, 2022) document which focuses on the street environments in new-build housing developments. In part addressing the point that rubrics like the Healthy Streets indicators do not consider more subjective elements of street quality (Karlsson, 2018), recent research finds that the ‘public life’ dimensions of more experimental street transformations are generally more widely accepted by citizens than logics focused purely on mobility or the environment (Smeds and Papa, 2023). This in part justifies such a framing that combines the quality of public space with broader attempts to reshape mobility. However, as

is discussed in more detail in Chapter 8, although various aspects of the built environment including its streets are well understood to be determinants of health, there is less research (Stappers *et al.*, 2018) demonstrating that small scale (street level) interventions like those advocated here are effective in changing mobility practices; even if they might improve the quality of the experience for those already using it to walk or cycle. This raises questions of whether this scale of built environment change is a meaningful tool for enacting behavioural change. Although not focusing on children, Karlsson (2018) also questions whether as an assessment tool it adequately captures the needs of all street users, with some streets designated as 'healthy' not adequately providing for disabled pedestrians. These considerations are particularly important in the context of a School Street intervention which focuses on the needs of child pedestrians, whose needs may also be different to the users most provided for in the Healthy Streets approach.

2.3.4. Trends across policy and practice

The improvement of residential streetscapes, the widespread adoption of school travel planning, and the more recent development of the Healthy Streets indicators demonstrate three approaches in planning and practice with linkages to the present proliferation of School Streets. Although there are several different convergences and divergences from the present approach, two trends stand out. The first is the shift away from traffic calming as represented in the woonerf and in part school safety zones promoted in the TTSI, towards the emphasis on traffic exclusion in School Streets. This could be read as a further extension of the restrictions on vehicle speed and parking at schools; however, when read within the context of the Healthy Streets approach, particularly indicators like "not too noisy" and "cleaner air", the removal of traffic also represents a shift in emphasis on to the experience of using the street. Another notable trend is the move from more durable changes to the use of time-limited and tactical closures with a lighter footprint on the built environment. As Chapter 5 examines this is not just limited to the built form but reflects a shift in governance too, with the much more deliberative processes around school travel planning and the TTSI giving way to more contingent and expeditious methods. Finally, a narrative thread through these dynamics is the way that improving the quality of the street environment for people in general, and children in particular has converged with wider goals around changing patterns of mobility – detectable in TfL's Healthy Streets approach for example. As will become clearer in the next chapter, School Streets are themselves indicative of this wider shift.

2.4. Conclusion

In his book *The Child in the City*, Colin Ward quotes Margaret Mead, advising that the ‘child’ in general does not exist – we can only speak of *children* (Ward, 1978, p. vi). Which is to say that a whole host of individual factors, family arrangements, legal designations, and social structures, all far larger than that of the neighbourhood or street, influence how children move around and experience their local environments. Nonetheless, there are still problems that children experience in general, and extensive research drawing from multiple disciplinary backgrounds demonstrates numerous ways that the neighbourhood environment can influence the independence, play, and mobility of children and that the nature of this relationship and the environment itself can have profound impacts on childhood health and development. The sociological concept of automobility provides a productive framework to understand how the environment and practices of mobility are co-created to form this complex ‘problematic’ of children’s (auto)mobility. This problematic, or perhaps more accurately, aspects of this problematic have been approached by a number of different governmental policies, approaches in urban and transport planning, and interventions in the design of streets of which School Streets represent a recent iteration. What the examples examined here show is that although there have been longstanding calls to improve the urban environment for the benefit of children, disrupting the dominant system of automobility in the UK has proven difficult. Although perhaps less ambitious in scope than say the widespread introduction of woonerf, as will be explored further there is a sense that they are a parsimonious solution, which intervenes at a critical juncture in this wider problematic.

Introducing the School Street

3.1. What is a School Street?

The intention of this chapter is to introduce the concept of the School Street in detail, considering its origins, characteristics, and divergences as well as the current state of knowledge on its impacts. Although some accounts differ, the oldest example of the paradigmatic School Street is from Bolzano in the Trentino region of Northern Italy (Clarke, 2022). Since the 1990s parents in the town had been using temporary barriers to close the streets directly outside of the school to vehicles. For many years this remained a local curiosity before at some point spreading to nearby Milan and then onto a handful of authorities in Belgium in the early 2010s. However, serious growth in the concept did not kick off until the middle of the 2010s. Around this time a group of local authority officers from Edinburgh City Council and the London Borough of Hackney visited Milan as part of an EU funded project called STARS Europe which sought to connect local government planners from across the continent working on issues around travel to school. The primary result of this knowledge exchange was an attempt to bring the concept to cities in the UK. The very first schemes in the UK were implemented in Edinburgh in 2015 with the first London scheme following the next year⁸ in Camden (Camden Borough Council, 2018). Hackney, Islington, and Croydon Borough Councils quickly followed with their own schemes and the concept began to take hold in the city. Across western Europe⁹ the concept also began to become more widespread with 8 different countries having implemented some kind of scheme by 2019.

⁸ The first scheme in London, however, was not inspired from the Milan trip and was instead implemented by the London Borough of Camden, which took inspiration from a completely different scheme in Reading (Camden Borough Council, 2018). This involved an enterprising head teacher implementing their own scheme separately from many of the parallel developments in Europe. There are also two isolated schemes in London that bear considerable similarities to School Streets that were implemented long before the Camden scheme, using a simple gate. These presumably were installed to solve quite specific problems with parents driving up very narrow school access roads.

⁹ Tirana in Albania is the most notable non-Western European example. Several trial schemes in North America have also taken place but it has not taken hold in the same way there (Clarke, 2022)

3.1.1. The basic premise

Although there is variation in the concept with different approaches falling under the umbrella term ‘School Street’, most schemes in the main follow the basic premise set out in the original Bolzano schemes. Generally speaking we can consider a School Street to be:

1. A periodic closure to the street – i.e. the closure only operates for set periods of time, typically an hour in the morning drop off time and an hour in the afternoon pick up.
2. The closure is recurring. This means that it has a regular repeating pattern. Usually this is every weekday, Monday to Friday during school term times.
3. The street is closed in such a way that if necessary residents who live on the street or other people deemed to be exempt from the scheme can drive into or out of the closure without penalty.
4. The closure is typically on the streets closest to the school unless these streets are main roads where the closure would result in significant traffic displacement.

Although the size of schemes, method of enforcement, length of closure, and degree to which they alter the built environment all significantly vary, in the UK these general principles are followed in most cases.

3.1.1.1. Feasibility in the UK

Although several different variables determine how local authorities choose schools, something discussed in more detail in Chapter 5, there are also basic restrictions on the kind of roads on which a School Street is considered feasible. To date local authorities have been reluctant to close streets with higher traffic volumes, either closing a near-by street perpendicular to the school, or not introducing a School Street at all. Although in Barcelona School Streets have been implemented on busy roads, albeit without a closure to through-traffic, in the UK local authorities have been slow to develop equivalent schemes for schools on main roads. Hopkinson et al. (2021) outline a flow chart which codifies the general conditions under which a School Street is deemed a suitable intervention for different schools. In theory, schools located on bus routes are still possible with the introduction of a camera-operated bus gate – allowing the bus through but issues a fine to other traffic. However, in practice this is quite rare, in part because bus routes typically run along larger streets that might not be suitable for a School Street in the first instance.

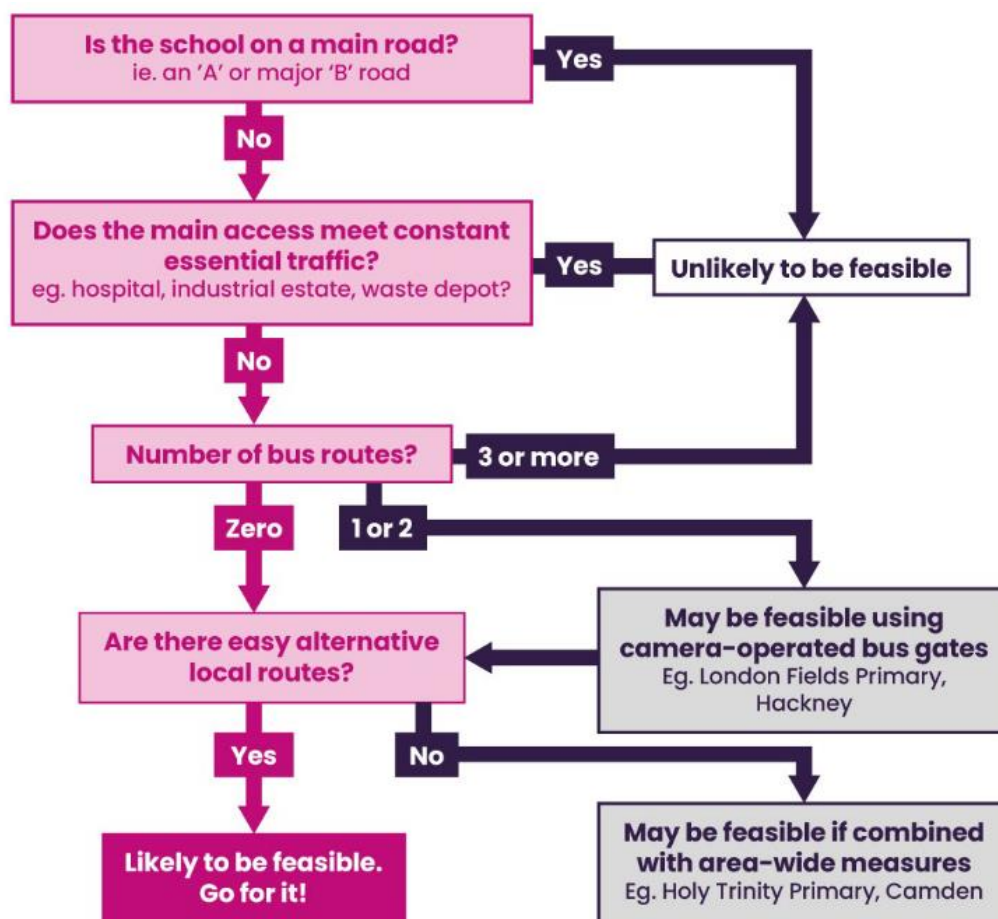


Figure 5 – The conditions under which a School Street is typically feasible in the UK. Source: Hopkinson et al. (2021)

3.1.2. Purported benefits of a School Street

Supporters of School Streets have highlighted several interrelated benefits. These can broadly be split into the direct benefits of removing traffic from the street in front of the school and more indirect benefits that are derived from changes in mobility associated with a School Street. Direct benefits include improved air quality and road safety, indirect benefits are improved physical activity from increased walking and cycling, as well as the reduced GHG emissions associated with a modal shift away from cars. As will be discussed in the existing literature section, several of these benefits are inferred or assumed and although some have since been corroborated by research, many School Streets were installed when little research on their impacts was available. The direct benefits are generally quite intuitive. For example, helping to manage excessive traffic in the school vicinity is a compelling rationale on its own without the need for extensive research on all potential impacts. Nonetheless many of the most significant benefits, particularly concerning physical activity, are derived from the indirect process of encouraging mode shift away from cars. These changes confer benefits

not just to the segment of street directly in front of the school, but also along the entire route taken. This is demonstrated in the flow chart in Figure 5 which shows the two pathways through which a School Street might operate. The upshot of this is that although a School Street can improve conditions without significant modal shift, the impact is greatly increased if parents/carers and children do change their mode of travel. Although modal shift has been an assumed impact, it is more difficult to measure and is generally not recorded by the local authorities implementing these schemes. This makes it difficult to fully assess the extent to which most schemes realise these indirect benefits, and produce the full impact sometimes assumed. Chapter 8 deals with this question more directly.



Figure 6 – London's first School Street on Macklin Street in Covent Garden with the closure in operation. Source: Camden Council (2016).

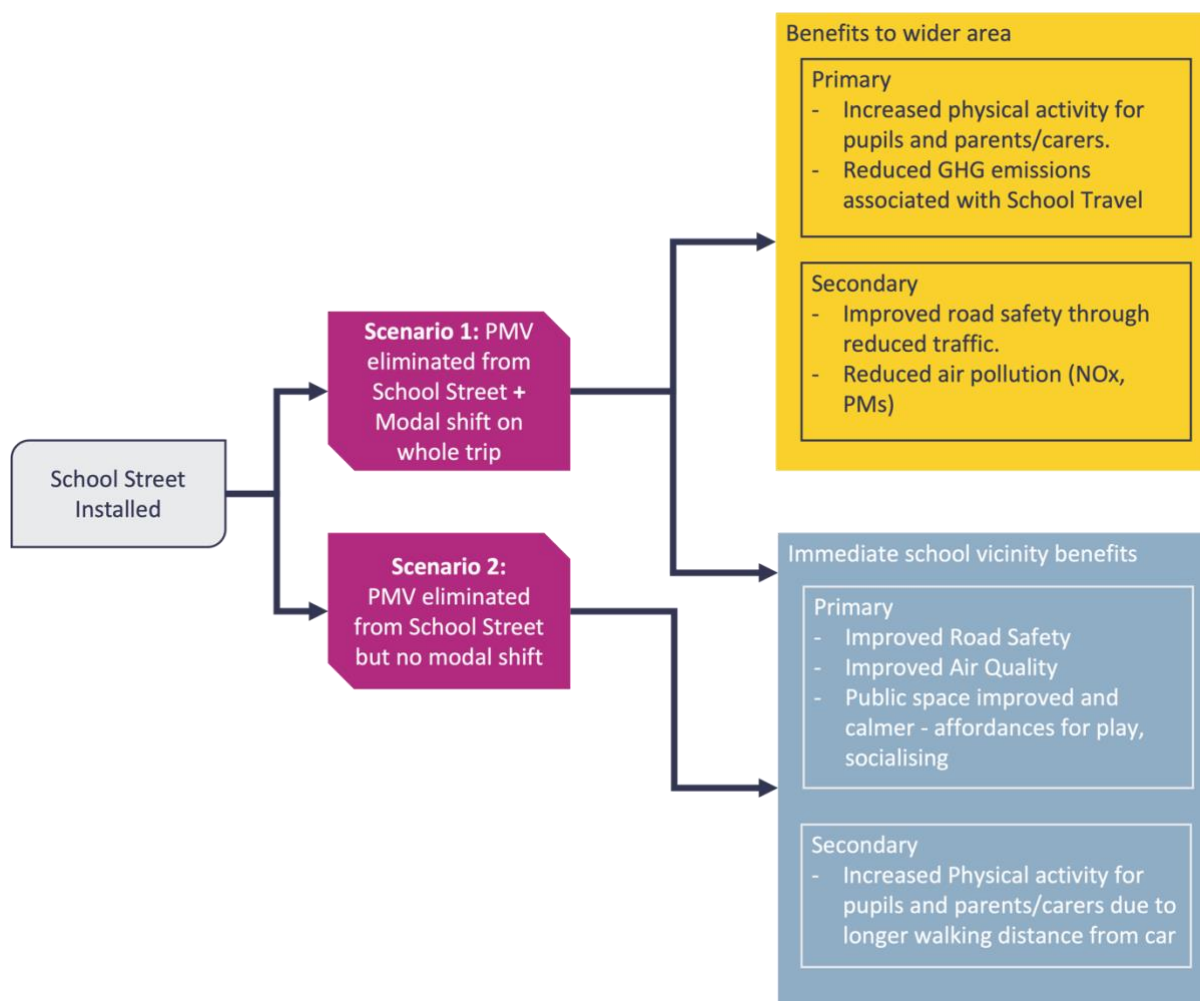


Figure 7 – Flow chart showing the typical impacts of a School Street and the potential benefits. PMV = Private Motor Vehicle, AT = Active Travel.

3.1.3. The materiality of School Streets and modes of enforcement

One of the key features of the design of a School Street is how traffic is prevented from accessing the closure while continuing to allow the vehicles from residents or other exempt groups to enter or leave the area. In general, the School Streets in London have achieved this by using measures that have not significantly altered the visual appearance of the street. The very first scheme in London used a bollard which could be lowered into grooves in the road when the closure was not in operation (Figure 6). In this case the school caretaker would raise and lower the bollard at closure time and for any potential exempt vehicles (of which there were very few). Many subsequent schemes have used temporary barriers which are retractable and stored at the school when not in use (e.g. Figure 1). These are often supervised by school staff or parental volunteers who can let exempt vehicles pass through if

necessary. This approach has been particularly popular as a low-cost way to trial schemes before they are finalised, allowing amendments to be made before more permanent infrastructure is put in place.

In London, by far the most common method of enforcing a School Street long-term is the use of automatic numberplate recognition cameras (ANPR) to issue fines to drivers who enter schemes during the closure times while exempt vehicles are added to a permit. This method, which was pioneered by Hackney council in the northeast of London, has the advantage of minimal staffing requirements and the high upfront costs are in most cases recouped by fines (Mums for Lungs, 2023). Because of the low ongoing burden on school administrations and volunteers, this approach is favoured by many local authorities and has become the dominant method in London. However, local authorities in other parts of the UK do not yet have the permission to use this technology for this purpose, so nationally approaches using temporary barriers or just signage without active enforcement are more common.



Figure 8 – Signs marking the entrance to a camera-enforced School Street in London. Unsupervised temporary barrier in place to calm traffic. Source: Author.

3.1.4. Beyond the temporary closure

However not all School Streets have followed these paradigmatic design principles and scheme characteristics. For example, on some streets where resident access is not required, local authorities have been able to permanently close small stretches of street. This is sometimes done using a modal filter (a barrier to motor vehicles which is in place at all times but through which pedestrians and cycles can pass, see Figure 10) and in other cases using more extensive transformations to the street. This approach creates a completely traffic free space and can also contribute to wider goals around reducing through-traffic throughout the entire day. It also has greater potential for creating new public space, with some schemes including elements of seating and new planting or sustainable urban drainage schemes like rain gardens. Although full closures are far from the norm, a handful exist around the city, including some significant public realm schemes. Bridget Joyce Square in the west of the city, for example, occupies what was once a stretch of street that separated a nursery and health

centre from a local park and adventure playground. Although not considered a School Street – ironically at the time of writing Hammersmith and Fulham borough council is one of only two boroughs in the city without a School Street programme – it demonstrates how full closures can create new child-friendly spaces (Figure 9).



Figure 9 – Bridget Joyce Square in Hammersmith and Fulham. Source: Greater London Authority

More common is the integration of some smaller built environment features or the closure of a single point on the street with a modal filter. A handful of schemes in the London Borough of Tower Hamlets for example have integrated new rain gardens and seating into their temporary closures, and on some of their schemes Haringey council have used a modal filter at one end of the street, with the other end closed only temporarily using a camera. These designs integrate schools into wider traffic reduction policies like Low Traffic Neighbourhoods (LTNs), and/or public realm strategies like Lambeth’s recent kerbside strategy – which seeks to reallocate 25% of the borough’s kerbside from parking to sustainable uses like planting or cycle storage.



Figure 10 – A School Street in London that is in place at all times. This short closure to does not include resident access so no exemptions are required. Source: Author

3.1.5. International variations

Although there is some variation in design in London, international examples provide even greater points of contrast. Clarke (2022) estimates that as of 2022 there were over 1200 School Streets internationally with around 16 different countries having implemented some kind of closure, or at the very least a trial scheme. However, the majority of these are in the three cities that have implemented the most significant programmes to date. With nearly 600 at the time of writing, London has by far the most School Streets of city, Barcelona has the next most with 217 (Ajuntament de Barcelona, 2021), and Paris is close behind with 180 (Ville de Paris, 2023). Although not concentrated in a single urban area, they have also been adopted in a number of different towns and cities in Belgium, with Ghent being one of the earliest adopters of the concept in 2012. For the most part these international schemes have followed the principle of the temporary recurring closure outlined in the earlier definition.

However, often these schemes look materially different to the relatively ‘light touch’ approach taken in the UK. Schemes in both Paris (Figure 11) and Belgium (Figure 13) have implemented some kind of permanent physical gate system to manage the closure. In the case of Paris these are designed to blend in with the other wrought iron street furniture in the city while other cities have taken a more playful approach to the design.



Figure 11 – A Paris School Street with an example of permanent swinging gates installed. Source: Mairie de Paris <https://mairie13.paris.fr/pages/rues-aux-ecoles-13083>

The *protegem les escoles* (protected schools) schemes in Barcelona perhaps represent the greatest departure from the UK examples. This broader policy seeks to improve road safety and crucially also public space at a wide variety of schools in the city. There is a greater emphasis on urban design, with benches and play elements added to the street and consistent design language expressed through street paint which is used to demarcate the protected school street from those nearby. In terms of traffic permeability there is also significant variability in how each of the Barcelona schemes operate. Some involve the full pedestrianisation of the street with the whole area reclaimed for children, others operate as temporary recurring closures similar to volunteer run schemes in the UK, others are simply traffic calming schemes with cars as ‘guests’ in the street but no restrictions on access. With

schools on major arterial roads which would be deemed unfeasible in the UK, in Barcelona they have reclaimed parking and other under-utilised road space with barriers, again adding play elements, planting and benches, to create more space for play and congregation without significantly altering the flow of traffic (Figure 12). Although similar, more modest principles have been used at London schools with pavement-widening schemes during Covid-19 (Fairfax, 2022), much less attention has been paid to the design of the street.



Figure 12 – Two protected schools schemes in Barcelona, reclaiming street space in front of two schools. Source: Ajuntament de Barcelona <https://ajuntament.barcelona.cat/ecologiaurbana/ca/que-fem-i-per-que/urbanisme-per-als-barris/protegem-escoles>



Figure 13 – In Leuven, Belgium a permanent flexible barrier installation is used to temporarily close the School Street. Source: https://www.standaard.be/cnt/dmf20201202_98018169, Copyright Kristof Vadino

3.1.6. Summary

School Streets in the UK can be generally defined as temporary recurring prohibition of motor vehicles on the streets outside of schools, but there is a great variety in the ways that this has been interpreted and enforced. Although the emphasis on camera enforcement is the norm at School Streets in London, this is not the case in the rest of the UK and internationally, with flexible barriers and volunteer operation more common. The focus on the closure of the street without significant change to its appearance or layout is also more unique to the UK, with international examples demonstrating a range of different design vernaculars for these schemes. Despite these deviations, the definition posited at the beginning and the wider discussion of different enforcement types provides guidance to the reader as to what is meant by a London ‘School Street’ in this dissertation.

3.2. Current state of the knowledge on School Streets

3.2.1. Overview

The existing body of research on School Streets is mostly limited to grey literature reports. From the installation of the first School Street in London in 2016 until 2020, the evidence

base for School Streets was limited to monitoring and evaluation reports produced by local authorities to assess individual schemes. In some cases these recorded changes in mode of travel to school as well as traffic counts. Other notable contributions included an in-depth case study of the first trial School Street in Camden which outlined the process of its introduction and some estimations of its impacts. During this time Hackney council also produced a guide aimed at other local authorities which set out their suggested method for designing and implementing schemes. As interest in School Streets increased rapidly in 2020 the inadequacy of the current evidence became apparent to a wider audience. However, somewhat ironically it also became more challenging to produce research on the topic. Plans for more extensive research on their traffic impacts were delayed as lockdown related changes to travel patterns meant that it was impossible to measure their 'typical' effect. The rapidity with which they were installed also presented challenges. Compressed timelines meant organising the collection of baseline data was difficult, or even unethical if it meant the delay of implementing a scheme that would otherwise help alleviate the spread of Covid-19. Budgets were also focused on implementation with little left over to properly monitor their effects. Therefore, while the number of schemes increased rapidly, the evidence-base for their effectiveness did not grow at the same pace.

Nonetheless, in 2021 and 2022 several important pieces of research on their impacts were completed by Transport for London, the Greater London Authority, and Sustrans. These efforts went some way to plugging the evidence gap, particularly on their air quality impacts and concerns around traffic displacement. However, knowledge gaps remain on their effect on mode of travel. Despite these unanswered questions, the extent of adoption across multiple cities, and the considerable novelty of both the policy process and mode of intervention, academic engagement with the topic has remained sparse. The only scholarly research published to date has been conducted as part of this thesis and is included in the chapters that follow. The research in these numerous grey literature reports provide important context for this dissertation. This section will consider the main aspects of this existing work in more detail, highlighting key findings and limitations. Table 1 provides a summary of the existing research documents for reference.

3.2.2. Mobility impacts

One of the key claims about the benefits of School Streets is that they lead to a change in the mode share for school travel (see Figure 7). However, this is one of the impacts most reliant

on before and after data which has been limited during the Covid-19 period. Although Chapter 4 of this thesis attempts to amend this, evidence before now has come primarily from a report estimating the potential effects of the wide-spread adoption of School Streets (Hopkinson *et al.*, 2021) and a small research project conducted by Transport for London (2021). Both approaches have reported positive albeit modest effects on private motor vehicle use and the uptake of active travel. Hopkinson *et al.* use the figure of a 3-6% reduction in private motor vehicle use associated with each School Street. This estimate is based on a meta-analysis of before-after travel surveys from 27 schemes introduced prior to 2020. Although TfL's rapid research using parental surveys was not able to measure travel behaviour before and after the introduction of a School Street, they did ask whether parents had changed their use of different modes of travel at intervention and comparator schools. They reported slightly higher rates of active travel amongst parents at schools with School Streets than those without. However, there are some limits to the reliability of such self-report methods is limited especially when asking people to recall past behaviour, and the focus of the research was on parental perceptions and acceptance of the schemes themselves as opposed to mobility *per se*. The limitations of the approach in Hopkinson *et al.*'s is more associated with the small sample size of schools and lack of comparison group (something addressed in Chapter 9).

3.2.3. Air quality

Given the emphasis placed on this topic by the current municipal administration in London, perhaps the other most important impact associated with School Streets is the reduction of air pollution. Although it is intuitive that the closure of the street would improve air quality in the immediate vicinity, the dynamics of the ambient concentrations harmful pollutants are complex, highly site-dependent, and determined by factors beyond simply traffic flow. Equally, however, the benefits of limiting highly localised exposures like a child walking near to an idling car for example are very difficult to measure through methods designed to assess wider ambient concentrations. Thus, there is the potential for the benefits to be either overstated or understated dependant on the methodology. In spite of these complexities the Greater London Authority commissioned Air Quality Consultants to conduct a study of the impact of School Streets on air pollution. As with many of the studies considered here, before and after observation was not possible due to the pace of scheme implementation so the researchers used a case-control study structure, with several control schools observed. The

effect of the School Street was measured through a comparison of the diurnal profiles (daily exposure pattern) between intervention and control sites. The report estimates that School Streets are associated with a reduction in NO₂ of up to 23% during the closure period, or 2% across the whole day. For NO the reduction across the whole day was 5%. These represent quite significant reductions given the relatively short period of time that these schemes are in place for. This study is perhaps the most significant of the existing evidence on the impacts of School Streets, especially considering the increasing concern over children's exposure to air pollution in public discourse.

3.2.4. Traffic dynamics

Another key area of existing evidence is around the changes to how the street is used and the dynamics of traffic in the wider area. Although this could encompass a wide range of different criteria, existing research has focused on changes in the flows of pedestrians, vehicles, and cycles; as well as the way in which pedestrians negotiate the street. The first contribution in this area was a report written by the author of this dissertation, which looked at traffic flows before and after the introduction of a School Street at two sites in Hackney using machine learning sensors provided by the company Vivacity (Thomas, 2022). This study generally found large reductions in traffic during the closure times, which persisted – albeit to a lesser degree – outside of these times. Traffic reduction effects were magnified when more punitive enforcement measures were used during the closure. Although there were no notable impacts on pedestrian flows, a small uptick in cycles was recorded during the closure times. A concern with School Streets (as well as other schemes like Low Traffic Neighbourhoods) has been their potential to displace traffic to neighbouring streets. Sustrans conducted a study in Birmingham looking at the changes in traffic flow on the closed street as well as those on the surrounding roads. Similar to the Hackney study, they found significant reductions in traffic during the closure, and only mild displacement effects. They also examined pedestrian-vehicle interactions at the intersections with the closed streets reporting an increase in overall interactions but no significant new road safety issues.

Changes in the modality of pedestrian use (not just flow) is another question that has seen some attention. The Hackney study compared the total movement of pedestrians on the pavement vs. the carriageway at one of the sites. There was no change in the proportion of pedestrian movement in either zone after the introduction of the School Street, with the pavement still being the primary site of pedestrian activity. This implies minimal changes in

pedestrian comfort of the street. However, this site had particularly high levels of residual traffic due to the large number of exemption permits issued and intermittent enforcement, perhaps explaining the non-finding. TfL have subsequently examined this question of the relationship between pedestrian use of space and residual traffic in more detail. They conducted a comparative study of five School Streets with different levels of residual traffic, looking at similar measures of pedestrian pathways through different zones of the street (Transport for London, 2022). They found that generally speaking, higher levels of residual traffic led to less use of the roadway, with some lower-traffic sites showing greater evidence of pedestrian adoption of the carriageway as a shared space. However, several gaps remain in the study of the use of space. Public-life studies for example could examine the different pedestrian uses of these streets (play, congregation, conversation etc). Crucially studies of street dynamics that utilise a quasi-experimental study structure to obtain findings around the improvement in pedestrian conditions associated with a School Street are also needed to augment the more limited findings from the Hackney study and more recent TfL research.

Table 1 – Summary of the existing research on School Streets as of May 2023, organised chronologically. Note: published research Thomas, Furlong, and Aldred (2022) is not included here as it has been adapted for inclusion in this dissertation (Chapter 6).

Source	Study Method	Impact	Key Findings
(Davis, 2020)	Literature review and stakeholder interviews	Traffic Displacement	No evidence for significant traffic displacement, or displaced road safety issues.
		Policy	Active travel uptake a key rationale for a School Street. Traffic safety in scheme allocation and design driven by perceived as opposed to objective measures.
(Air Quality Consultants, 2021)	Intervention and control study (but not before/after) of 16 schools using 30 air quality sensors.	Air Quality	23% reduction in NO2 concentrations at a School Street vs comparator School during morning closure time.

	Difference in diurnal profiles analysed. London, UK		Results in 2% decrease over 24hr period.
(Transport for London, 2021)	Parental Surveys at 36 Schools in London, UK. Intervention and comparison sites.	Mode of Travel	Usual mode of travel relatively unchanged before/after Covid across both groups, but both saw increase in regular active travel to school, particularly walking (27% at, intervention, 22% at control)
		Perceptions	84% of parents/carers at School Street schools approve of them. Majority at control schools also approving of concept. Perceptions of improved congestion and satisfaction with local area in intervention group.
(Hopkinson <i>et al.</i> , 2021)	Modelling for four UK cities based on spatial characteristics of existing School Streets. Also includes meta-analysis of existing local authority monitoring and evaluation data.	Mode of Travel	Estimated a 3-6% decrease in motor vehicle mode share due to School Street.
		Feasibility	School Streets likely feasible at around half of schools in 4 UK cities studied.
(Belcourt-Weir, Cannell and Pearce, 2022)	Before and after traffic counts on a School Street and surrounding roads at two sites in Birmingham, UK. Pedestrian-vehicle interaction monitoring. Survey of residents.	Traffic Displacement	Overall decrease in traffic at School Street (-44%, -63%) and surrounding roads (-9%, +2%). Evidence of traffic evaporation. More pedestrian/traffic interactions at the entrances to closure but interactions not more severe.

		Perceptions	Strong resident support schemes. Perception of improved safety on surrounding streets.
(Thomas, 2022)	Before and after motor traffic, cycle, and pedestrian counts at two sites. Pedestrian path analysis at one site.	Traffic	Decrease in motor traffic both during (-55%, -64%) and outside of closure (-16%, -11%) times. No increase in pedestrian use, slight increase in cycle use. Stronger results when stricter enforcement measures in place.
		Pedestrian Use of Space	No change in % of pedestrian distance walked in roadway before/after School Street.
(Transport for London, 2022)	Stakeholder Interviews, traffic counts, pedestrian path analysis at 5 case-study sites	Policy	Strong school/local authority partnership, integration with wider active travel activities, and responsiveness to local needs important to scheme success.
		Traffic	70-80% reduction in vehicles per hour during closure times (as compared with rest of the day).
		Pedestrian Use of Space	Sites with lower levels or no residual traffic had higher pedestrian use of roadway (30-35%) vs the busier school (2%).
(Clarke, 2022)	International survey of the extent of School Streets in each country.	Global Distribution	London has by far the most extensive network of School Streets, followed by Barcelona and Paris. Most growth since

			Covid. Still highly concentrated in Europe.
--	--	--	---

3.2.5. The limitations of research to date

Systematic reviews of the existing research on interventions promoting AST have emphasised the variability of both the observed outcomes and the quality of evidence (Chillon *et al.*, 2011; Pang, Kubacki and Rundle-Thiele, 2017; Larouche *et al.*, 2018). Common problems that have been identified include the use of study structures without control groups and inadequate sample sizes (Möser and Bamberg, 2008; Larouche *et al.*, 2018). Although great effort has gone into improving the evidence base for School Streets under the challenging research circumstances (of which more will be said in the next chapter), these methodological problems in the wider research on AST are also found in the existing literature on School Streets. In this literature there has also been less focus on important potential impacts of these schemes, most notably the impacts on mobility but also rates of road traffic injury. The second theme of this dissertation (Chapters 7 and 8) addresses the question of mobility. Considering again the dynamics of the ‘problematic’ of children’s (auto)mobility, another key gap relates to assessing the potential contribution of School Streets to wider issues of environmental equity. Air quality and road safety have long been understood as justice issues, but the contribution of School Streets to ameliorating these inequities depends in part on their distribution and policy dynamics. The first ‘policy process’ theme of this dissertation, and Chapter 6 in particular attends to this question. Finally, the study of School Streets as a novel intervention provides an important contribution to the growing literature on interventions to promote AST, but it also engages in wider questions around the transformation of urban environments to challenge the system of automobility for the benefits of children. This cannot be limited to an assessment of ‘impacts’ but must also engage in wider questions of the politics of change at the hyper-local level.

Research Design

4.1. Introduction

This chapter covers the overarching research design for this dissertation. It aims to outline and reflect on the unifying research approach and the way that the knowledge in this dissertation has been produced in total. It also aims to assess the benefits and limitations of this mode of knowledge production. In all, this chapter argues that a worldview grounded in pragmatist philosophy provides an intellectual basis for the flexibility needed to fully study a ‘live’ research topic in the uncertain conditions presented by Covid-19. However, in terms of actually describing a research practice, the concept of *bricolage*¹⁰ is best placed to articulate the methodological pluralism of the approach taken here.

Table 2 – A summary of the methods used in each chapter of the dissertation

Chapter	Theme	Topic	Method
5		Implementation and tactical urbanism	Reference to documents and qualitative Interviews
6	Policy Process	Distributional Equity	Quantitative analysis of distribution of School Street locations.
7	Behavioural Change	Practitioner Perspectives on Behaviour Change	Qualitative interviews with themes systematically analysed
8		Modal Shift	Quantitative analysis of school travel surveys.

Table 2 shows the different methods drawn on by each of the core research chapters in the dissertation. In general, each of these chapters follows the conventions of a research paper

¹⁰ Bricolage refers to a mode of research which draws on a patchwork of different contrasting methods to produce new knowledge (Kincheloe, 2001). This outlined more in detail in section 4.6.

and in the interest of clarity each contain their own methodology¹¹ section which outlines in detail how the research was conducted and the how the inferences were made. However, this research does also seek to make connections within each of the two major themes and across the collection of chapters as a whole, and within each chapter there is generally less engagement with how each relates to wider research paradigms and the underpinning ontological and epistemological assumptions. Filling this gap, this short chapter explores these issues around knowledge production while also providing an account of how the research for this dissertation was conducted in practice. Reflecting on this process, and the challenges faced during initial stages of the Covid-19 pandemic in particular, connections are drawn to new and existing debates firstly on the need for ‘research resilience’ in emergency contexts, secondly on the use of mixed methods in research, thirdly on the adoption of a pragmatist research paradigm in policy-focused research, and finally on the approach of methodological bricolage as a research practice.

4.2. [Researching in a pandemic: an account of an adaptable research practice](#)

The research planning for this thesis began in February 2020, just prior to the initial UK Covid-19 lockdowns. In the first few weeks I¹² had planned a pilot study for an initial methodology. The approach was focused on adapting and expanding methods previously conducted by Aldred and Croft (2019) on similar small-scale road space reallocation schemes. Central to this was an intercept survey which involved stopping passers-by and asking them a quick list of questions or providing a QR code to a survey. As I began designing the survey and applied for ethical approval the first of several lockdowns began and it quickly became clear that the research as I had intended it may not be possible for quite some time. The use of face-to-face research methods was indefinitely suspended by the university, and it was many months until protocols were outlined for safe in-person research. With the rapid proliferation of these

¹¹ Although relying on the same data source, the qualitative chapters are an exception to this. Chapter 1 draws more tangentially on the interviews and the full details of the qualitative methodology and thematic analysis are outlined in Chapter 3.

¹² In contrast to most of the rest of this document, this section is written in the first person. I felt that this was appropriate for this chapter which focuses extensively on my own actions. It felt more natural to describe these activities in this way here.

schemes during this lockdown period, I also feared that even if these methods became possible later on (which they ultimately did), opportunities to capture both before and after data on planned schemes would have been missed.

One of the few research methods available during this time was the use of remote interviews conducted over video conferencing. During the initial acute phase of the pandemic I decided that instead of waiting for conditions to change, I would conduct an initial rapid qualitative research project interviewing practitioners about their experience implementing School Streets. The aim was to find out more about how participants understood behavioural change (Chapter 7) but also to capture some of the ways they were responding to the new pressures of working during Covid 19 (Chapter 5). From May-July 2020 I interviewed 18 practitioners who were involved in the introduction of School Streets in one way or another. Participants were mostly drawn from local authorities but also from other organisations who provide support or advice, or were involved in higher-level policy work on the topic. See Table 3 for a breakdown of the balance of interviewees by type of organisation. These were conducted mostly over video conferencing software but in handful of cases over the phone. Transcription was completed using an automatic transcription service which involved heavy manual editing to make usable.

Table 3 – Interviewees segmented by sector of employer

Organisation Type	
London Borough Authorities	10
Transport Authority	1
Third Sector/Charities	5
Independent Experts	2
Total	18

The full methodological process for these interviews is covered in Chapter 7. However, the initial intention was that this would feed into a more fulsome survey-based quantitative study that would reveal more about the mechanisms of behavioural change. In this version of events, the research project as a whole would have taken the form of a more formal ‘exploratory sequential’ mixed methods study design (Creswell and Plano Clark, 2018). However, early findings from these interviews prompted a change in direction. This was for three major reasons. Firstly, the content of these interviews did not directly yield the kind of

insights that I had hoped could be integrated and tested in a follow-on quantitative approach – participants did not engage in extensive elaboration of their understandings of behavioural change, instead focusing on more pragmatic concerns around policy implementation; concepts less easily explored in the survey project I had in mind. Secondly, several interesting and potentially timelier research questions were developed from these initial findings. These questions surrounded the policy processes involved in enabling the installation of these schemes and the potential equity implications of such a rapid process, as well as whether behavioural change was occurring at all as a result of these schemes.

The third, and perhaps most important reason was the emerging availability of new secondary datasets. Parallel to this interview project, the campaign group Mums for Lungs were recording the locations and start-dates of all School Street schemes in London, creating a critical resource for researchers and campaigners. As time went on and the number of schemes grew, the University of Westminster supported ongoing updates to this dataset and I undertook an effort to validate it further to make it usable in research. This included comparisons to other available data sources such as that from the non-profit organisation Sustrans – who through their network of officers embedded in each London borough were maintaining a similar albeit less exhaustive dataset. This process is described in more detail in Chapter 5. With schemes quickly numbering in the hundreds as opposed to tens, the scale at which they could be researched also changed substantially. As a result, it became clear that this dataset of School Street locations could be combined with secondary transport and demographic datasets to assess the equity of their distribution and some wider impacts, in part addressing the new questions raised from the analysis of the initial interview project.

Immediately following the interview project, TfL also expressed an interest in the project, particularly the initial research question on behavioural change. They offered access to their school travel survey data as a potential resource. In combination with the scheme location data collected by Mums for Lungs, these surveys could be used to assess behavioural impacts across a much larger number of schemes than would be possible through any primary data collection exercise. With these newly available data sources, I decided to re-focus my efforts on addressing these emerging research questions on policy processes and the question of transport behaviour at the larger scale afforded by TfL's dataset. I felt that this research would be of more use to policymakers in the short term, and that it represented a unique opportunity to directly research the emergency implementation of such schemes. This new

research path also had the significant advantage of being primarily desk-based, limiting the risks around further waves of the pandemic jeopardising longer-term plans for in-person research. Figure 14 provides a graphical representation of this process and demonstrates how both research ideas, events, and emerging data sources informed new research questions and ultimately the final research outputs included here.

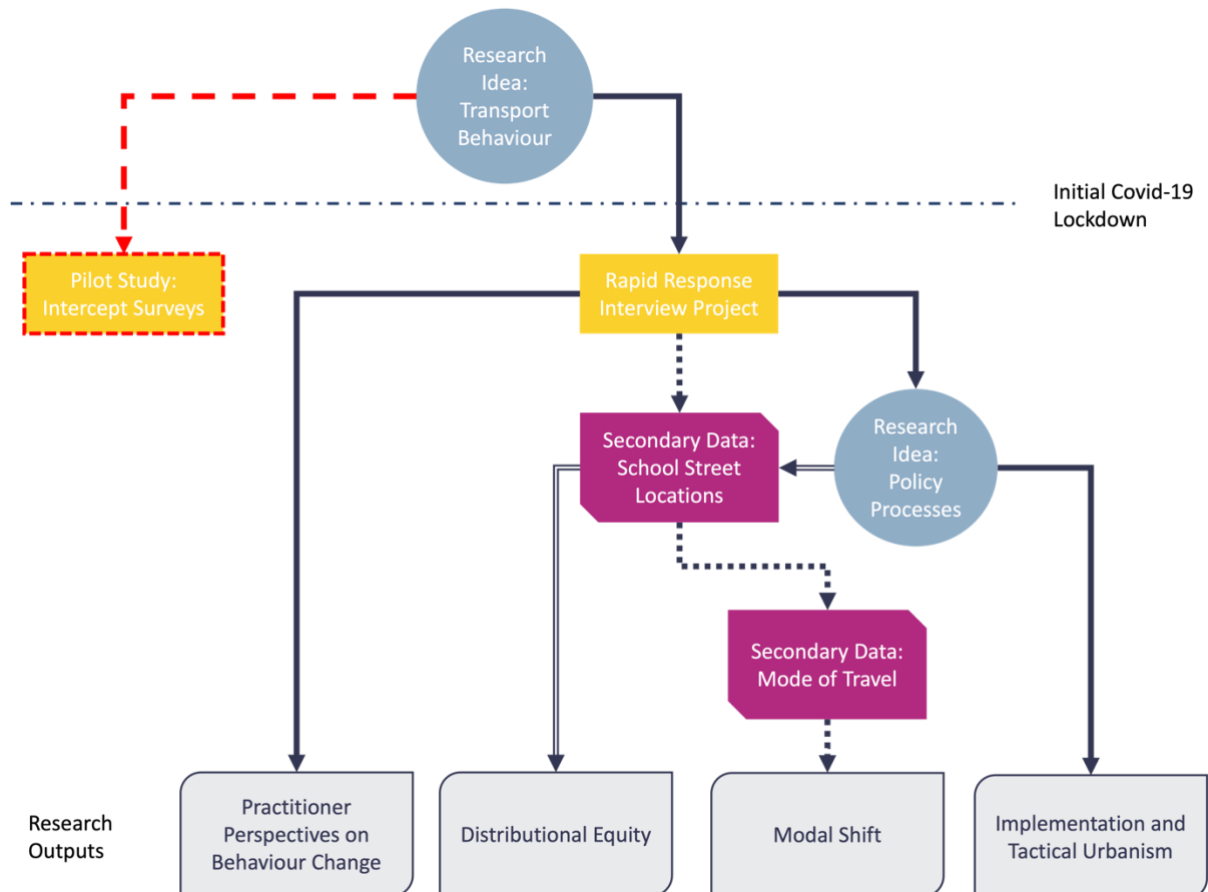


Figure 14 - A graphical representation of the research process, showing initial plans, primary research ideas, adaptations, secondary data that became available, and how they relate to the different project outputs.

4.3. New writing on research resilience and innovation in Covid-19

During the research for this dissertation, initial plans were adapted due to unexpected constraints, emerging opportunities, and new research questions; the result of studying a highly variable and ‘live’ policy topic within the wider Covid-19 context. The essay-based structure of the document in part reflects this process of adaptation. However, this experience was far from unique. The pandemic created a set of problems that almost all researchers faced in one way or another. In response, an increasing number of reflections

have been written on the challenges of researching in this context, contributing to a growing methodological literature on research resilience, a discourse that provides important context for this account.

The case for researchers to adopt adaptable research methodologies had also been made prior to the Covid-19 pandemic, focusing more on the challenges of negotiating or failing to negotiate access to participants, data, or research settings (Jung *et al.*, 2021). Prior writing on 'crisis research' has also emphasised the need for methodological flexibility as well as providing insight into the issues of using partial data, retrospective data collection, and the ethical concerns of conducting research in these contexts (Buchanan and Denyer, 2013). The more recent literature on the specific issues raised by researching during Covid-19 echoes some of these insights (Nind, Coverdale and Meckin, 2020). Several lessons for how to adapt research to the Covid-19 context are posited, including embracing collaborative data collection and citizen science, deploying rapid response projects, utilising new digital methods of data collection, building contingency planning into study designs, borrowing methods from other disciplines, and embracing multiple methodologies to create research 'bricolage' (Bueddefeld *et al.*, 2021; Jung *et al.*, 2021). Rahman *et al.* (2021) use the term 'research resilience' to describe the use of such tools to adapt methodologies during a crisis and cite its importance in ensuring that academic practice can continue within such practical constraints. This is relevant to in cases such as mine where time-limited funding means that long delays to research may be impossible.

Alongside the obvious challenges, accounts of methodological adaptation during Covid-19 also often cite the new opportunities for research that this context has afforded (Rahman *et al.*, 2021). This has been framed both in terms of emerging research questions as well as the potential for methodological innovation. For many social science researchers, the pandemic served as a natural experiment which allowed for unique insights into prior modes of enquiry (Couvrette, 2021). It has also raised new policy problems and interventions which have necessitated rapid research responses, sometimes employing interview projects similar to the one conducted here for Chapters 5 and 7 (Braun *et al.*, 2020; Vindrola-Padros *et al.*, 2020). From a technical perspective, the role of remote video conferencing for conducting qualitative interviews is also emphasised as a key opportunity. Potential benefits include flexible scheduling, ease of recording, and integration with transcription tools, all of which can make interview research less practically arduous; as well as the potential for the

integration of different media in interview prompts and creative tools for focus-group formats (Ndhlovu, 2020; Keen, Lomeli-Rodriguez and Joffe, 2022; Meixner and Spitzner, 2022). There is also a sense that for some participants a digital format provides greater interpersonal comfort, which along with the ease of scheduling can make such techniques more inclusive¹³. This sense of opportunity was reflected in my own interview process, with practitioners more willing to speak on remote calls during the lockdown than they perhaps would have been prior when aligning diaries to schedule an in-person conversation would have been more difficult.

Other features of my own process of research adaptation that are reflected in this literature include the new speed of methodological deployment, digital transposition of pre-existing qualitative interview methods, and the adoption of collaborative data collection methods. Several authors (McEachan *et al.*, 2020; Ahmed and Ali, 2022), including those contributing to a special issue of *The Journal of Mixed Methods Research* (Bueddefeld *et al.*, 2021; Fetters and Molina-Azorin, 2021) on the topic, also cite the use of mixed methods study structures as a potential mode of research adaptation. Here a greater diversity in methodological approaches is framed as a strength in the uncertainty created by Covid-19. However, past methodological debates within mixed methods research (MMR) has expressed a contested relationship to the idea of the flexible use of both qualitative and quantitative methods.

4.4. Mixed Methods research and Covid-19 adaptability

Mixed methods study designs are increasingly common and have been applied to research topics closely related to this study including work on urban health (Gomez *et al.*, 2015), transportation research (Deutsch and Goulias, 2012; Tao and Næss, 2022), and more specifically, research on children's transportation to school (Ikeda *et al.*, 2020; Elliott *et al.*, 2022). Mixed methods research has generally been defined as research that combines quantitative and qualitative approaches, integrating these data types to answer specific research questions. Some framings also characterise this integration as systematic and ideally

¹³ Although the limited nature of non-verbal communication and the use of the potentially non-private domestic settings for research are cited as potential drawbacks here – especially when dealing with more sensitive research topics (Meixner and Spitzner, 2022).

determined prior to data collection and analysis (Creswell and Plano Clark, 2018). Certain mixed method study designs fit well in the Covid-19 context. Sequential mixed methods studies, for example, use an initial scoping exercise in one method to inform more exhaustive follow-up studies in another. This could allow for a desk based rapid-response study to lead to an in-person method following the easing of restrictions. However, accounts of research resilience that have reflected on the need to change direction *during* the research process are less easily assimilated in these frameworks. In my own research for example, I had intended for the project to follow an exploratory sequential design but with the findings of the initial scoping study more ambiguous than expected and with new research questions emerging, a more ad hoc mix of methods was ultimately adopted. Such a research design which emphasises the individual contribution of different phases of research marked by different methods is not as easily reconciled with conceptions of mixed methods research that emphasise their systematic integration¹⁴.

A key concern in this strain mixed methods writing is ensuring that resulting findings are not reducible to the sum of their respective methods and are thus adequately ‘mixed’ (Ahmed and Sil, 2012). Important context for this is the so-called ‘paradigm wars’ of the 1980s in which the post-positivist and constructivist research paradigms were construed as incommensurable (Denzin, 2010). Although for some authors these concerns are still prescient (Ahmed and Sil, 2012), this debate has in the eyes of many been settled through the development of study designs and evaluation methods for ensuring the validity and reliability in the mixing of different data types (Denzin, 2010). However, although the validity of mixed methods enquiry itself is largely accepted, debates remain over whether the rigid systematisation of these study structures to this end is necessary or even desirable. For example, it has been posited that many systematic and ‘valid’ mixed methods approaches implicitly require the qualitative element of research be rearticulated in a postpositivist frame to be mixed with the quantitative data, and in doing so flatten the more reflexive insights of

¹⁴ The term ‘multi-method’ research has been used to refer to this kind of research (in contrast to mixed methods). However, it has also been used to refer to the use of multiple qualitative *or* quantitative methods in a single study. Additionally, these terms are also used interchangeably (e.g. in Ahmed and Sil, 2012), adding greater confusion. For the sake of simplicity I stick with the term mixed methods research here, and take my approach to be one way of doing mixed methods research, even if the ‘mixing’ is not central.

these methods (Howe, 2004; Gobo, 2023). This is less an argument against mixed methods research, but more about reframing it as a pluralistic research practice which embraces the difference between its constituent elements. This articulation of mixed methods research is perhaps more compatible with the need for flexibility implied by its use in adaptive research during Covid-19 where rigid protocols for data collection and mixing might limit the uncertain and inductive qualities of qualitative analysis.

However, these debates are not just limited to specific modes of mixed methods research, but are also played out at the level of the research paradigm. Critically, echoes of this debate are also present in writing on the role of pragmatism as a world view particularly in relation to the use of mixed methods research.

4.5. Mixed methods and the pragmatist research paradigm

Following from the work of Kuhn – to whom the use of paradigms to understand different modes of knowledge production is often attributed – Morgan (2007) takes the term ‘research paradigm’ to mean a shared set of beliefs among a group of scholars. However, popular understandings have also characterised the term as relating to world views that entail the use of certain epistemologies (understandings of the nature of knowledge), ontologies (understandings of the nature of reality), as well as moral positions and methodological approaches (Kaushik and Walsh, 2019). In other characterisations it is used interchangeably with the idea of an epistemological stance, like positivism or constructivism. Although a number of different paradigms, including realism (Kaushik and Walsh, 2019), have been used to reconcile the differences between qualitative and quantitative research, the pragmatist position is increasingly adopted as a philosophical grounding for mixed methods approaches, or indeed considered as *the* foundation for mixed methods enquiry altogether (Tashakkori and Teddlie, 1998; Biesta, 2010; Creswell and Plano Clark, 2018). Although, as we will see, critical push-back on a blanket-use of pragmatism in mixed method research remains, it is arguably helpful in articulating both a worldview for mixed methods enquiry as well as for adaptive and resilient modes of research.

Pragmatism broadly follows from the work of the American philosopher John Dewey in the early 20th century, although Richard Rorty’s writing on the topic in the 1970s is also in part responsible for its present popularity (Kaushik and Walsh, 2019). In broad terms,

pragmatism emphasises the need for knowledge to be useful and to solve practical problems. For Dewey the production of knowledge was synonymous with the act of doing research, or indeed any other act of enquiry or attempt to understand. As Greenhalgh and Engebresten (2022, p. 2) write of pragmatism, “knowledge can only be explained in terms of—and evoked within—practice, and not the other way around.” This rejection of the separation of the researcher from the object and process of study also amounts to a rejection of a dualism between positivist and constructivist epistemologies (Biesta, 2010; Kaushik and Walsh, 2019). In practical terms this approach emphasises the emergent properties of research and requires researchers to adopt a flexible approach that can respond to the specific problem faced in a given moment. In pragmatism researchers should adopt the method that best fits the problem at hand. The pragmatist world view, although also used to situate more systematic modes of mixed methods research, also provides a philosophical grounding for more flexible modes of enquiry. Implied in the pragmatist notion of choosing the best tool for a specific problem is the notion of choosing the best tool available to study a particular problem. Thus, during the initial constraints of Covid-19, pragmatism arguably served as a latent research paradigm for those adapting research programs, whether they were embracing mixed methods research or not.

This later point is especially apt given the greater emphasis placed on the need for evidence to inform policy during this time. Advocating for a pragmatist paradigm, Greenhalgh and Engebresten (2022) argue that the Covid context revealed the need for a more pluralism and flexibility in the science-policy relationship. Partially in reference to the inertia in policymakers’ responses to emerging data at the beginning of the pandemic, they advocate for a model of evidence-based policy making more comfortable with uncertainty and multiple data types. This connection to the practice of evidence-based policymaking relates in part also to the moral dimensions of the pragmatist worldview articulated by Dewey. Denzin (2010) and Morgan (2014) suggest that Dewey’s conception of pragmatism was more than just a call for practicality, but also conceived of the act of enquiry as inherently social, with decisions about what it means to do research in a particular way as a highly ethical and moral. The implication being that pursuing a pragmatic mode of enquiry should mean approaching research problems as social problems (Morgan, 2014). This connection between a moral philosophy and research practice reorientates the role of the researcher as an agent in social change. Thus, there is a natural pairing between pragmatism and research such this which

seeks to critically interpret and ultimately inform policy. This is arguably intensified in contexts where both the conditions of research and the objects of inquiry are ever-changing, as Greenhalgh and Engebresten (2022) have alluded to.

4.6. Bricolage and the researcher as bricoleur

However, pragmatism is not the only lens through which an approach like the one adopted by this thesis might be productively interpreted. Indeed, the adoption of pragmatism as the paradigm de rigueur for mixed methods enquiry has received its own critical engagement. In contrast to other research paradigms like post-positivism, pragmatism's practical implementation in research is less closely proscribed and methodologically defined. This ambiguity has led to differing interpretations of pragmatism. Some have viewed the paradigm as a way to incorporate multiple epistemological perspectives within a single study; however, this position is not universal. For others it is a rejection of epistemology as an organising logic in research (Morgan, 2014). Critics of this latter perspective assert that this avoids productive tensions that can be explored when the differing 'natural' paradigms of contrasting methods (post-positivism for many quantitative methods, constructivism for many qualitative methods) coexist (Hall, 2013; Gobo, 2023). Others (Maxwell, 2011) have instead advocated for a greater comfort with the incompatibility of approaches and for encouraging dialogue between these diverse methodological perspectives, seeking depth within each individual approach rather than superficial congruence across their breadth. Proposed alternatives have emphasised more emergent study designs (Denzin, 2010), or dialectical approaches wherein the worldview of a project can shift as it moves between qualitative and quantitative phases (Creswell and Plano Clark, 2018). Although some authors have read these alternative approaches within a pragmatist world view, they at the very least implicitly reject readings of it as anti-epistemological.

Another mode of mixed methods study which emphasises the concurrence (rather than the convergence) of different epistemological approaches is bricolage, or conceptions of the researcher as bricoleur. Originating with the French structuralist anthropologist Claude Levi-Strauss, an early application of the term to the study of methodology was by Denzin and Lincoln (2000). In French a *bricoleur* is a handyman or woman who makes do with the tools they have at hand (Kincheloe, 2001). In the context of research, bricolage refers to the

accumulation and combination of multiple perspectives and practices. This can be put to the ends of furthering the depth, breadth, complexity, richness, or rigour of a given study (Denzin and Lincoln, 2000). Bricolage involves a self-conscious understanding of the ways in which different research practices produce knowledge and the use of them to ends suited to their particular attributes. Kincheloe (2001), whose writing has contributed significantly to the development of the concept, emphasises that bricolage evokes interdisciplinarity as much as it does the use of mixed or multiple methods. Here again the emphasis is on critiquing disciplinary boundaries but equally understanding the ways these demarcations have come to represent different modes of knowledge production and expertise, providing contrasting perspectives on a given topic. Throughout the reflexive or critical literature on mixed methods research is a worry that what may result is a set of findings that is simply the sum of its respective methodological parts. Bricolage instead takes this as its starting point, validating the co-presence of these different parts in a study and investigating connections and contradictions as they emerge through the process of research as opposed to imparting order from above.

As with pragmatism, bricolage has obvious compatibility in the context of research in uncertain contexts. Taking the tools at hand to study in the moment and reassembling narratives after the fact, has an appeal in the context of rapid-response research, for example. However, the interdisciplinarity of this approach also suits research in which the object of study might prompt research questions that cut across several disciplinary boundaries. As outlined in the introductory chapters, the varying rationales for and contexts of School Streets demand engagement with literature on public health, the behavioural sciences, urban design, transport geography among others. In the context of this research, which is organised around a specific phenomenon in a specific context, a research approach that allows for interdisciplinary perspectives is important. It allows the subject matter to lead the way through research questions and data types better suited to different methodological as well as disciplinary perspectives.

4.7. Contextualising this research approach

This chapter has firstly aimed to provide an account of the overarching process that has led to the research contained in this dissertation. Although for the most part each empirical

chapter contains its own exhaustive methodology section outlining the more technical elements of each method, this chapter provides a necessary narrative account of how each of these more discrete research activities came to be, and the logic behind their development and sequencing over the course the research. The chapter emphasises the need for responsiveness to the changing research conditions created by the Covid-19 pandemic and the changing scale of the subject matter as School Streets proliferated in London over this same period. This chapter has also served in part as a methodological literature review for the growing writing on the way methods have been adapted in this emergency context. This literature has raised several possible avenues for how to conduct flexible and adaptive research – some of which have been adopted in this thesis. To explore the implications of and potential critical response to these approaches I have sought to contextualise them in three interrelated bodies of work on methodology. This includes debates over the use of multiple or mixed methods in research, the adoption of a pragmatic research paradigm, and finally conceptions of multi-method and interdisciplinary approaches to bricolage. The primary argument is that although this research was originally conceived of in more rigid methodological terms, the deviation from this path is made legible as a legitimate research practice when viewed through the lens of writing on pragmatism¹⁵ and methodological bricolage.

As a broader philosophy that has been read as rejecting epistemology as a demarcating logic within research (Morgan, 2014), pragmatism has potential contradictions with the view of methodological bricolage as epistemological pluralism. Nonetheless, when considered in terms of research practice, bricolage is characterised in such a way that it can be interpreted as a way of doing research within a pragmatist research paradigm. I have chosen to read them as complementary concepts operating on different levels of philosophical abstraction. This is in part a reflection of the observation that both pragmatism and notions of bricolage are attractive in part because they resonate with the experience of

¹⁵ There are also some connections between pragmatism and some of the subject matter of the thesis. Although often not explicit, the approach of Tactical Urbanism outlined in Chapter 1 is highly informed by a pragmatist worldview. Practice Theory, which is touched on in Chapter 3 also draws from philosophical pragmatism.

research as it actually unfolds, often in ways more chaotic than originally planned or than can be perceived in the writing that follows. As Kincheloe has put it in relation to bricolage: “as cultural studies of science have indicated, all scientific inquiry is jerryrigged to a degree; science, as we all know by now, is not nearly as clean, simple, and procedural as scientists would have us believe.” (Kincheloe, 2001, p. 680). Kincheloe’s argument is not to completely abandon notions of rigour, but also to acknowledge the reality of the conditions within which research is conducted – an enterprise that has arguably never been as important as it is when discussing the research conducted during the global pandemic (a point also echoed by Bueddefeld et al (2022), and Greenhalgh and Engebresten (2022)).

Although I did not consciously narrate my own process of research adaptation in such terms, by moving from a more systematic sequential research design to a parallel multimethod approach the end result has been a pragmatic and pluralistic methodology. The invocation of pragmatism or bricolage is not intended to deflect from the potential limitations of this approach. The choice to move towards discrete research outputs has meant a trade-off between on one hand the adaptability of the research, and on the other, the degree of integration and synthesis of qualitative and quantitative methods. This is felt most profoundly in the behaviour change section where, although an important question around whether School Streets lead to transport behaviour change *is* answered, as a consequence of this change in direction more integrative insights into the mechanism of such change are mostly unanswered. However, the connection is stronger on the policy side, with initial interviews raising new questions about the equity of School Streets implementation and quantitative methods investigating this further. Although, Halcomb (2019) argues that a series of outputs derived from a mixed methods project can focus on the individual ‘child’ methods without necessary reference to their wider mixing, most writing on the topic emphasises the active mixing of methodologies such that resulting outputs contribute more than the sum of their individual methods. This has been only partially achieved here and is acknowledged as a key limitation of the research, if one that was potentially unavoidable given the need to adapt research practices to new and emerging contexts.

Cherryholmes (1999, quoted in Meixner and Spitzner 2022) has warned against an expedient use of pragmatism to justify poorly conceived research structures. Similarly, critics of bricolage have emphasised the risk that researchers end up with only shallow disciplinary and methodological understandings. Through writing full methodological accounts in each

chapter, I intend for the constituent elements of this research to stand on their own. The rigour and reliability of this research is primarily a function of the individual methods adopted in its constituent chapters and extensive synthesis across has greater risk of providing a false sense of depth from these parallel and nonlinear research processes. In spite of these limitations, I cite pragmatism and bricolage here primarily to acknowledge that notions of the way research *should* unfold is itself contested, and that the (necessary) adoption of more responsive and ad hoc research practices can be framed not simply as a failure to fulfil the requirements of a predefined study structure, but within a broader research paradigm that recognises the efficacy of socially embedded, plural, and mutable modes of conducting research. The methodological and disciplinary pluralism advocated by proponents of bricolage is arguably particularly applicable to intervention or problem-centric research such as this, where a phenomenon like a School Street can lead the researcher through different methodological and disciplinary boundaries.

Interpreting School Streets through state-led tactical urbanism

5.1. Introduction

This chapter is the first in this dissertation to engage with the policy process theme. It sets out how School Streets came to be implemented in London, focusing on how and why they proliferated during the Covid-19 pandemic, and on the factors that facilitated this expansion. It uses the concept of tactical urbanism and the academic debate surrounding it to investigate the successes and tensions within this project. With this established, Chapter 6 will examine what the outcome of this process has been in terms of the distribution of these schemes in the city and the broader implications for transport equity.

As outlined in Chapter 2, prior to the pandemic, London's School Streets had been a small part of Transport for London's wider Healthy Streets policy (Plowden, 2020), which set out an ambition to change the emphasis of the city's streets towards active mobility. This had been done using both significant infrastructural investment as well as through "temporary, light touch and low-cost projects" (Transport for London, 2017d, p. 4), the city's emerging School Streets programme being a key example at the time. In London as well as many other cities (particularly but not exclusively in the Global North), this enthusiasm for the temporary or flexible use of streets only increased during the Covid-19 pandemic, with pop-up cycle lanes, temporary pavement/sidewalk widening interventions, weekend closures of large thoroughfares, and some School Streets proliferating across many different urban contexts. These broader efforts to reallocate road space during Covid-19 have been characterised as examples of 'tactical urbanism' (Pradifta *et al.*, 2021; Rojas-Rueda and Morales-Zamora, 2021; Kim, 2022), although in most accounts this concept has not been significantly expanded upon.

As a concept, however, tactical urbanism has been elaborated over several key texts and case studies, as well as a handful of critical responses primarily by urban studies scholars. Generally, these accounts focus on both the clandestine and unsanctioned acts of citizens (for example painting their own cycle lanes), as well as the activities of local government or other official actors who seek to demonstrate future possibilities for an area. In practice, tactical urbanism is most often associated with a loose material vernacular of cheap and temporary materials such as street paint, shipping containers, furniture made of scrap wood, old tires used as planters amongst many other examples. However, on a theoretical level, it is most extensively elaborated by Lydon and Garcia (2015), who in their quasi-manifesto on the topic

describe it as a practical orientation towards urban change where many small actions implemented at the hyper-local level can achieve, in aggregate, the longer-term goals of a liveable, walkable, sustainable, broadly 'New Urbanist' (p. 67) city. Inverting Michel de Certeau's (1984) distinction between the strategies of the state and the oppositional tactics of citizens, Lydon and Garcia implore citizens to think more strategically about long term change and for governments to adopt tactics to implement changes immediately (2015, p. 10).

These recent efforts in cities should be distinguished from a parallel but related trend of more formal processes of urban experimentation by municipal authorities. These urban living labs are often intended to spur on innovation in policy areas from transportation to housing, a trajectory charted by Karvonen and others (Karvonen and van Heur, 2014; Evans, Karvonen and Raven, 2016; Bulkeley *et al.*, 2019) often through the lens of Science and Technology Studies (STS). Although there is indeed overlap between urban experimentation and tactical urbanism, for example common trends in urban governance often identified as explaining the increasing adoption of both approaches, there are also important distinctions to emphasise here. Whereas urban experiments are often tasked with testing novel concepts, formally assessing their impacts, and actively pursuing their scaling to the city-scale,¹⁶ tactical urbanists are more concerned with the hyper-local, place-based interventions and citizen participation. Although, as we will explore later, tactical urbanist interventions do move between localities, this movement is often more ad hoc, horizontal, and networked with much less emphasis on the systematic generalisation of observed learnings implied by efforts of urban experimentation. With the increasing state-adoption of tactical urbanism – something which will be explored in greater detail in this chapter – there is an inevitable conceptual blurring of these practices, and although London's School Streets fit uneasily into either this chapter seeks in part to demonstrate the relevance of current debates in tactical urbanism in particular in exploring the unique tensions at play in this case.

The critical debates surrounding tactical urbanism are nuanced and often concerned with the role of official actors. For example, Jeffery Hou (2020) has drawn contrast to Lydon and Garcia's vision of state-citizen collaboration, instead emphasising the importance of active resistance to and contestation of dominant urban paradigms. In this framing, also in

¹⁶ Often unsuccessfully (Torrens and von Wirth 2021)

part adopted by Mould (2014), the centrality the state or other official actors can co-opt and de-fang citizen-led action, narrowing the scope of these activities away from more critical and radical practices. As state-initiated schemes, School Streets and many other Covid-19 street space schemes could perhaps be criticised along these lines. However, doing so forecloses the opportunity to reflect on the reasons for this disjuncture between the way ‘tactical urbanism’ has been elaborated in the literature, and the actual dynamics of some of these more recent state-led examples. This is especially important as both ‘tactical’ approaches become increasingly embedded in existing local government policy practices, however tenuously related they might be to initial ideals of tactical urbanism and its antecedent concepts.

Seeing tactical urbanism and its critical engagements as a complex of ideas through which schemes like London’s School Streets can be productively interpreted, this chapter sets out to answer three questions:

1. What methods or techniques did local government actors use to rapidly implement School Streets during the early stages of the Covid-19 pandemic?
2. In what ways is this approach similar or different to dominant understandings of tactical urbanism?
3. How do current debates in tactical urbanism inform our understanding of the roll-out of School Streets during Covid-19, and concurrently, how might this case reinforce the critical literature on tactical urbanism?

Drawing on interviews with practitioners (see Chapters 4 and 7 for more details on this process) as well as policy documents and official guidance produced during the early stages of the pandemic, this chapter provides an account of the rise of School Streets in London, starting from initial trial schemes and including their rapid expansion during 2020. Overall, this story articulates a pragmatic and action-centric outlook among practitioners and policymakers, but also clear deviations from dominant understandings of ‘tactical urbanism’. This chapter argues, however, that the idea of ‘tactics’ provides a compelling framework through which to understand these pragmatic tendencies amongst local government actors, both in this case and beyond. On the direct contribution of debates within tactical urbanism, it is also argued that, as Webb (2018) and Tonkiss (2013) have written regarding austerity, these practices or tactics should be understood as embedded in the wider political and economic contexts of the early stages of the Covid-19 pandemic. Furthermore, that critical debates over the role of state and citizen in such ad hoc and informal planning practices reveal a key tension in the creation of these schemes.

5.2. Current debates in tactical urbanism

This review section focuses on tensions within the literature on tactical urbanism, especially focusing on those that relate closely to the use of these practices by local governments to intervene in public space. In all, four major tendencies in this literature are identified. Firstly, debates over the use of tactical urbanism by official actors and its wider professionalisation are explored alongside the notable divergence in the literature over the relative importance of citizen resistance versus citizen participation. Secondly, this section considers the re-framing – particularly by Lydon and Garcia – of policymakers and officials as ‘tactical’ actors focused on the quick implementation of interventions as opposed to their more traditional role of ‘strategic’ planners orientated towards the longer-term. The third focus of this section is on the problem of the scalability in hyper-localised and participatory approaches to urban change and what this means for the role of the state in a tactical urbanist model of change. The final section examines the political aspects of tactical urbanism, in particular the insistence by Webb (2018) that wider political and indeed economic contexts have shaped and facilitated the rise of the use of these ‘tactical’ approaches to policy making. In all this review section aims to show the way in which the imagined role of official actors in the practice of tactical urbanism has been a key fault line in the literature, with some seeing a newly pragmatic and action-centred local government as an opportunity, and others drawing attention to the way these practices reinforce existing urban inequities.

5.2.1. Varied understandings of the state and citizen in tactical urbanism

The term tactical urbanism can be defined along several axes. Projects tend to have a number of features in common: a small spatial scale, lower costs, a time-limited temporality either serving as a temporary installation or an initial trial, a use of flexible materials either for speed or iteration, a creative ‘design’ element, and a significant involvement of grass-roots organisations or groups. The term has been used to refer to a varied set of different interventions, not all necessarily matching all of these criteria.

One strand of these approaches is characterised by bottom-up, perhaps clandestine, and often whimsical citizen interventions in urban space. These include the creation of DIY street benches, pop-up events, and temporary or ‘meanwhile’ uses in vacant lots, often community gardens but also sometimes pop-up bars, restaurants, or theatres. Some more

counter-cultural activities such as the creation of DIY skate parks or graffiti are included in this framing (Finn, 2014). Like the School Streets discussed in this research, many of the paradigmatic examples of tactical urbanism have focused on improving the conditions of active mobility and public space. For example, tactical urbanists have undertaken the repainting of faded crosswalks neglected by local governments and created unofficial new bike-lanes on dangerous stretches of road. Within the literature, two features of the immediate aftermath to the financial crisis are cited as important contexts for the rise of these somewhat disparate practices. First is the decline in the conditions of many urban centres, where state investment in the public realm decreased significantly under emerging austerity policies (Vallance *et al.*, 2017). Secondly, Tonkiss (2013) also highlights that vacant sites slated for future development were left empty for longer due to the (temporary) withdrawal or slowing of financial capital at this time, thereby creating space for creative meanwhile uses.

The adoption of ‘tactics’ also resonates with changing trends in more formal discourses around urban planning. For example, the use of participatory (Finn, 2014; Wohl, 2018) or collaborative (Andres, 2013) planning methods is increasingly emphasised, as are wider concerns over the growing implementation gap between ambitious urban strategies and actual policy outcomes (Lydon and Garcia, 2015; Vallance and Edwards, 2021). Here tactical urbanism is identified as a potential way for municipal governments to implement policy agendas more effectively, while also providing greater scope for civic engagement in public space. That some clandestine, counter-cultural, or DIY interventions accompany these trends in more official planning discourse highlights a key tension that is present in scholarly writing on tactical urbanism. In dominant framings of the term these interventions are not always bottom-up activities operating counter to the wishes of the state, but often done with the permission of, or actively by, official bodies. This inclusion of state activity within the term ‘tactical urbanism’ is present in Lydon and Garcia’s book/manifesto by the same name (2015), arguably the most extensive theorisation of the concept. It is also present in Bishop and Williams’ early essays on the topic in *The Temporary City* (Bishop and Williams, 2012) and Kelvin Campbell’s more recent text *Making Massive Small Change* (2018) both of which also avoid ascribing an inherently bottom-up directionality to tactical urbanism’s method of change.

This tendency to fold both bottom up and top-down models of change into the concept of tactical urbanism has been a subject of criticism, particularly from urban studies scholars, and different terminologies have been proposed to attempt to parse official schemes from the genuinely clandestine. For example, Jeffrey Hou (2020) invites the term ‘Guerrilla Urbanism’ to distinguish genuinely counter-hegemonic informal urban incursions from the increasingly professionalised realm of state-sanctioned or state-directed tactical urbanism. For Hou, what is now considered as tactical urbanism – the vision popularised by Lydon and Garcia among others – fails to represent the full spectrum of informal, unscripted, and perhaps most importantly, unmediated acts of urban intervention. Similarly, Douglas (2018) seeks to distinguish what he calls DIY urbanism from more official notions of tactical urbanism, to allow for greater conceptual clarity in analysing the fully citizen-led and mostly unsanctioned urban practices that form the focus of his research. In their respective typologies of these different terminologies Dovey and Stevens (2022), and Bragaglia and Rossignolo (2021) associate the term ‘temporary urbanism’ with the most formal activities around official pop-ups or meanwhile uses of space.

Despite these arguments over nomenclature, Lydon and Garcia make no such distinction in their less narrowly defined use of the term tactical. For them, many of the various practices of tactical urbanism exist on a spectrum, ranging from the unsanctioned to the fully state led. This tension between citizen and state action is in fact central to their theorisation of the concept. In their model Lydon and Garcia imagine governments and citizens changing roles. Here, citizens must learn to act more strategically, envisioning the long-term goals for their neighbourhood. Officials on the other hand must act tactically, moving away from the creation of well-meaning strategies and focusing instead on techniques for quick implementation (see Figure 15). The specific role of the citizen as either strategist or guerrilla here represents a key difference between these two approaches. As Iveson (2013) has argued, it is not always clear whether authors writing on the topic of temporary, DIY, tactical (etc) urbanism are always referring to the same thing. Nevertheless, the centrality of citizen participation in urban change – taken broadly – represents a common thread throughout these contrasting accounts and is important in both state-led, bottom up, and hybrid conceptualisations.



Figure 15 – The model of tactical urbanist change as proposed by Lydon and Garcia (source: *Streets Plan Collaborative in Lydon and Garcia 2015*)

5.2.2. State Tactics

Putting the role of citizens aside for the moment, in the framework for tactical urbanism proposed by Lydon and Garcia, there are different ways in which states can act tactically. The use of this term here draws in part from de Certeau (1984) who understands tactics as the flexible and creative practices used by those who hold no influence over wider power structures. Hou also draws on de Certeau’s concept of tactics to understand elements of resistance, but for Lydon and Garcia, this concept is also applicable to official actors who may themselves be constrained by regulatory, institutional, or political structures, both within and above their institutions. Their more flexible reading of de Certeau’s tactics is primarily focused on municipal state actors, some of whom in their view are constrained by broader bureaucracies and must deploy tactics to achieve meaningful change.

One such official tactic is for municipal governments to turn a blind eye to clandestine changes that provide genuine benefit to communities. Here the role of the state might be

best described as ‘getting out of the way’¹⁷. Another potential tactic is for municipal governments to formally adopt more anarchic citizen interventions. This is well charted in a recent account of the phenomena of park(ing) day which started as small art project in San Francisco during which people occupied parking spaces for a single day. This eventually became formally recognised and facilitated by the municipality and has since been repeated in several other cities internationally (Herman and Rodgers, 2020). A related approach, and one relevant to the example of School Streets, is the forming of partnerships with community groups or ad hoc citizen organisations, and providing space, administrative support, and/or resources to help facilitate community-initiated change. A particularly relevant example of this approach is that of play streets in the UK (already mentioned in Chapter 2) where local governments provide administrative and legal support to ad hoc groups of families for a temporary closure of a street to facilitate children’s play (Ferguson, 2019).

However, some tactics also involve greater levels of state intervention. A paradigmatic example of this kind of state-led tactical urbanism is the use of temporary materials to trial new street layouts and public realm improvements. This ‘test before you invest’ approach has been used most notably in the pedestrianisation of Times Square in New York City during Janette Sadik-Khan’s tenure as head of the city’s Department of Transportation (Sadik-Khan and Solomonow, 2016), and in Barcelona’s Superblocks projects (Ajuntament de Barcelona, 2023). Although sometimes used as part of a participatory design process, and on smaller scales, this approach has also been adopted into highly formal processes of planning. This tactic represents perhaps the greatest cross-over with the literature on urban experimentation. However, key differences remain, particularly in the way in which the framing of these activities by formal actors as ‘tactical’ as opposed to ‘experimental’ evokes a disruptive quality which is somewhat distinct from more technical goals around promoting innovation and demonstrating proof of concept. This tendency, which is particularly prevalent in Lydon and Garcia’s framing, casts ambitious proactive municipal workers and politicians as ‘tactical’ actors in opposition to forces of inaction.

¹⁷ In this vein Bishop and Williams (2012), for example, suggest the state might create zones where the barriers preventing enterprising citizens from experimenting with or in their cities are removed. This approach, however, is not without its critics (Dovey, 2014).

5.2.3. Bridging tactics to wider change

Although actors within local government are theorised as a key vector of change in this model, in both Lydon and Garcia's *Tactical Urbanism* (2015) and Kelvin Campbell's *Making Massive Small Change* (2018), the forces of inaction that they must overcome are also associated with the modern bureaucratic municipal state and to some extent the exercise of city planning writ large. Instead, they emphasise action, however it is achieved and however ad hoc, above all else¹⁸. In this conception, intervention (whether citizen or state) precedes or replaces planning; and instead iterative, 'evolutionary' (Silva, 2016), or 'acupunctural' (Lerner *et al.*, 2014) changes accumulate in aggregate to achieve larger urban transformation. For Brenner (2016), this conception of additive urban change is somewhat naive. He is sceptical that an incrementalistic approach will succeed in tackling the intractable environmental and social crises identified by tactical urbanists. Here, the source of these failures is neoliberal urbanism rather than the modernist or statist models of urban governance that Lydon and Garcia repudiate. Although multifarious and historically contingent (Theodore, Peck and Brenner, 2011), neoliberalism can be understood here as a process through which the state is reconfigured by techniques of privatisation, marketisation, and decentralisation – aligning it, however incompletely, with a free market ideology. This alignment of state failure with neoliberalism has implications for the purported solutions to these crises. For Brenner, solving urban crises requires the (re)provision of the essential services gutted or stymied under neoliberal austerity, an activity that requires the strategic lens and resources of the state as opposed to a rejection of its bureaucracy suggested by Lydon and Garcia.

For some, however, the pursuit of strategic city planning is not necessarily at odds with tactical urbanism. For example, tactical urbanism has been articulated as a potential bridge for the 'implementation gap' (Vallance and Edwards, 2021) between the strategic spatial plans of urban governments (which often remain unrealised) and their on-the-ground implementation. In this way Brenner's critique has implicitly been reappropriated in more mainstream articulations of the role of tactical urbanism in contemporary urban governance.

¹⁸ This situates them with a longer urbanist tradition connecting to Jane Jacobs (who is cited frequently in this work) (Dovey and Stevens, 2022), as well as the work of a number of lesser-known planning theorists who have drawn on pragmatist and neo pragmatist philosophical traditions (Healey 2009, Hoch, 2017), see Andres (2013) for more on this later aspect.

And as we will see in the next section, they are also implicit in the use of many of these tactics in the urban response to Covid-19. This is perhaps best represented by efforts on the part of the consultancy Arup to formalise the ‘tactics’ used by local governments during Covid-19, with an aim to further embed these practices of urban governance in the mainstream (Carmichael *et al.*, 2020). Thus, understandings of state-led tactical urbanism are subtly contradictory. Some models emphasise a critique of centralised city planning that argues for a reorientation of the state towards action, while others advocate for the state to utilise tactics in the explicit pursuit of its larger strategic plans.

5.2.4. Tactical urbanism and the neoliberal state

In part as a response to this framing of tactics as policy tools as opposed to radical practices, critiques of state-led tactical urbanism have aligned it with a wider turn towards post-political and technocratic modes of urban governance often associated with neoliberalism (Haughton, Allmendinger and Oosterlynck, 2013; Mould, 2014; Hou, 2020). However, slightly more sympathetic versions of this critique have sought to contextualise tactical urbanism within the political and economic forces that operate beyond the confines of the municipal and local state. In this vein Webb (2018) situates a project involving the renovation of residential back-alleys in Newcastle, United Kingdom, within its broader context of national government-imposed austerity in the UK. Under the Cameron administration in the early 2010s, significant cuts to local government budgets were accompanied by a new narrative of localism under the aegis of the ‘big society’. This political programme sought increasing roles for charitable organisations and community groups to work in partnership with local governments, delivering services and interventions that would have once been the sole remit of the state (Lowndes and Pratchett, 2012; Jacobs and Manzi, 2013). Although this shift has been interpreted as a thin veil for austerity politics (*ibid*), in acknowledging this context Webb (2018) also explores its more heterogeneous effects. In this case the state’s re-cast role affords surprising opportunities for community action. Despite salient critiques around co-optation or complicity with neoliberal urbanism levelled by Mould (2013) or Hou (2020), in the case of Newcastle, Webb argues that these projects have a ‘hybrid politics’ with genuine commitment to social solidarity by those involved, while nonetheless caught within the logics of the narrow political discourse behind new localism and austerity.

Tonkiss' review of 'austerity urbanism' (2013) in the years directly following the financial crisis strikes a similar chord. Although reading these changes as indicative of a wider urban decline, Tonkiss is similarly careful to situate these interventions as in part a response to the conditions of the neoliberal city rather than simply another constitutive element of it. These accounts historicise tactical urbanism and situate them within a broader political context. A similar approach is arguably important in the context of the state response to Covid-19. Within the post-2008 context of state withdrawal, drawing on Kevin Lynch, Tonkiss characterises these projects part of the 'possible city' – in other words a practical refocusing on the undervalued and underused spaces that have potential for creative and autonomous uses. The tactical response to Covid-19 has occurred within an almost antithetical context of state action, one instead characterised by significant involvement in everyday life and the management of public space. This version of tactical urbanism could instead be read as creating what one could call the 'necessary city', where small scale acts of tactical urbanism are focused on what is deemed essential in the acute phase of the crisis. Many of the critiques of municipal governmental action perhaps still stand, but as Tonkiss and Webb's approach makes clear, their contextualisation in wider political and economic processes is also necessary. The version of state action articulated here is also perhaps more aligned with a model of tactical urbanism concerned with augmenting rather than subverting strategic city planning.

5.3. London School Streets as state-led tactical urbanism

This section examines state-led tactical urbanism in London as an emerging and evolving urban policy approach prior to and during the initial stages of the Covid-19 pandemic, examining how these tendencies were manifested in multiple levels of government and facilitated through bureaucratic processes. Drawing on accounts from practitioner interviews, these wider dynamics are considered specifically in terms of the shifting ways that School Streets have been rationalised, designed, prioritised, and consulted on during the emergency response to Covid-19. Here several different 'tactics' are identified for further discussion. Among the several axes of tactical urbanism mentioned earlier, this section focuses on the use of flexible materials for expedience, the temporality of these schemes as trials, and the role of citizens in this process.

5.3.1. Early School Streets and pre-pandemic tactical urbanism in London

Prior to the Covid-19 pandemic London had a significant record of tactical urbanist activity; much of which is recorded in a number of policy documents and secondary accounts. As in other major cities in the Global North these actions and interventions had taken several forms ranging from creative meanwhile uses on vacated spaces waiting for development, DIY parklets on residential streets, and new pop-up community events (Transport for London, 2017d). Mara Ferreri's (2021) account of temporary urbanism in London over the last decade provides a helpful guide for some of these activities. Additionally, Bishop and Williams' review of schemes in *The Temporary City* (2012) draws heavily on London case studies. More critically for this research, in addition to the various pop-ups and meanwhile uses in the city, several street-based initiatives have also gained traction. Notable examples include the use of temporary materials to trial new street designs (for example hay bales and paint at an intersection in Lambeth in South London) and the temporary activation of streets to demonstrate alternate uses (plans to fully pedestrianise Narrow Street in East London were supported by a street party) (Transport for London, 2017d). Short-term temporary closures of residential streets have also proliferated in the form of play streets, including some examples focused on schools (Sustrans and Playing Out, 2019). Although several of the paradigmatic examples of tactical urbanism in London are the direct result of the activities of enterprising citizens, many are also the product of varying collaborations between combinations of local borough governments, London's transport agency, community groups, business improvement districts, small architecture/design practices, housing associations, and in some cases property developers and property management companies. In the case of street-based initiatives, it has most often been a combination of local governments, organisations with expertise in community engagement (e.g. Sustrans), and local communities.



Figure 16 – Parklet on a School Street in Hackney, East London. Source: Author.

The city's Healthy Streets approach (introduced in Chapter 2), which was developed around 2016, has actively adopted elements of these tactical urbanist activities into official policy discourse on London's streetscape. Sitting within the Mayor's broader transport strategy (Mayor of London, 2018a) and the city-wide London Plan (GLA, 2016), the Healthy Streets approach (Transport for London, 2017b) seeks to embed walking and cycling into the built environment through the transformation of all street spaces from small residential streets to London's major arteries and intersections. The Healthy Streets approach has informed the design and implementation of infrastructural changes including the construction of cycle lanes, the improvement of pedestrian areas on high streets, and the redesign of major junctions. However, a parallel set of activities drawing on more 'tactical' approaches has also been promoted by TfL through Healthy Streets (Transport for London, 2017a). This strand has

been aimed in part at improving the smaller residential or local streets that sit under the control of London's 33 local authorities. In 2017 TfL commissioned the development of a toolkit document entitled *Small Change, Big Impact* for implementing "small scale, light touch and temporary projects" (p. 4). The aim was to provide techniques or 'tactics' to help implement the wider Healthy Streets approach on residential streets, smaller local high streets, and under-used urban spaces – areas generally less amenable to larger-scale engineering projects. This explicitly tactical urbanist document was aimed at individuals, communities, and private entities, and presented an array of different case studies, suggesting possible approaches that could be taken. This included the use of trials to pedestrianize streets in the style of the 'streets to plazas' projects advocated for in New York by Janette Sadik-Kahn (2016), but an emphasis on partnerships between communities, businesses, and local government is also present here.

Appropriately, *Small Change, Big Impact* highlights a School Street as a key example of an inexpensive 'quick win' change that could be made. The document explicitly references a scheme that had been trialled the year before in the London borough of Camden, one of the first examples of a 'School Street' in the UK. The project had been funded through TfL's 'Future Streets Incubator Fund' (Camden Borough Council, 2018) which is an initiative explicitly centred around developing flexible trials for new street-layouts. TfL's highlighting of this scheme in 2017 appears prescient, as very quickly other local borough authorities in London followed the example of Camden and developed their own schemes, although in some cases these plans were already being developed in parallel. The London borough of Hackney was especially enthusiastic in their embrace of School Streets. Deviating from Camden's initial trial design which had used folding bollards, Hackney were the first to install traffic cameras to automatically issue fines to transgressing drivers during the closure. They also developed their own document (London Borough of Hackney, no date) outlining their School Street design and methodology, aiming to support other local authorities in setting up School Street schemes based on their model. This toolkit set out an implementation process which promoted the use of initial trials to test out early scheme designs. This process typically involves using volunteers and temporary barriers to enforce the closure before a more permanent traffic camera can be installed as a long-term solution. It also advocated a street-party style launch event for each School Street trial to actively demonstrate the potential for

use of space. This emphasis on ‘activating’ the space in addition to removing cars, mimics prior tactical approaches in London and elsewhere.

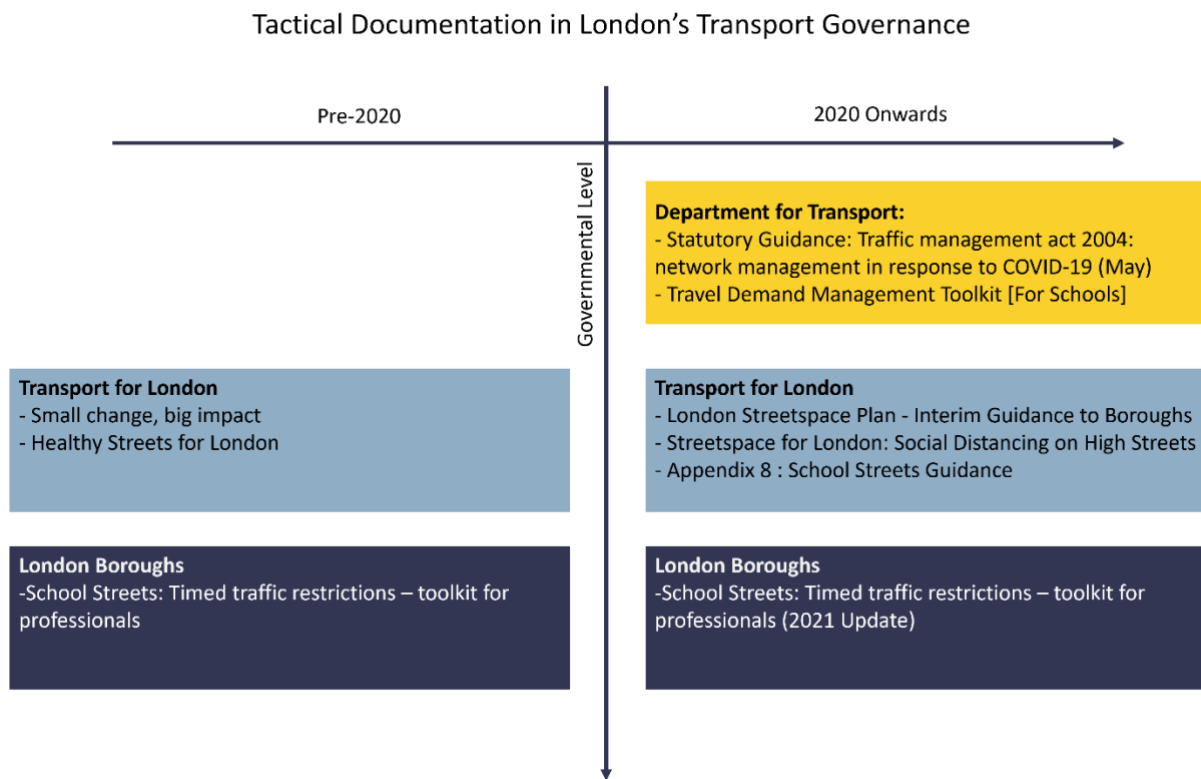


Figure 17 – Diagram showing the different documentation produced to inform the implementation of School Streets

Thus, well before the advent of Covid-19, School Streets were becoming part of a wider lexicon of temporary ‘tactical’ interventions in London’s streets. Although still peripheral in some parts of the city, particularly outer London, a broader tactical urbanist approach was internalised in some parts of London’s policy-making apparatus. This was in part through high-profile schemes like the GLA’s Good Growth fund, which provided match-funding to a wide range of community-initiated schemes (Greater London Authority, 2022), alongside more targeted funding under initiatives like the Future Streets Incubator Fund or the High Streets Challenge Fund. As well as the wider endorsement of these methods in the Healthy Streets approach, innovative local governments in London were also supported by TfL and the GLA to pursue similar methods at the street-level. This provides a good example of the operation of the state-led or top-down model of tactical urbanism discussed in the previous sections, where local or regional governments provide strategic and financial support for small scale, community initiated, or community-minded schemes. However, especially in the case of

School Streets and other road space reallocation initiatives, these interventions remained geographically uneven, concentrating initially in more proactive and ‘entrepreneurial’ boroughs located primarily in the north and east of inner-London (e.g. Camden, Islington, and Hackney). However, as Figure 18 shows, since the pandemic, School Streets have spread to almost every borough in the city, including some that have been historically hostile to reallocating road space away from cars.

In summary, prior to Covid-19 School Streets played a small role in a nascent state-led tactical urbanist programme in London. This included the use of tactics such as the promotion of ‘test before you invest’ style street trials, community partnership building and information sharing, all hallmarks of the particular style of tactical urbanism promoted by Lydon and Garcia and others. This has been supported by TfL and the GLA through several specific initiatives and funding streams, as well as the discursive framing of the emerging Healthy Streets approach.

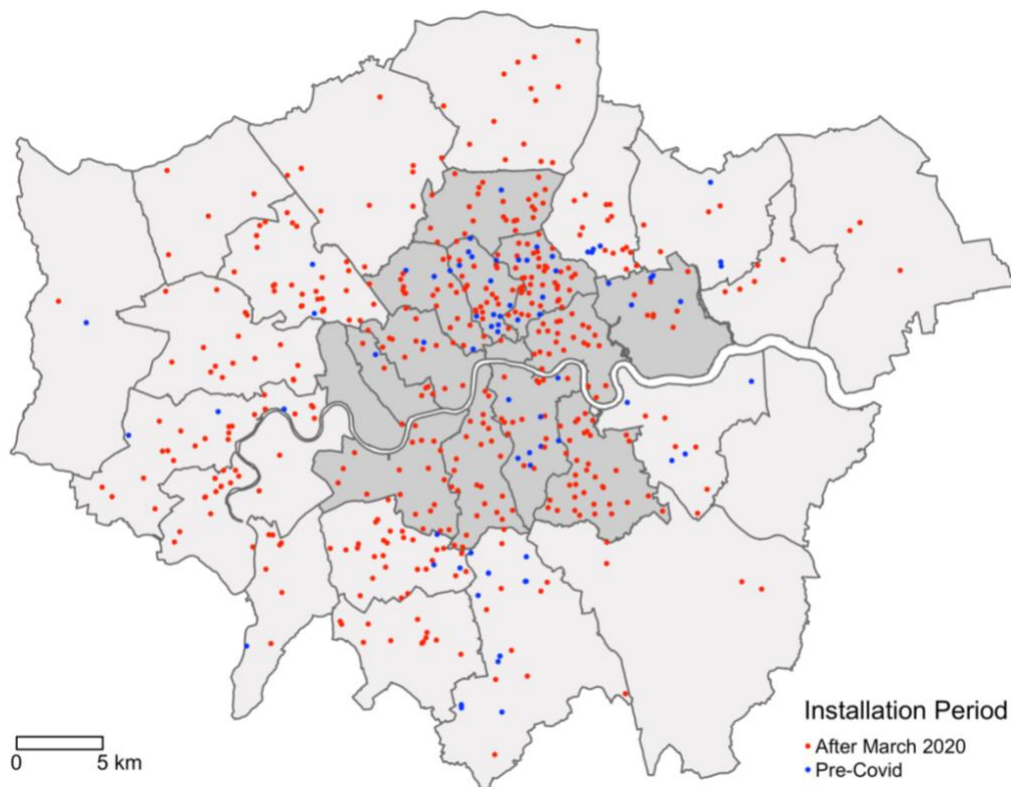


Figure 18 – Map of School Street schemes installed before and after March 2020, with inner and outer London boroughs highlighted. School Street location data accurate to April 2022.

5.3.2. Tactical urbanism and the early stages of Covid-19

As covered in Chapter 2 of this dissertation, implementing Healthy Streets schemes became a high priority in the early stages of the pandemic. This served three primary needs in the city: firstly, the greater pedestrian space required to allow for physical distancing at crowded pinch-points in urban spaces; secondly, to facilitate cycling as a mode of travel for essential workers in the context of severely constrained public transport capacity; and thirdly, to facilitate walking and cycling on a local level as part of daily shopping and exercise. As with many other cities globally (Honey-Rosés *et al.*, 2021), London quickly developed a range of proposals. On main arterial roads, these included utilising temporary materials to extend footways and create new temporary cycle-lanes, often reclaiming a lane of traffic. TfL and London's local authorities also focused on residential streets, recognising the risk to these spaces by a 'car-based recovery' and the need to facilitate local active trips while commute pressures were reduced. The return of children to schools once they reopened was of particular concern due to the narrow streets many of London's primary-stage schools are located on. The development of filtered permeability schemes to create Low Traffic Neighbourhoods and the rapid expansion of the nascent School Streets programme formed the basis of this aspect of the approach.

Although several local borough governments in London had prior experience of implementing temporary street schemes, the constraints of Covid-19 required significant changes in approach. Previous tactical urbanist street projects in London had often utilised site-specific designs and community engagement methods as part of street changes. However, the rapid implementation, need for flexibility to amend schemes as they bedded-in, and the breadth of the areas in need required the use of more generic materials such as plastic barriers, concrete blocks, and basic wooden planters – an approach to some extent prefigured in the temporary barriers used during pre-Covid trial School Streets. Aside from a shift in materials, this new context also required significant acceleration of the pace of implementation. This was in part achieved through a combination of new funding, streamlined bureaucratic processes, logistical support/knowledge-sharing, and increased political pressure from central and regional government.

In the spring of 2020, the UK central government's Department for Transport (DfT) encouraged all urban borough authorities in the UK to adopt temporary and experimental measures to support walking and cycling (Department for Transport, 2020b). This guidance

explicitly highlighted existing legislation allowing for the use of Experimental Traffic Orders (ETOs) to amend streets on a non-permanent basis. ETOs are a legislative tool enshrined in the 1984 Road Traffic Regulation Act (c. 27 Section 9) (2010) that allows local authorities to trial new road layouts for up to a maximum 18 months without the requirement for formal consultation prior to implementation. Instead during this trial period, a consultation process is undertaken while the temporary scheme is in place, with the scheme either becoming permanent or being removed at some point before the end of the 18-month trial. These laws had been a powerful tool for local governments, giving leeway to officially implement the ‘test before you invest’ principles advocated by proponents of tactical urbanism. Although often used to facilitate temporary changes to street layouts due to extended disruptions like those often caused by large construction projects, these powers had also already been used selectively in some of London’s pre-pandemic School Streets. However, in the guidance issued by the Department for Transport in May 2020, all local authorities across the country were actively encouraged to use ETOs as a tool to install trial road space reallocation schemes quickly. Speed of implementation was emphasised with the guidance recommending that “measures should be taken as swiftly as possible” (Department for Transport, 2020b), and additional funds were rapidly made available to local authorities as part of a national ‘Active Travel Fund’ to facilitate these changes.

Although aimed explicitly at emergency measures, the Department for Transport clearly emphasised that these low-cost flexible interventions should be interpreted as part of a long-term change. For example, the Transport Secretary at the time, Grant Shapps, wrote that “we recognise this moment for what it is: a once in a generation opportunity to deliver a lasting transformative change in how we make short journeys in our towns and cities” (Department for Transport, 2020b). This attitude was very soon supported by the creation of a national active travel strategy entitled *Gear Change* (Department for Transport, 2020a), as well as the announcement of the creation of a new government body, Active Travel England, to oversee active travel issues nationally (Dudley, Banister and Schwanen, 2022). The machinations of national government rarely make an appearance in accounts of tactical urbanism, but in this context both a recognisably ‘tactical’ material vernacular in terms of ‘pop-up’ cycle lanes or temporary road closures *and* a methodology of flexible urban intervention have been advocated for at high levels of government.

Despite this endorsement from central government, the ultimate responsibility for implementation of interventions in response to Covid-19 remained at the level of local and regional governments. To help bridge strategy and implementation with London's borough authorities, TfL produced additional guidance documents under the auspices of the London 'Streetspace' plan (Transport for London, 2020b), outlining how this change should be interpreted for London's streets. This ranged from more technical elaboration on the use of ETOs (ibid), design guidance for the use of temporary materials (Transport for London, 2020c) to the way that new schemes should be prioritised by the local borough authorities (Transport for London, 2020b). With speed again emphasised, this guidance pragmatically recommended that 'shovel-ready' projects with pre-existing plans be prioritised alongside new proposals for schemes in the areas most obviously in need; an approach that could be characterised as an emergency 'tactic'. Here, as with central government's guidance, the long-term viability of schemes was also emphasised, with recommendations that the emergency prerogative should not trump the responsibility to collect data and monitor the operation of schemes. This reflects a preference for the ongoing development and amendment of schemes as opposed to a binary process of approval or rejection.

In addition to the rhetorical and administrative shifts, these central and regional government activities were also accompanied by new sources of funding. In 2020 the Active Travel Fund accompanied this flurry of changes, providing rapid resources to support local authorities in administering these trial schemes quickly and effectively. In London, where TfL acted as an intermediary in the allocation of funding, the net result of these factors was several (sometimes ambitious) plans for School Streets, Low Traffic Neighbourhoods, pavement widening schemes, and pop-up cycle lanes. The borough of Hackney, for example, pledged to implement a School Street at every primary school they considered to be eligible (see Chapter 3 for more on feasibility). Other boroughs also prioritised School Streets and over the summer of 2020 plans for well over 200 schemes across the city were drawn up ready for the return to school in September. These schemes alone quickly increased the pre-Covid-19 tally three-fold, and since then nearly another 300 schemes have steadily trickled in (see Figure 32).

In summary, during the acute early phase of the Covid-19 pandemic lower levels of government were supported both rhetorically, financially, and administratively by the DfT and TfL to reallocate road space using temporary or trial schemes. In London, the opportunity

created by this additional funding and endorsement was – at least initially – seized upon by local authority actors, and School Street schemes proliferated notably. This built on prior practice using legislative tools like ETOs and temporary methods of trialling School Streets before more permanent installation.

5.3.3. Shifting rationales for and materiality of a School Street

These shifts in approaches on regional and national levels also accompanied changes in how School Streets were perceived, designed, and implemented by practitioners in local borough authorities.

Like many of the paradigmatic examples of tactical urbanism School Streets were generally characterised as an intervention that ‘works’, with a significant benefit derived from a relatively low initial financial investment. The simplicity of a temporary closure contrasted well with the complexity of the problems of traffic and air pollution faced at the school gates. It could be said to be solving several interconnected and intractable issues. “It’s School Streets, I think more than a lot of the initiatives that we take forwards, [that] ticks a lot of boxes”, as Terence¹⁹, a transport planner for an outer-London borough put it. Several interviewees felt that, as a scheme, this low-cost implementation was particularly effective at delivering important benefits and contributing to wider policy goals within a borough – especially as compared with other more expensive active mobility infrastructure. For example, unlike many schemes on main roads or with twenty-four hour closures most School Streets did not require traffic modelling studies prior to implementation. However, the issues and potential benefits emphasised by interviewees to justify these schemes varied. Differences in wider rationale were often based on the audience in question, source of available funding, and sometimes the political priorities of the borough. As Sydney stated,

“If you’re trying to hook into a council’s strategy, then air quality and road danger will be in there, [as] there will be funding [available] for road safety and road danger reduction initiatives. If you talk to parents [on the other hand] they will understand about air quality”.

Another cited their borough declaring a climate emergency as the genesis for their plans for a School Street scheme, aligning it more with sustainability as opposed to public health

¹⁹ All names are pseudonyms

agendas which are also common. The perception, particularly amongst borough officers and transport planners was that, due to the different interrelated benefits of School Streets, as a policy they had a certain conceptual flexibility that allowed them to be framed as solutions across the varied priorities and strategic goals of their different local borough authorities.

The rationale used for School Streets shifted dramatically under Covid-19 with the need for physical distancing at the school gates bolstering pre-existing justifications around active/sustainable travel and its downstream benefits. The need to move quickly was also emphasised. In the first instance many boroughs prioritised the use of retractable barriers and cones operated by volunteers to enforce initial closures (at least initially). This technique, which had been used prior to the pandemic in initial trials, was drawn upon to expand the scheme quickly across an increased number of sites. This was in lieu of implementing the more expensive automatic traffic camera enforcement that had been used by several boroughs prior to Covid – although these often followed shortly after once follow-on funding became available. When traffic cameras were used during this time, they were sometimes movable, with the camera shared between locations and enforcement only occasional. As Kirstie, who is involved in School Streets across London explained: “I think in terms of volume and numbers and getting things in quickly, thinking about things in a temporary nature can be helpful, but hopefully that's just the start and we can develop more permanent schemes”.

5.3.4. School prioritisation as tactic

The processes by which school sites were prioritised also shifted. This is a more significant adaptation of the process of School Street implementation and ties into the wider tensions in state-implemented tactical urbanism outlined earlier. TfL advised boroughs that when prioritising schemes during the Covid-19 response they should balance the expediency of ‘shovel-ready’ schemes with an effort to prioritise the needs of areas that had particularly acute concerns around physical distancing. This was no different for School Streets. Specific guidance issued to borough governments on implementing School Streets (Transport for London, 2020a) advised that schemes be prioritised for schools with the narrowest pavement widths – where physical distancing would be most difficult. However, in the interest of expediency, lenience was given to implement schemes where initial engagement work had already been conducted with the school prior to the pandemic. Although the interviews were completed at a time when it was too early for policymakers to reflect fully on how schemes

were prioritised during Covid, their early impressions highlighted slightly different priorities to those recommended by TfL. As Kirstie says,

“we're hearing from boroughs ... that many of them are tending to work with those schools that perhaps they'd wanted to work with before or they were already developing plans and this is their chance to accelerate them.”

Although there had been variation between boroughs in how they had previously selected schools, with air quality or the surrounding street layout being the most important indicators for some, the school's track-record of promoting active travel interventions was often repeated as a key metric for deciding which schools would receive School Streets. This could be decided either through TfL's STARS scheme where schools can achieve different levels (Bronze, Silver, or Gold) indicating their commitment to sustainable travel or more general ad hoc engagement with the local borough authority on active travel related issues.

This prioritisation of schools where the leadership of the school and/or parents of the student body were already aligned with the goals of the scheme was not only emphasised in terms of expediency but also formed a more fundamental understanding of the way School Streets should achieve their goals. The importance of selecting appropriate sites for School Streets was frequently emphasised during the interviews. As Karen, a borough officer said: “you have to have ambition to do the work within the school as well, because a School Street itself is not going to achieve behaviour change”. Indicating that the nature of the partnership with the school was also important in having parents change their mode of travel. There was also a sense that it was better to initially allocate resources to schools that had a higher chance of a successful scheme due to either pre-existing engagement with parents about active travel issues or the general characteristics of the road layout. This was a way to reward previous involvement and potentially avoid unnecessary opposition from a less willing partner. Furthermore, and similarly to certain rhetorical framings around tactical urbanism, this approach also served to demonstrate proof of concept within the local government with a successful initial case study. As Keith, a borough officer, said in relation to their schemes “the ones we looked at initially... we looked for the easier sort of ones where we thought there'd be less displaced traffic affecting local residents”. Similarly, Winston said “we're looking for schools where a School Street would have a disproportionate impact because there was a wider network that was quite sympathetic to walking and cycling”.

5.3.5. Changing approaches to community engagement

This sense of partnership and prior engagement with the school community as critical to the success of a School Street was a sentiment repeated by several interviewees. In this framing, schools should aim to change parental behaviour away from motor-vehicle use before a School Street is installed. This creates greater consent for the scheme and the closure acts as a deterrent for returning to old behaviour as opposed to a penalty for ongoing behaviour. As Dennis, a borough officer explained,

“what we did in order to reinforce that modal shift element leading up to the School Street installation was to have a number of assemblies and various other things... it didn't just happen overnight. We tried to engage with the schools and to a certain extent with the residents and the parents as well to sort of get them to adopt the change in their behaviour before the measures came into place.”

Schools with pre-existing track records for advocating active/sustainable modes of travel were well placed to deliver schemes that would be successful in terms of achieving the necessary consent from various stakeholders, a process deemed essential in realising the goals of the schemes.

This dynamic between the intricacies of scheme implementation and operation can be read intuitively within a tactical urbanist framework. The council officers interviewed emphasised an action-centric element to their approach where the methodology of change was as important as the specific content or design of the scheme being implemented. Change is here read to be as much the product of engagement and cocreation with the wider school community as it is a practical outcome of the closure of the street. Although ultimately state-directed, there is a creative friction between local government and school community, with participation in the conception and development of schemes as a central focus of government concern.

This approach, however, was complicated by the pandemic and the need to implement schemes quickly before children returned to school in September. This, along with restrictions on social interaction, limited the chance to work with the school community and engage in the usual process of pre-consultation and community co-design.

“...which is not great, it means obviously we don't have quite as good of an opportunity to speak to as many people [as possible] to help sort of design the

scheme. But to get those schemes in in September, that's what we're going to have to do. We can obviously... because it's an experimental traffic order we can tweak things and changes as it goes if need be.”

This quote from Keith reflects the perspective of the government guidance mentioned earlier whereby local authorities were advised to make use of experimental traffic regulation orders and temporary measures to trial schemes often in lieu of more time-consuming engagement efforts. With the use of flexible trials, this method still represents an iterative approach to urban change with the possibility of responding to local conditions after initial designs were implemented. However, these initial Covid-19 School Streets represent a much more limited engagement with the participatory elements of tactical urbanism than their pre-Covid cousins.

However, not all local borough authorities adapted their approaches under Covid, with one officer largely continuing to introduce their borough's School Streets programme with extensive pre-consultation. Denis expressed their concern at the rapid approach to temporary schemes across London:

“I think we might be creating trouble for ourselves by getting in all these rather hastily, perhaps sometimes ill-conceived schemes that cause a whole lot of other impacts and, you know, undermine our support for these sorts of measures going forward”.

This sentiment has been to some extent borne out in the opposition to Low Traffic Neighbourhoods projects, where in addition to complaints around the (often inferred) negative effects of the schemes such as displaced traffic or increased car journey times, critics have cited the speed of the process and limited (initial) consultation as evidence of cynical use of the emergency context and flexible tactics to advance projects without democratic oversight (see LGA (2021) for a detailed exploration of these tensions). Although School Streets have proved more resistant to similar criticisms²⁰, and complaints about Low Traffic Neighbourhoods have persisted well after the emergency context of the pandemic

²⁰ In opinion polling commissioned by Hackney Council on their wider 'Rebuilding a Greener Hackney' strategy, around 74% of residents wanted at least some of the School Streets to remain permanent, compared to below 50% when asked the same question about the borough's Low Traffic Neighbourhoods schemes (Hackney Council, 2022).

and the resumption of prior consultation, it does indicate potential limits to the use of tactics without a significant participatory element.

5.4. Discussion

The primary questions this chapter deals with are how governmental actors in London adapted their approach to implementing School Streets during Covid-19, the extent to which this process overlaps with or diverges from conceptions of tactical urbanism, and how this relates to central debates on the topic. Several notable themes can be drawn from the examples considered here. Firstly, London's regional and (some) local governments had embraced a version of state-led tactical urbanism prior to the pandemic, of which School Streets were an emerging element. Secondly, many of these early examples were scaled rapidly during the pandemic with central government both actively funding and advocating for temporary and flexible measures, and a significantly larger number of local authorities getting involved than before. Thirdly, local governments have employed several different 'tactics' in their pursuit of School Streets. Some were in use prior to the pandemic but were intensified and added to during their period of preparation and proliferation in September 2020. Moving from the specifics of scheme implementation to the wider activities of the local government, these tactics include:

1. The trialling of schemes using temporary materials and volunteers and the use of movable cameras to spread budgets across more sites.
2. The formation of partnerships with schools to communicate effectively with the parent and student bodies.
3. Ensuring initial schemes were successful (thereby demonstrating proof of concept) by prioritising schools with administrations and parental bodies already amenable to active travel or where they would cause least disruption and/or face less opposition.
4. The prioritisation of 'shovel ready schemes', with prior engagement and existing plans in place.
5. Using flexibility in framing the rationale for a School Street to suit the needs of different stakeholders.
6. The full use of ETO legislation to implement schemes quickly without extensive initial consultation or co-design activities.
7. The sharing of information across different local authority areas through document production and network formation.

Not all local authorities utilised each of these tactics, and the curtailing of community consultation was deemed contentious or at the very least regrettable by some participants. Nevertheless, there was a general articulation of an action-centric approach, with these activities supporting the expeditious implementation of School Streets in an emergency

context. This process of proliferation has several connections to the central debates around tactical urbanism detailed earlier. On a very basic level, policymakers framed School Streets as an intervention that allowed them to do more with less, addressing key policy goals around air quality and active travel with relatively low levels of investment and disruption. This fits well with dominant narratives around tactical urbanism which see small-scale ‘acupunctural’ changes resulting in multiple wide-spread benefits. The extent to which such community-engaged projects have been embedded in wider plans for London’s streets also resonates with more recent efforts to codify the way that state-led or state-initiated tactical urbanism might help to bridge the implementation gap between strategic spatial plans and actual implementation (Vallance and Edwards, 2020). This could be read as a response to Brenner’s criticism that tactical urbanism is unable to deliver significant changes to the urban condition. Although London’s School Streets policies have by no means solved problems associated with school travel, that they have come to cover 25% of the city’s schools in a relatively short space of time is a significant achievement that contrasts with the image of widespread municipal inaction presented by many proponents of tactical urbanism. This can be read in part as a product of the window of opportunity presented by Covid-19. However, as Maria et. al. (2020) outline in the case of Milan, having prior experience utilising tactical approaches to reallocating road space allowed the city government to respond more quickly during the crisis. Given the pre-pandemic knowledge and experience of implementing School Streets that existed in London (exemplified by Hackney’s toolkit document), it is likely that this too was the case here.

This concurrence with practices of state-led tactical urbanism also draws London’s School Streets into the fault lines of more critical debates on the concept. The schemes implemented during the most acute phase of the pandemic, which make up a significant portion of the city’s total, had their community participation activities significantly curtailed or delayed. This could be read as an additional state ‘tactic’ as it allowed for more rapid implementation, but it also cuts against central principles of most tactical urbanist writing. Additionally, unlike in Barcelona where changes at schools were the result of highly vocal

parental protests around road safety²¹, London's School Streets are less associated with acts of resistance. This is one of Hou's central characteristics of guerrilla urbanism but is also implicit in the 'creative friction' envisioned by Lydon and Garcia's more establishment model of tactical urbanism. The perception of experimentation without participation has itself become a point of contention in the opposition to the city's Low Traffic Neighbourhoods (LGA, 2021). The lesson here is perhaps that although the implementation gap can be bridged quite effectively through state-tactics, some of the essential qualities that make tactical urbanism a compelling model for change may be lost in the process. The model of tactical urbanism which emphasises a balance between action and participation, bottom-up and top-down, and citizen and state, can clearly skew to one side or the other. This tendency is at the heart of criticisms brought about by Hou (2020), Douglas (2020), and Mould (2014) and others.

However, critics of tactical urbanism do not only focus on the absence of participation, but also on the way in which token or purely aesthetic community involvement, especially when conducted by state or private actors, serves as branding exercises within wider 'creative city' strategies or cover for neoliberal processes of city building (Mould, 2014). As mentioned in the review section, this view is gently rearticulated by Webb (2018) and to some extent Tonkiss (2013), instead emphasising the way such projects respond to dominant political logics and economic imperatives in creative and potentially counter-hegemonic (in the case of Webb) ways. A lesson here is that often contexts far larger than the dynamics of municipal politics are intimately involved in way that these tactical practices operate and proliferate. In this regard, what is interesting about London's overall 'tactical' response to Covid is the extent to which it is highly embedded in multiple levels of government, from hyper local borough authorities to the national level. The DfT had active involvement in encouraging the use of several 'tactics', and arguably demonstrated their own tactical approach by setting the pace of change through the use of rapid funding calls with very specific remits around road space reallocation (Dudley, Banister and Schwanen, 2022). As with Webb this case demonstrates that larger scales of governance are essential to properly understand the context for tactical action. The context in this case is arguably two-fold. Firstly, many of the pragmatic approaches

²¹ Many of the changes to school streets in Barcelona have followed a vocal protest movement of parents/carers (referred to as *Reuelta Escolar*) following the death of a child from a motorbike collision in 2019 (*In Spain News*, 2021). These regular protests over traffic at schools still continue as of Spring 2023.

of local government officers could be read as learnt behaviours from a decade of operating in a context of austerity – evidenced to some extent by the importance granted to the outsized or ‘less is more’ rationale given for School Streets policies. Secondly, the rapidity must also be understood as part of the imperative placed on this change by central government rhetoric and funding, despite resistance to this by several local authority areas (Dudley, Banister and Schwanen, 2022).

The debates around tactical urbanism provide an informative framework to think about School Streets. The potential for bridging the implementation gaps, the tensions around citizen participation (or resistance), the contested legitimacy of state action in this context, all reflect contradictions within the way that School Streets were implemented during Covid-19. Although through their Healthy Streets programme, TfL have at times framed these and similar activities within a narrative of tactical urbanism (at least prior to the pandemic), this framing arguably obscures the ways in which these activities were the result of a top-down process which operated on multiple levels of government. In this case, the concept of ‘tactics’ can help disentangle how change was achieved, and the utility of this framing is well articulated in scholarship on the potential role for tactical urbanism in bridging implementation gaps. It provides a way to think about the responsive, ad hoc, collaborative, and pragmatic elements of state-led small scale urban intervention as distinct from the more formal innovation discourses that are prevalent in studies of urban experimentation. Nevertheless, care should be taken in ascribing ‘tactical urbanist’ characteristics to purely top-down state enterprises. These might employ what could be described as tactics in the ways discussed here, but without the countervailing element of citizen strategy, and perhaps lacking much of the genuine creative potential of more participatory schemes.

5.5. Conclusion

In part recognising the contested nature of state-led tactical urbanism, Hou and Gordon argue for other terminologies to properly describe fully bottom-up urbanism. They do so in part to resist a tendency to ascribe the term tactical urbanism to any and every instance of the use of temporary materials in public space, especially when community involvement has been limited or non-existent. Some examples of School Streets in London could genuinely be considered acts of tactical urbanism in the paradigmatic sense, with processes initiated

through community collaboration and co-design, temporary materials used, and ongoing amendments to the scheme made. Equally, as this example has shown, although employing discrete tactics, many schemes – especially those implemented during the early stages of the pandemic – lack the creative contribution of local communities, drawing into question their status as tactical urbanism (although not their efficacy or virtue as interventions in their own right). Critical engagement around the role of the state and citizen, and the wider legitimacy of these approaches provide a helpful diagnostic with which to analyse schemes like School Streets. But equally there is a case to be made for ‘tactics’ as a term to describe the collaborative and pragmatic ways in which local governments increasingly make their sometimes-mundane interventions in urban space. De Certeau writes that tactics both “take advantage of opportunities and depend on them” (de Certeau, 1984, p. 36 quoted in Andres 2013, p. 764), emphasising not only the practice of acting tactically, but also the importance of them as a response to changing context. Given the way in which a wider emergency afforded the opportunity of rapid expansion, this conceptualisation fits well with the story of School Streets in London. It also demonstrates the importance of understanding these practices as responsive to and embedded within wider political contexts.

With the slowing of the pace of implementation community participation is again a much larger element of how School Streets are introduced. For example, Islington council have more recently used workshops with pupils to co-design changes to the public realm at new and existing schemes, in some cases incorporating artworks and planting into the streetscape. This reflects a possible return to the model of state-led tactical urbanism adopted in London prior to the pandemic but it is unclear how widespread these slower more participatory approaches will be. In terms of policy processes, one of the most interesting outcomes of the Covid-19 School Street response has been the extension of these schemes to areas, often in suburban outer London, with little prior engagement with these pre-pandemic activities. This has likely been facilitated by the adoption of some of the tactics described above, and leaves a complex spatial pattern of provision across the city. The next chapter addressing the policy process theme engages with this question of distribution more directly, looking at the outcome of this Covid response in terms of issues of transport equity.

Achieving a ‘minimum standard’ of equity in the distribution of London’s Covid-19 School Streets

Note: This chapter has been adapted from the paper ‘Equity in temporary street closures: The case of London’s Covid-19 ‘School Streets’ schemes’ published in *Transportation Research D* in 2022. This is a co-authored paper by Asa Thomas, Jamie Furlong, and Rachel Aldred. The CRediT author contribution statement for the original article is as follows: **Asa Thomas:** Conceptualization, Methodology, Validation, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration. **Jamie Furlong:** Conceptualization, Methodology, Validation, Formal analysis, Writing – original draft, Writing – review & editing, Visualization, Supervision. **Rachel Aldred:** Writing – review & editing, Supervision, Funding acquisition. Additional work has been conducted to harmonise the text with the rest of the document, but the research remains unchanged.²²

6.1. Introduction

Following on from the exploration of the tactical process of policy implementation, this chapter examines the fairness of its outcome. Focusing specifically on the schemes introduced after March 2020, it presents a quantitative analysis of the distribution of School Streets in London along several demographic, socioeconomic, and environmental variables. It aims to understand how these measures of (in)equity interact with the complex administrative geography of London. To date, analysis of the socio-spatial distribution of School Streets has been limited. Evidence of the equity and justice implications of other Covid-19 road space reallocation schemes is still emerging, with only a few studies to date (Aldred *et al.*, 2021; Firth *et al.*, 2021; Fischer and Winters, 2021). Existing work on the equity of wider road-safety interventions at school has presented a mixed picture, with both equitable and inequitable distributions found (Jones *et al.*, 2005; Rothman, Cloutier, *et al.*, 2018). This chapter contributes to this literature by investigating whether School Streets implemented in London during Covid-19 have been equitably distributed and are likely benefiting London’s deprived and minority ethnic primary school pupils and the surrounding populations, as well as those

²² I would also like to acknowledge the contribution of Nikki Smiton and Tash Hartke for support in collecting and sharing data on School Streets locations as well as Anna Goodman for comments during the initial stages of the study design.

most subjected to the negative effects of car dominance and resulting pollution. In doing so, this research seeks to answer two questions:

1. How does the (in)equitable distribution of School Streets vary depending on the dimension of equity (e.g. ethnicity, deprivation, local environment)?
2. How do(es) a) the overall spatial distribution of School Streets, and b) the relationships between dimensions of equity and School Street presence vary across London's diverse geography?

This analysis assesses School Streets against a minimum standards approach to equitable policy prioritisation, measuring the extent to which schools most in need by measures of equity are treated first. Through this approach, the chapter argues that alongside more typical social dimensions of equity, local-environmental and spatial dimensions must also be considered to ensure a fair distribution of School Streets in London. It finds that the current distribution, although demonstrating *equality* on several measures, does not meet a minimum standards definition of *equity*, especially when considering these additional environmental and spatial dimensions.

6.2. Literature Review

At its most basic level, transport equity is concerned with the distribution of both the benefits of transportation systems as well as the burdens or negative outcomes of these systems across society (Di Ciommo and Shiftan, 2017; Lee, Sener and Jones, 2017). This has been an area of significant international research – often focusing on the equity of transport accessibility. In London, for example, research has shown that although public transport accessibility varies substantially across the city's social demography, non-White and deprived Londoners are less likely to have access to a car or van (Transport for London, 2012) and are more likely to experience negative consequences related to their use (Edwards *et al.*, 2006; Steinbach *et al.*, 2007; Moorcroft *et al.*, 2021). In spite of this attention, there is currently limited research on the equity of interventions to support active travel to school (Buttazzoni *et al.*, 2018). After first considering theoretical engagements with the concept of transport equity, this literature review will examine the adjacent research on the equity of active travel interventions and the equity issues around children's transport and travel to school.

6.2.1. (Active) Transport Equity

The use of the concept of equity in transport research has several different dimensions. At the broadest level, most conceptualisations have focused on the moral or fair distribution of goods and burdens in society. Although some authors distinguish notions of justice from equity (Karner *et al.*, 2020), for others, this distinction is less important with equity being the practical result of the application of a theory of justice such as utilitarianism or egalitarianism (Nahmias-Biran, Martens and Shiftan, 2017; Pereira, Schwanen and Banister, 2017). Here, any assessment of equity invokes a normative understanding of fairness, meaning that quite different distributive principles might be understood as 'equitable'. Indeed, varied dimensions of equity have also been invoked in the transport context. For example, the importance of spatial equity has been distinguished from the social equity of active travel interventions (Lee, Sener and Jones, 2017). This perspective considers the equity implications of an uneven spatial distribution of a transport intervention alongside its distribution across the socio-demographic composition. Due in part to the varied normative judgements involved, and differing domains of equity emphasised, there is no agreed upon method for measuring equity in transport (Lucas *et al.*, 2019).

Nevertheless, there is growing research that assesses the equity of the distribution of active travel interventions (see Aldred *et al.*, 2021 for an overview), and of Covid-19 related road space reallocation more specifically (Aldred *et al.*, 2021; Firth *et al.*, 2021; Fischer and Winters, 2021). Aldred *et al.* (2021) found that London's pandemic Low Traffic Neighbourhood interventions were broadly equitably distributed on the city level, but with significant variation between borough authorities. Research on the equity of cycling infrastructure has generally reported poorer provision in lower-income areas (Flanagan, Lachapelle and El-Geneidy, 2016; Hirsch *et al.*, 2017; Parra *et al.*, 2018; Braun, Rodriguez and Gordon-Larsen, 2019). However, studies in Australia and Canada have shown more equitable distributions arising from investment in specific low-income areas (Pistoll and Goodman, 2014; Houde, Apparicio and Séguin, 2018). For pedestrian infrastructure, research in the UK and Europe has found less favourable walking environments for higher-income residents (driven by lower densities) (Zandieh *et al.*, 2017; Kenyon and Pearce, 2019), but also higher quality infrastructure (such as pavements and crossings) in wealthier city centres (Bartzokas-Tsiompras, Tampouraki and Photis, 2020).

6.2.2. Children and Transport Equity

Transportation equity research has not only uncovered that in the UK, ethnic minorities and more economically deprived populations are most exposed to poor air quality (Mitchell and Dorling, 2003; Goodman *et al.*, 2011; Fecht *et al.*, 2015), but that children are also disproportionately affected, particularly on their journeys to school (Osborne *et al.*, 2021). In both the UK and internationally, children from ethnic minority and deprived backgrounds are disproportionately exposed to air pollution (Jephcote and Chen, 2012; Gaffron and Niemeier, 2015) and most likely to be injured by road traffic (Nantulya and Reich, 2003; Hwang, Joh and Woo, 2017; Ferenchak and Marshall, 2019). These inequalities have also been found to exist in London²³ for both air quality and road traffic injuries (Edwards *et al.*, 2006; Steinbach *et al.*, 2007; Moorcroft *et al.*, 2021).

The transport geography of school travel can also be highly inequitable. Research (often from North America) has shown that many recent policies intended to promote school choice or consolidate schools often increases school travel distance, disadvantaging children from deprived and minority communities with less family capacity for mobility (Talen, 2001; Andersson, Malmberg and Östh, 2012; Lee and Lubienski, 2017; Scott and Marshall, 2019; Fast, 2020; Bierbaum, Karner and Barajas, 2021). This hostile school travel environment is compounded by a general decline in children's independent mobility and increasing car dependence (Marzi and Reimers, 2018). As already outlined, calls emphasising a child's 'right to the city' or for cities to become more child-friendly have become more frequent (Whitzman, Worthington and Mizrachi, 2010; Mayor of London, 2019; Gill, 2021).

6.2.3. School Travel Interventions

Barriers to independent mobility are often embedded in the objective features of the built environments around schools as well subjective parental perceptions of safety (Mitra, 2013; Mitra, Papaioannou and Habib, 2015; Rothman *et al.*, 2015b, 2021; Rothman, Cloutier, *et al.*, 2018). These can be ameliorated by interventions aimed at improving road safety both at the school gates and along routes to school. In cities in the Global North, these efforts have historically been dominated by traffic calming measures, improved pedestrian infrastructure (e.g., crossings) and the use of crossing guards. Such interventions have been effective in

²³ Although for air quality this picture is improving with the introduction of recent measures such as the Ultra Low Emissions Zone which introduced a charge for the most polluting vehicles.

reducing the perception of danger (Rothman *et al.*, 2015b), and in one UK case study, addressing the inequitable distribution of objective danger for children (Jones *et al.*, 2005)²⁴. However, other research has found traffic calming measures around schools to be inequitably distributed (Rothman, Cloutier, *et al.*, 2018).

Traffic calming is one of several features of the built environment that have been found to impact active travel to school: high car-dominance/traffic levels (Giles-Corti *et al.*, 2011; Larsen, Buliung and Faulkner, 2016; Buliung *et al.*, 2017), less dense road network densities (Mitra and Buliung, 2014; Ozbil *et al.*, 2021), greater distances between home and school (Page *et al.*, 2010; Waygood and Susilo, 2015; Yu and Zhu, 2015), and larger roads surrounding the school (Panter *et al.*, 2010), are all often negatively associated with active travel to school. These characteristics, which Chapter 8 also considers, are often also unevenly distributed within cities, leading to environmental inequities in the experience of active travel. Accordingly, the location of any equitable policy (e.g. School Streets) that aims to ameliorate the negative effects of car dominance on active travel to school should consider dimensions of the local built environment alongside social and spatial characteristics.

Most studies of transport equity outlined in this literature review have focussed on one single dimension of equity, looking at the distribution of benefits *or* burdens, typically in strictly social terms. There is also currently very limited research on the equity of interventions to support active travel to school. One recent study of School Streets in the UK found them to be more often implemented in more deprived schools (Hopkinson *et al.*, 2021), and unevenly spread across London's boroughs. However, there are still several aspects of equity outlined in this review that merit attention in the context of School Streets, including the social equity of the benefits they provide, the environmental equity of the negatives they intend to ameliorate, and the spatial equity of their overall distribution in the city. The next section will outline in more detail how these different dimensions of equity will be measured in this chapter.

²⁴ There is also some evidence that the benefits of active travel are greater for children from lower-socio economic backgrounds (Laverty *et al.*, 2021)

6.3. Methods and data

6.3.1. Measuring Transport Equity for School Streets

Although there is no agreed upon definition or measurement of equity in transport (Lucas *et al.*, 2019), research on the theory of transport equity has increasingly drawn upon John Rawls' theory of egalitarianism, as well Sen's capabilities approach (Martens, 2012; Pereira, Schwanen and Banister, 2017; Verlinghieri and Schwanen, 2020). These approaches share a common perspective which holds that an *unequal* policy is only fair if it benefits those more disadvantaged in society. The distributive principle that underpins this could be broadly described as a minimum standards or sufficiency approach, where policy efforts are prioritised first and foremost on those defined as most disadvantaged and most in need (Martens and Bastiaanssen, 2019). This chapter utilises the minimum standards approach in to help understand the extent to which an incomplete policy (School Streets) has been prioritised to serve schools and local areas most in need before others.

Given the current inequities in transport identified in the literature review, an equitable School Streets policy, according to a minimum standards approach, would initially have prioritised these improvements for low income and ethnic minority Londoners for whom transport options are most limited. However, School Streets also seek to ameliorate the environmental disbenefits of motor traffic. Thus, a focus on the social equity of its benefits as transport infrastructure may not represent a fair distribution in terms of the children most affected by air pollution and road danger. A prioritisation of School Streets along minimum standards should also attend to whether the policy is equitably distributed across the schools in the most car-dominated and most polluted areas. Lastly, the equity of School Streets across London's administrative geography should be considered. Some of the schools most in need in terms of social and environmental equity exist in all of London's district authorities. However, not all have embraced School Streets policies, potentially opening spatial inequities in provision.

From this perspective, it would be expected that an equitable distribution of School Streets would favour schools with higher proportions of non-White pupils, pupils from economically deprived households and in more car-dominated, polluted local areas, irrespective of London's administrative geography. This section will examine in more detail how these different variables will be measured and analysed.

6.3.2. Identifying School Streets

Two different organisations have maintained databases of School Street locations in London and have been made available for this study. Between the two databases there were some discrepancies. Manual research has been conducted to check these and to complete the validation and produce a harmonised dataset of School Street measures. Given the frequency with which School Streets have been installed and difficulties in obtaining up to date data from districts, a small number of sites may have been missed. However, given the large number of sites recorded, this database is considered sufficiently accurate.

The validated list of School Streets was matched by postcode and Unique Reference Number (URN: an id number for all schools in the UK) to the dataset of all schools in London. As a single School Street measure can serve multiple schools, and some schools are split into multiple institutions with different URNs, all schools with the same postal code were deemed to have the same School Street status. The dataset and analysis that follows only includes School Streets that had commenced after March 2020 because this analysis is primarily concerned with the measures installed as part of the Covid-19 pandemic. In addition, the analysis has been restricted to state-funded primary schools since the vast majority - some 89% - of School Streets have been implemented in this school type (see Table 4).

Table 4 – The breakdown of schools with School Streets (implemented since March 2020) by school type in Greater London

School type	Total Schools	School Street Schools (n)	School Street Schools (%)
State-funded primary	1813	446	24.6
State-funded secondary	520	32	6.2
State-funded nursery	79	2	2.5
State-funded special school	153	3	2
Independent school	541	20	3.7
Non-maintained special school	4	0	0
Pupil referral unit	57	0	0

6.3.3. Data and Variables

School Streets impact on both the pupils themselves and on those that live nearby. Therefore, this research considers both the characteristics of the school population as well as the surrounding area. At the school-level, publicly available sociodemographic

data has been attained for the student body of each primary school in London. For the area-level data, a lookup file has been used (Office for National Statistics, 2022) to locate each primary school in London within a Lower Super Output Area (LSOA)²⁵. LSOAs have been used as this is the finest geographical scale, with an average of 1718 residents (mid-2020 estimate, (ONS, 2021)) in Greater London, at which there is data available on variables such as the Index of Multiple Deprivation (IMD). Most LSOA-level data come from the most recent UK census (2011). Where possible, more recent datasets are used (see Table 5 for more details).

While this analysis uses widely established variables - deprivation and ethnicity – to measure social equity, it omits any consideration of gender and physical disability. Although both measures are highly relevant to any study of the impacts of School Streets, there is no significant gender variation between state-funded primary schools or LSOAs in London. On physical disability, school-level data was not available to conduct any analysis.

A measure of car dominance of the local environment has been created for each school based on local road characteristics. A straight-line²⁶ buffer has been mapped from the centre-point of each school of different distances: 1) 500m; 2) 1000m and 3) a unique value for each school calculated as the median of the 75th percentile of travel to school distances of all pupils across the years 2010-2016 (Greater London Authority, 2018). In cases of missing data, the median 75th percentile has been used from the corresponding district. Each buffer area for each school has then been intersected with road data (Ordnance Survey, 2021) to calculate the proportion of the total road length within 500m, 1000m and the 75th distance percentile by road type. Schools with more car dominated local environments are those which have a higher proportion of 'A roads, B roads and motorways'. In the statistical models, a 'ratio of main roads to minor roads' has been calculated - that is, the proportion of road lengths that are 'A/B or motorway' divided by the proportion that are 'local or minor roads'.

²⁵ For more details on how LSOAs fit into the UKs census geography, please consult the Office for National Statistics overview: <https://www.ons.gov.uk/methodology/geography/ukgeographies/censusgeography>

²⁶ An alternative would have been population-weighted buffers but there was also uncertainty that this would more accurately map on to the school catchment areas.

Table 5 – A summary of the data used in this equity analysis

Equity dimension	Variable	Geographical level	Year	Source	Categories				
Socioeconomic	% of pupils eligible for Free School Meals ²⁷	School	2020-2021	Department for Education (DfE, 2022)	NA				
	Index of Multiple Deprivation rank and Score	LSOA	2019	Ministry of Housing, Communities and Local Government (2020)	NA				
Ethnicity	% of pupils in each ethnic group	School	2020-2021	DfE (2022)	White				
					Black/Black British				
					Asian/Asian British				
	% of population in each ethnic group	LSOA	2011 ²⁸	ONS (2013a)	Mixed/Multiple				
					Other				
					White				
Local environment	Road classification (% of road length of total road length in area around a school)	School buffer: a) within 500m; b) within 1000m; c) within 75th percentile of students' travel distances	2021	OS Mastermap Highways	A/B road or motorway				
					Local or minor road				
					Restricted/Access road				
	Ratio of main roads to minor roads (% of total road length within 500m of school that are A/B or motorway roads divided by % that are local/minor roads)	School buffer: within 500m of school	2021	OS Mastermap Highways	NA				
					Air pollution: modelled NOx levels from motor vehicles	School	2020	Breathe London (2020)	NA
									NA
Geographical distribution	Geographical location	School	2022	ONS (2013b)	Inner London				
					Outer London				
					London borough				
Other variables ²⁹	Population density (persons per hectare)	LSOA	2021 (based on projected population)		NA				
	% of population with degree-level qualifications	LSOA	2011	ONS (2011)	NA				

6.3.4. A Composite Index of Equity

Schools have been ranked according to a composite index of equity that incorporates both social (socioeconomic and ethnicity) and environmental dimensions. The variables used to create the overall index are shown in Table 6.

Table 6 – A summary of the variables used to create the equity index

Equity dimension	Variable	Direction
Socioeconomic	% of pupils eligible for FSM	+
	IMD score	+
Ethnicity	% of pupils in White ethnic group	-
	% of LSOA population in White ethnic group	-
Local environment	Ratio of main roads to minor roads	+
	NOx levels from motor vehicles	+

As the variables are ‘substitutable’ - that is, a low value in one indicator can be offset by a high value in another - an additive aggregation method using the arithmetic mean was deemed most appropriate (Mazziotta and Pareto, 2013). The final composite variable (C) was therefore created by summing the standardised z-score values (z) for each variable:

$$C = z_1 + z_2 + \dots + z_p \text{ where } z = \frac{x - \bar{x}}{SD}$$

Due to the different variances of the variables, without standardisation one variable could have a greater impact on the composite index than another (Song *et al.*, 2013). As this analysis assumes no prior belief regarding the importance of the different indicators or dimensions in

²⁷ Research has shown that FSM eligibility is a suitable proxy for socioeconomic disadvantage (Ilie, Sutherland and Vignoles, 2017) and, with some caveats, for family income (Hobbs and Vignoles, 2010).

²⁸ The 2011 variable is used at LSOA level because more recent ethnicity projections are only available at the much wider geographical scale of local authority borough and at the time of analysis this was the most up to date census data.

²⁹ These variables are not part of the main bivariate analysis, although population density is controlled for in two of the logistic regression models. This is because, while it is not considered a key dimension of equity, it is a key determinant of School Street location and not doing so would threaten the internal validity of the research.

measuring equity, weights have not been utilised – all variables contribute equally to the composite index. In Table 6, for each variable, where the direction is positive (e.g. % of pupils eligible for FSM), this implies that a higher value of the variable contributes to an increase in the overall score. A negative direction (e.g. % of White pupils) implies that a higher value contributes to a decrease in the score. Overall, if a school has a high index score, under an equitable policy distribution it would be more likely to have a School Street.

6.3.5. Statistical Modelling

For both primary schools and their surrounding areas, relationships between sociodemographic, economic, and environmental characteristics and the presence of a School Street are examined through regression models. As the outcome in all models is a dichotomous variable (1: School Street; 0: no School Street), binomial logistic regression models predict the probability that a school has or does not have a School Street scheme. To examine both the additional district-level association with School Street provision as well as the extent to which school and area-level factors remain significant after accounting for district, a multi-level random intercept model has also been executed, in which the school and area-level characteristics (level 1) are nested within the district (level 2).

To avoid unreliable or indeterminate regression coefficients (and therefore, spurious findings), variables are excluded from the models where there is evidence of multicollinearity - as detected by a variance inflation factor (VIF) of greater than five (Harris and Jarvis, 2011). As there was evidence of non-linearity between three independent variables (NO_x levels, ratio of main to minor roads and population density) and the logit of the outcome, a Generalized Additive Model (GAM) has also been performed with smoothed terms for these variables. The outputs from the additional GAM models are in Appendix F.

6.4. Results

6.4.1. Overall Equity: A Composite Index of Equity

In Figure 19, all state primary schools have been ranked into deciles, such that the higher the composite index score, the higher the decile it falls into. An equitable distribution would have a higher proportion of schools/pupils attending schools with School Streets in the highest deciles. However, Figure 19 shows little evidence of any increase or decrease in School Street proportions in the highest deciles with the highest index scores. Rather, a higher proportion

of School Streets are found at schools in the centre of the index distribution, in what might be termed the most “average” schools on these measures.

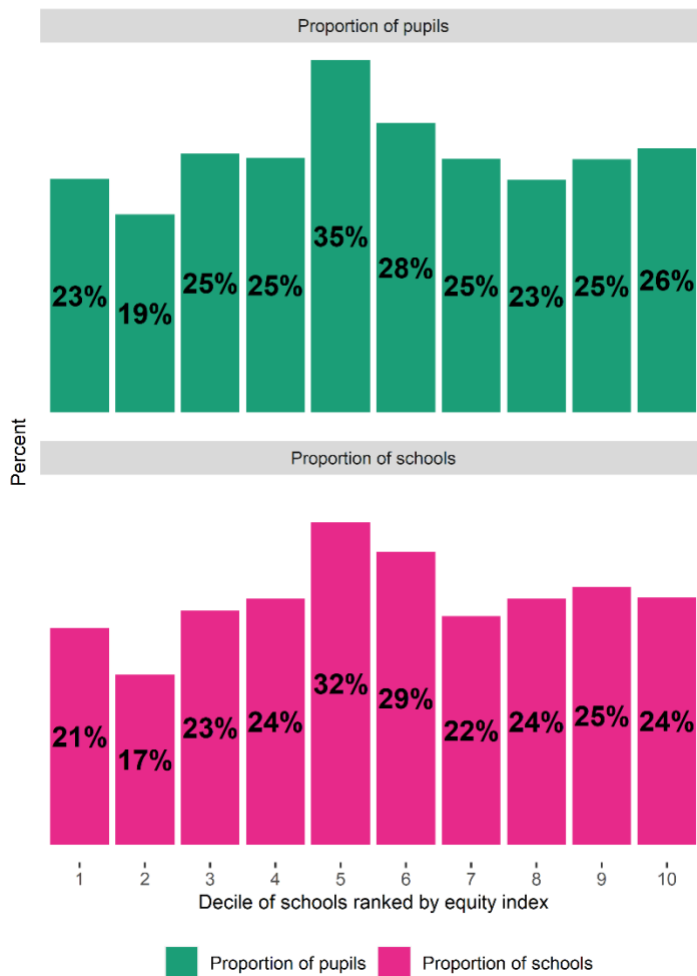


Figure 19 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by equity index

Figure 20 shows that the distribution of School Streets is more inequitable across inner London schools than those in outer London. Generally, in inner London there are higher proportions of schools and pupils in schools with lower equity index scores. At the most extreme, some 54% of pupils in the third decile of schools attend a school with a School Street compared to only 23% in the seventh decile of schools. In outer London, while there is some variation between deciles, on the whole School Streets appear somewhat equally but not equitably distributed.

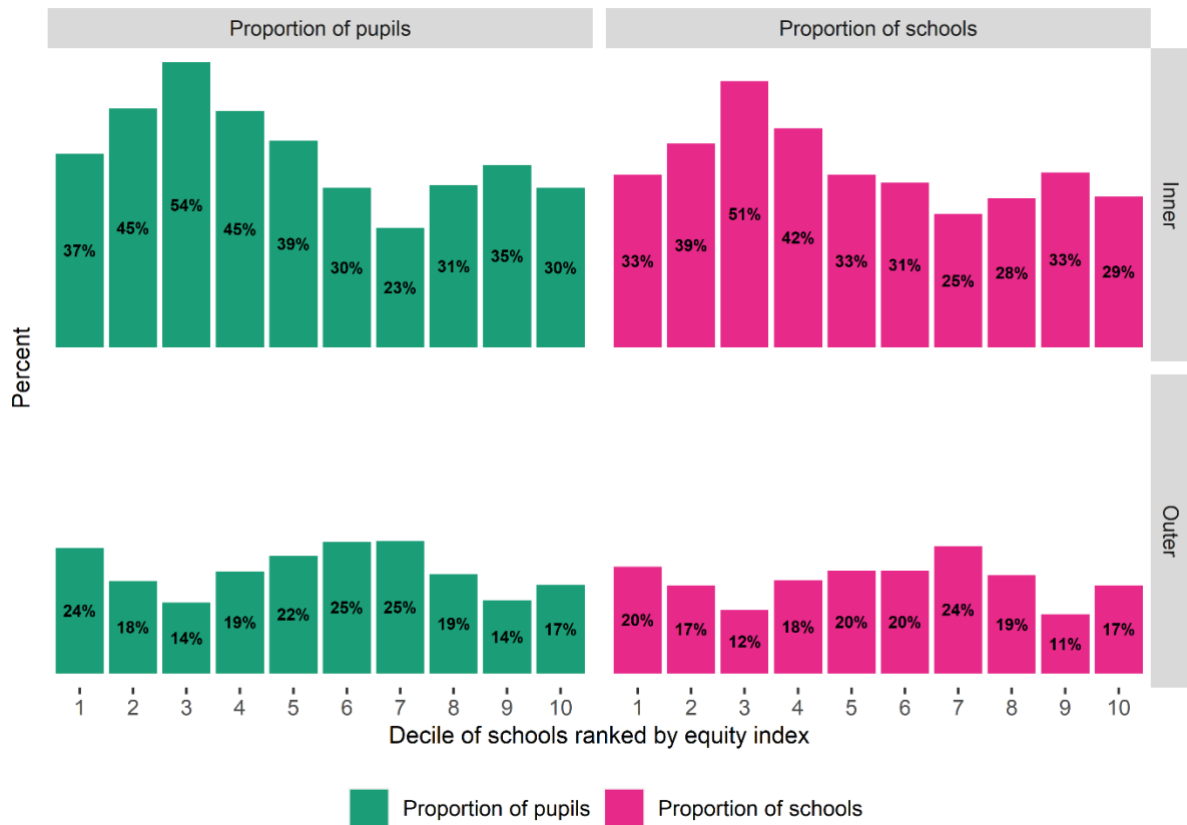


Figure 20 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by equity index (inner and outer London)

6.4.2. Spatial Equity: District Borough Distribution

There is a clear geographical inequity in the spatial distribution of School Streets: 34.4% of all inner London state-funded primary schools have School Streets in comparison to only 17.7% for outer London where many boroughs are under-served (see Table 4). This fits closely with the strong positive relationship between School Streets and population density of the surrounding area (see Figure 43, Appendix A). While some 30 out of 33 London local authorities have a School Street³⁰, there is a significant concentration in the north-east of inner London in boroughs such as Hackney and Islington with other boroughs such as Hammersmith and Fulham and Bexley having no School Streets.

³⁰ For analysis at the borough-level, boroughs are excluded if: a) they have fewer than five School Street interventions or; b) either fewer than 10% of the total state primary pupils attend a school with a School Street or fewer than 10% of the state primary schools have School Streets implemented.

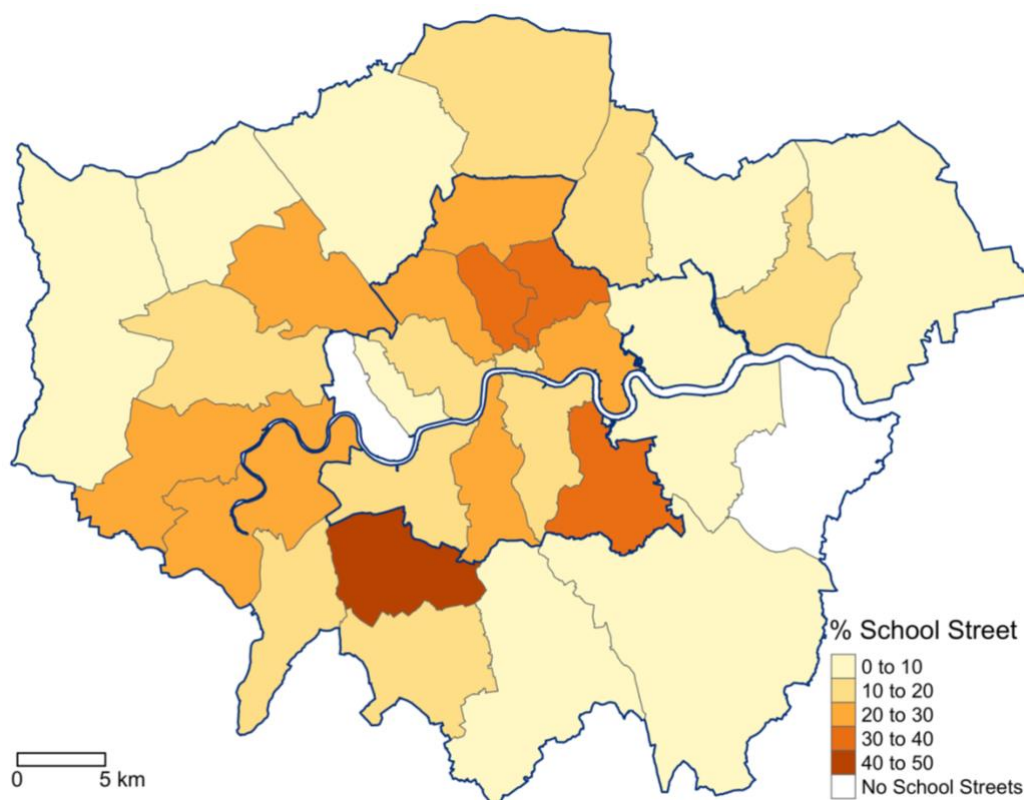


Figure 21 – A map showing the proportion of state primary schools with School Streets (implemented post-March 2020) across Greater London boroughs (April 2022)

Table 7 – Distribution of School Streets (state primary) by inner and outer London

	Overall			Borough-level		
	Non-School Street schools (n)	Schools with School Street schools (n)	Schools with School Street (%)	Median count: School Streets per borough	Mean count: School Streets per borough	Mean percentage: schools with School Streets per borough
London	1319	420	24.2	11.0	12.7	24.3
Inner London	438	230	34.4	17.5	16.4	31.2
Outer London	881	190	17.7	10.0	10.0	19.2

There are currently 420 state-funded primary schools with School Streets implemented since March 2020. Based on the overall equity index, we have identified the 420 schools that *would have* received a School Street intervention if this policy had been implemented equitably according to the minimum standards approach. There is huge geographical variation here: in some boroughs (Hackney – 74%, Lewisham 47%, Brent, 45%), a significant proportion of these most ‘at need’ schools have received School Streets (see Table 25, Appendix A). In others, the

opposite is the case: in Newham for instance, only 6 School Streets have been implemented compared to a predicted 38 under an equitable Greater London distribution (see Table 24, Appendix A).

6.4.3. Socioeconomic Equity

6.4.3.1. School-level Deprivation (Free School Meals)

The proportion of students at School Street schools that are eligible for FSM in 2020-21 was 24.3% - slightly higher than the 21.5% at schools without a School Street. The implication is that, across Greater London, the student body of schools with School Streets is likely to reflect higher levels of socioeconomic deprivation than that at non-School Street Schools.

Table 8 – Total and percent of pupils eligible for FSM by school status

School status	Total pupils	Total pupils eligible for FSM	Percent of pupils eligible for FSM
Non-School Street	513,540	110,892	21.6
School Street	175,682	40,912	23.3

The graphs in Figure 22 rank schools into deciles by the proportion of pupils eligible for FSM, from the lowest 10% (least deprived) of schools in the first decile to the highest 10% (most deprived) in the tenth decile. Broadly, the distribution is equitable: with increasing proportions of pupils eligible for FSM, the proportion of schools that have a School Street and proportion of pupils attending a school with a School Street both increase. Indeed, some 31% of schools in the top 10% most deprived schools have a School Street – the highest figure at any decile.

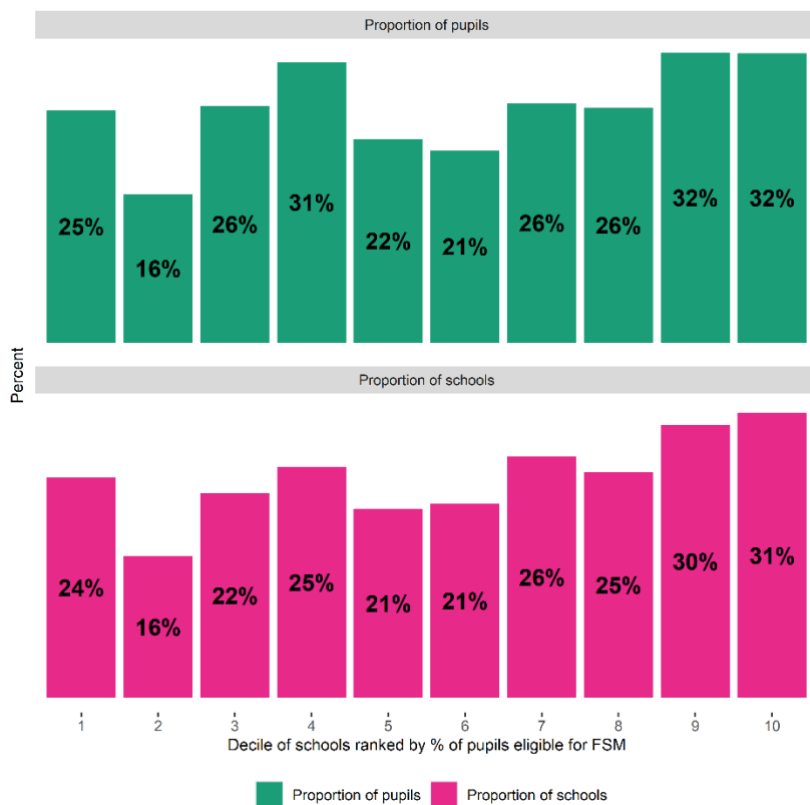


Figure 22 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by percent of pupils eligible for FSM

This equitability of School Street distribution by FSM eligibility is driven by trends in inner London (see Table 9). The pattern is much more mixed when each borough district is considered as a separate entity. In fact, in only 6 of 22 local authorities, the proportion of pupils eligible for FSM is higher at School Street schools than non-School Street schools. This shows quite how significantly the data is skewed by a) a small number of districts that simultaneously have higher levels of FSM eligibility overall; b) significantly higher eligibility at School Street schools; c) a greater proportion of pupils at School Street schools. It also indicates that while School Streets overall are more likely to be introduced at schools with more deprived student bodies, for most local districts this is not the case.

Table 9 – Total and percent of pupils eligible for FSM by school status and geography

Geography	School status	Total pupils	Total pupils eligible for FSM	Percent of pupils eligible for FSM
Inner London	Non-School Street	143,043	41,690	29.1

	School Street	84,040	24,737	29.4
Outer London	Non-School Street	370,497	69,202	18.7
	School Street	91,642	16,175	17.7

6.4.3.2. Area-level Deprivation (Index of Multiple Deprivation)

Table 10 – Summary statistics of IMD score by School Street status

School status	n	min	Q0.25	mean	median	Q0.75	max	sd
School Street school	420	3.3	14.5	23.2	23	31	53.3	11
Non-School Street school	1318	2.8	12.7	22	21.5	30.2	64.7	11.1

The IMD ranks every LSOA in England by level of deprivation, using a score summarising several different variables. Table 10 presents the IMD score distribution across School Street and non-School Street school areas. Overall, on both median and mean values, the average IMD score is slightly higher in areas around School Street schools, implying a somewhat equitable distribution on this measure. However, each school was also ranked into deciles based on the IMD score of the surrounding LSOA ranging from 1 (least deprived: lowest 10% of scores) to 10 (most deprived: highest 10% of scores). Overall, across London, there was a somewhat equal (rather than equitable) distribution of School Streets by deprivation in the surrounding area. In all but one decile, the proportion of schools that had School Streets is between 22% and 28%. An equitable distribution would have more clearly increasing proportions of School Street schools and pupils with increasing levels of area-level deprivation.

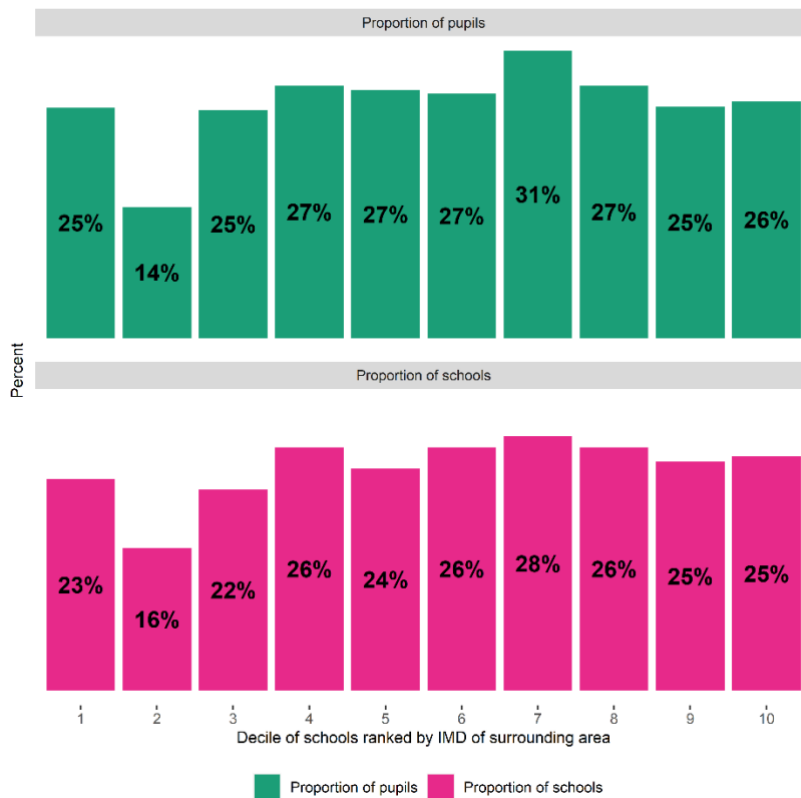


Figure 23 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by IMD score of surrounding area

While IMD encompasses educational levels, the bivariate association between the proportion of the population with degree-level qualifications and the presence of a School Street was also tested, finding a clear positive relationship: School Streets are disproportionately located in areas with more highly qualified populations (see Figure 45, Appendix B).

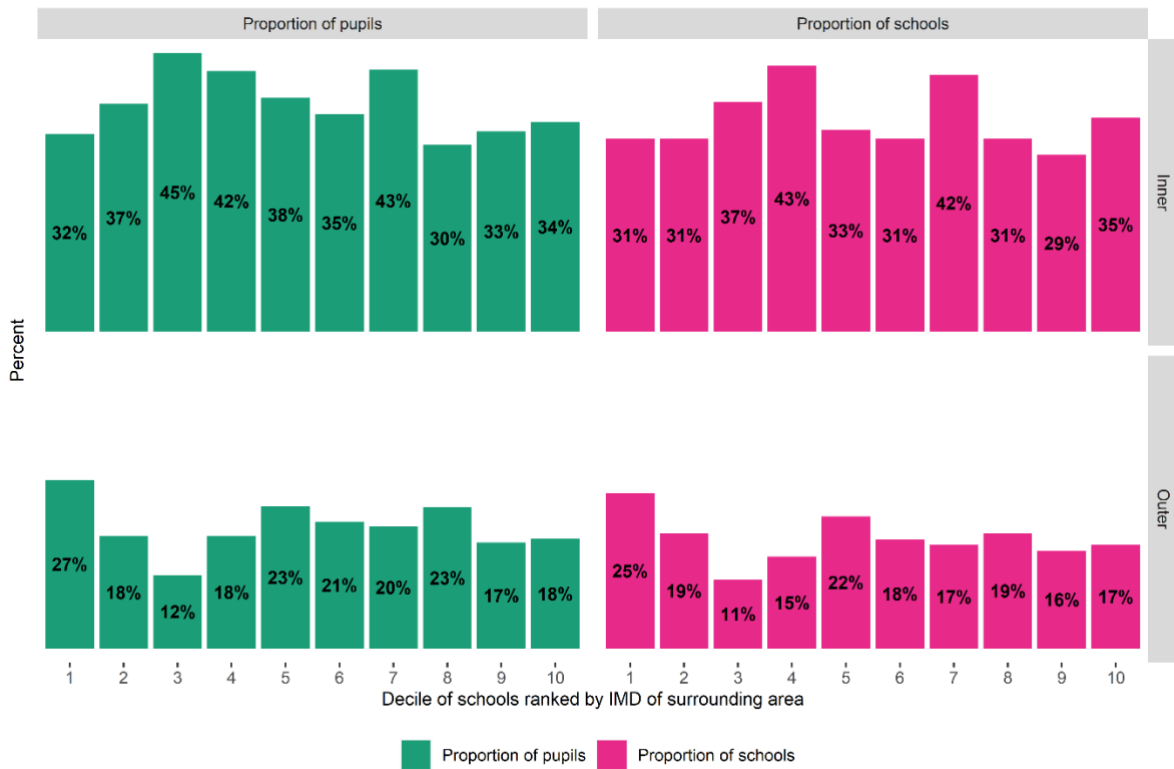


Figure 24 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by IMD score of surrounding area (inner and outer London)

6.4.4. Ethnic Equity

It is somewhat unclear whether the distribution of pupils by ethnic group by School Street and non-School Street schools across Greater London is equitable. On the one hand, a slightly higher proportion of pupils at School Street schools are Black/Black British or have a Mixed ethnicity or multiple ethnicities and overall the non-White population at School Street schools is slightly higher (59.2%) than at non-School Street schools (57.5%). In contrast, 21.5% of School Street school pupils are Asian/Asian British compared to 23.8% at non-School Street schools. The equity of the policy in this case depends on the ethnic group being considered.

Table 11 – Distribution of pupils by ethnicity across schools with School Streets and without School Streets in Greater London

Ethnic group	Non-School Street		School Street	
	Total pupils	Percent of pupils	Total pupils	Percent of pupils
Asian/Asian British	124,463	23.8	39,752	21.5
Black/Black British	85,961	16.4	34,541	18.7
Mixed or multiple	60,348	11.5	23,936	13
Other	30,168	5.8	11,153	6
White	222,476	42.5	75,309	40.8
Total	523,416		184,691	

As with deprivation, the somewhat equal distribution of School Street schools by ethnic group is matched across inner and outer London, as can be seen in Figure 25. However, at schools in inner London with School Streets there was a slightly higher proportion of White pupils and slightly lower proportion of Asian/Asian British than at non-School Street schools. There was significantly more variance by the more defined geography of London’s districts, as shown by Figure 47 in Appendix C. In some London districts, an inequitable distribution is evident. In Greenwich for example, only 13% of pupils at schools with School Streets are Black/Black British compared to 32% of pupils at schools without School Streets implemented. In Ealing, only 21% of pupils at School Street schools are Asian/Asian British and some 40% are White compared to 35% and 27% respectively at non-School Street schools.

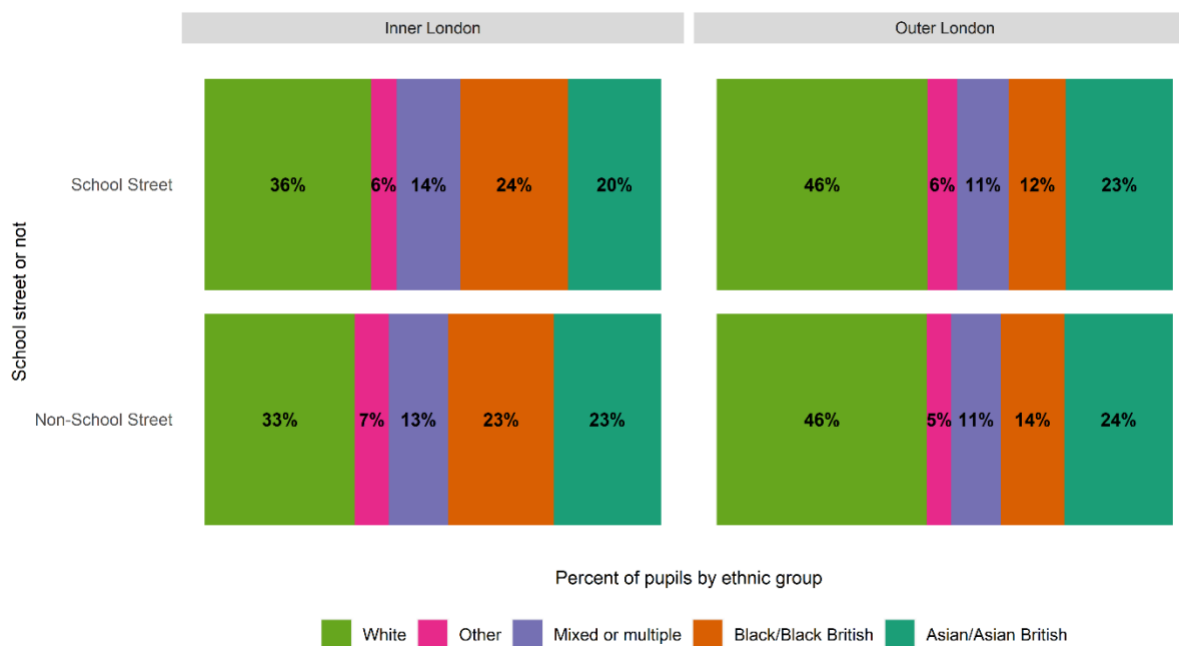


Figure 25 – Distribution of pupils by ethnicity across schools with School Streets and without School Streets in Greater London (inner and outer London)

In terms of the ethnic make-up of the areas surrounding School Streets, there is some evidence of a more equitable distribution: in both inner and outer London, there is a lower proportion of White residents and a higher proportion of Black/Black British residents in areas surrounding School Street Schools than non-School Street Schools. The relatively high levels of Black/Black British residents are particularly evident in inner London School Street areas. However, the opposite is true with Asian residents, where there is an under-representation in both inner and outer London areas.

Table 12 – Distribution of ethnic groups across state primary school LSOAs with and without School Streets by inner/outer London

	% White	% Mixed/Multiple ethnic groups	% Asian/Asian British	% Black/African/Caribbean/Black British	% Other ethnic group
All LSOAs					
London	60.7	4.9	17.9	13.1	3.4
Inner	58.0	5.9	15.5	16.6	4.1
Outer	62.5	4.3	19.5	10.8	2.9
School LSOAs with School Streets					
London	58.8	5.5	16.7	15.4	3.6
Inner	56.6	6.1	14.7	18.7	3.9
Outer	61.7	4.7	19.2	11.2	3.2
School LSOAs without School Streets					
London	61.4	4.8	17.8	12.6	3.4
Inner	57.8	5.7	16.4	15.9	4.3
Outer	63.6	4.3	18.6	10.7	2.9

6.4.5. Environmental Equity

This section considers the distribution of School Streets according to three measures: 1) the characteristics of roads nearby to the school 2) modelled air pollution from motor vehicles at the school site.

6.4.5.1. Characteristics of the Roads Surrounding Schools

Overall, across Greater London, there is an equal but not equitable distribution of School Street interventions according to how car-dominated the immediate local environment is. For example, within 500m of the school, 71% of the total road length is classified as ‘local or minor’ at School Street schools compared to 72% at schools without School Streets (Figure 26). The equivalent percentages for ‘A roads, B roads and motorways’ is 12% at both School Street and non-School Street schools. The distribution by inner and outer London is also remarkably similar, though there is fairly significant geographical variation across London’s boroughs (see Figure 49, Appendix D).

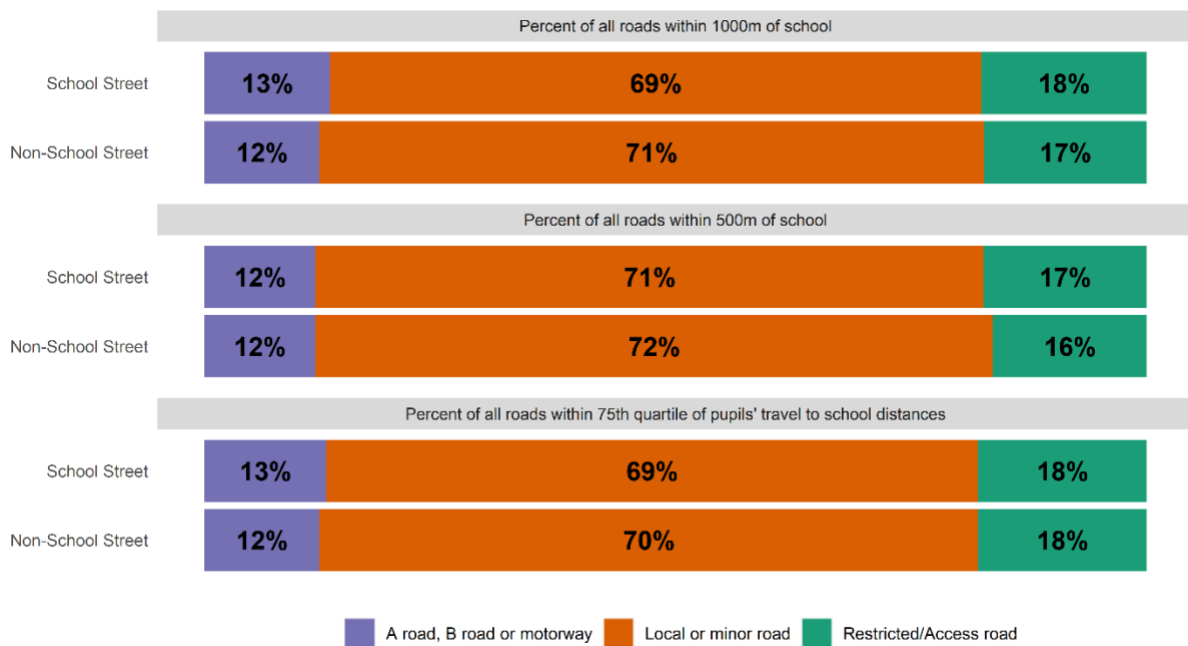


Figure 26 – Proportion of roads in the local environment surrounding a school by road classification and School Street/non-School Street school

6.4.5.2. Air Pollution

Table 13 – Summary statistics of NOx air pollution values ($\mu\text{g}/\text{m}^3$) from motor vehicles by School status

School status	n	min	Q0.25	mean	median	Q0.75	max	sd
School Street school	417	6.4	12.5	17.2	14.4	16.5	122.7	11.9
Non-School Street school	1314	5.5	11.4	20.3	14	18.5	148.9	17.7

Given the equal (but not equitable) distribution of School Streets by the car dominance of the local environment, it is unsurprising that the distribution of air pollution levels from motor vehicles is quite similar (see Table 13). The proportion of School Streets does not appear to be higher or lower in the most or least polluted schools (see Figure 27). However, the proportion of School Streets is much higher at schools closer to the centre of the distribution, favouring schools with levels of air pollution closer to the average across all schools. For example, in schools in the fifth decile, 39% of pupils attend a school with a School Street compared to just 16% in the schools with lowest levels of air pollution and 18% in schools with the higher levels of air pollution. Just 13% of schools that have the poorest air quality

have School Streets. The School Streets policy is not effectively reaching schools where children are likely to be most exposed to air pollution from motor vehicles.

The distribution of School Streets is significantly more inequitable by air pollution in inner London than outer London. A much higher proportion of School Streets have been implemented at schools in inner London with the lowest levels of air pollution than those with the highest. For example, some 43% of the least polluted 10% of schools have a School Street compared to just 17% of the most polluted 10% of school in inner London (see Figure 28).

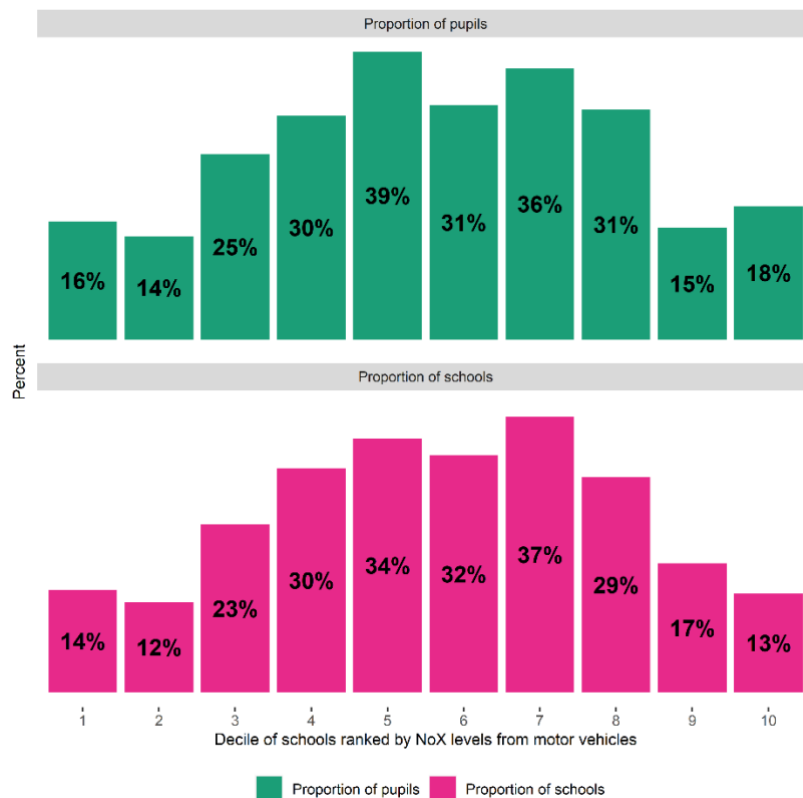


Figure 27 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by NOx level from motor vehicles

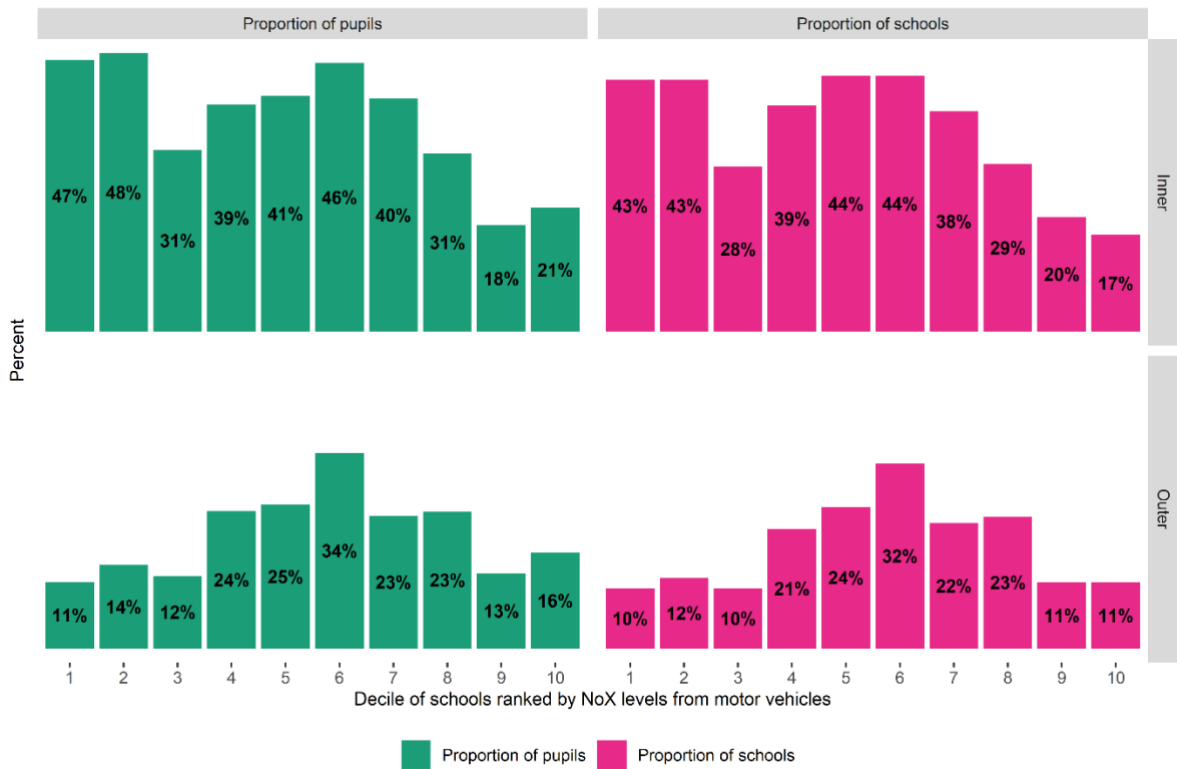


Figure 28 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by NOx level from motor vehicles (inner and outer London)

6.4.6. Summary of Models

Three separate logistic regression models have been executed to predict a binary outcome: the presence of a School Street at each school. Model 1 uses only school-level explanatory variables; Model 2 uses school and local area variables; Model 3 is a multi-level random intercept model with district as the level 2 grouping variable. The model summaries are presented in Table 14. Versions of these models with normalised explanatory variables as well as a GAM version of Model 2 with smoothed terms (see Section 6.3.5) have also been executed. The model summaries can be found in Appendix F.

Table 14 – Regression summaries from three models predicting School Street presence at state-funded primary schools in Greater London

	Dependent variable:		
	School Street (1) or not (0)		
	School-level only (1)	With local area variables (2)	Multilevel model with fixed effects (L2 = Borough) (3)
Free school meals (% eligible)	0.011* (0.005)	0.006 (0.006)	0.004 (0.008)
Asian/Asian British (% pupils)	0.003 (0.003)	-0.002 (0.004)	0.004 (0.005)
Black/Black British (% pupils)	0.002 (0.004)	-0.014* (0.006)	-0.012 (0.007)
Mixed/Multiple ethnicity (% pupils)	0.031* (0.012)	0.023 (0.013)	0.012 (0.016)
Black/Black British (% of LSOA pop)		0.033*** (0.009)	0.027* (0.011)
IMD score		-0.021* (0.008)	-0.034*** (0.010)
Ratio of main roads to minor roads		-0.341 (0.315)	-1.130** (0.381)
NOx level from motor vehicles		-0.017*** (0.005)	-0.021*** (0.005)
Population density		0.008*** (0.001)	0.005*** (0.001)
Intercept	-1.881*** (0.218)	-1.663*** (0.246)	-0.972* (0.404)
Observations	1,739	1,728	1,728
Log Likelihood	-952.251	-904.503	-811.480
Akaike Inf. Crit.	1,914.502	1,829.006	1,644.960
Bayesian Inf. Crit.			1,704.962

Note: *p<0.05 **p<0.01 ***p<0.001

Although in Model 1 the proportion of students eligible for FSM and in Model 2 the proportion of Black/Black British pupils are positive and negative predictors respectively, after accounting for district in Model 3, there are no statistically significant predictors at the school-level. The implication is that, after accounting for local area characteristics and the specific borough district of each school, there is little evidence of school ethnic makeup, deprivation or attainment determining the presence of a School Street.

After accounting for the relationship between districts and School Streets in Model 3, IMD is a statistically significant negative predictor, implying that the higher the level of deprivation in the area surrounding the school, the lower the probability of a School Street. This is *precisely the opposite* of what would be expected under an equitable distribution by deprivation. In contrast, the proportion of Black/Black British residents in the surrounding area has a positive association with School Streets, in line with the findings in Section 6.4.4.

The environmental variables present evidence of an inequitable policy: overall, there was a statistically significant negative association between air pollution from motor vehicles (NOx levels) outside a school and the presence of School Streets. Similarly, the more car

dominated the area around a school (the ratio of main to minor roads), the lower the probability of a School Street being present. These two findings are broadly confirmed in the GAM models: although the partial effects plots (see Figure 51, Appendix F) present the road ratio variable as having a non-monotonic relationship with the outcome, there is not sufficient confidence to confirm anything other than the probability of a School Street is significantly lower in the most compared to the least car dominated school areas. While School Streets are disproportionately being implemented in more densely populated parts of London, it is evident that – after controlling for demographics, population density and borough – they are still less likely to be implemented in car-dominated, polluted environments where they may be of most benefit.

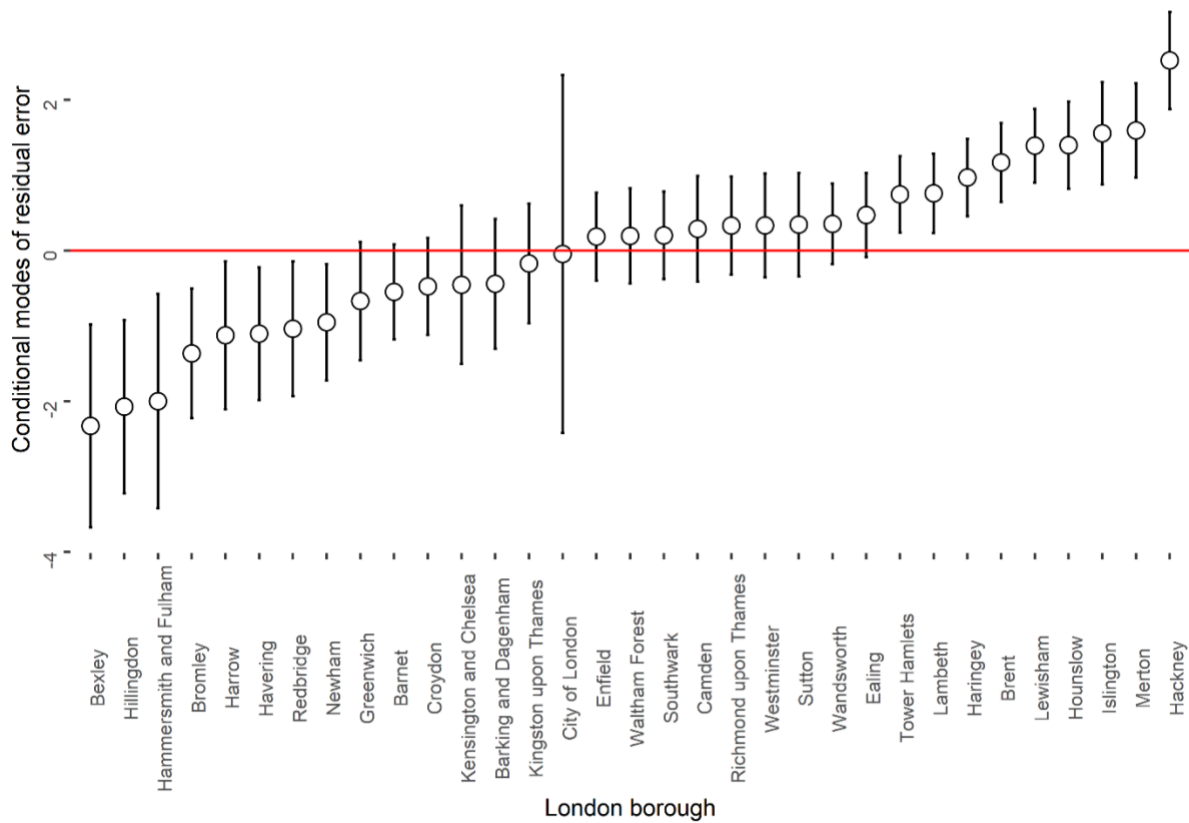


Figure 29 – Confidence intervals of residual error for London's district boroughs

Overall, the variance of 1.29 for the district-level random effect indicates that there is substantial within-school variance that is explained by the differences across borough districts. This district-level geographical inequality in the distribution of School Streets is exemplified most clearly by the plot of the conditional modes of residual error for each

borough in Figure 29. This shows the borough-level (L2) residuals and their associated standard errors to explore the variation in School Streets interventions across local authorities in London. The residuals in this plot can be understood as the estimated borough-level effect on the probability of their schools having a School Street. Where the confidence intervals cross the x-axis – as is the case for many district boroughs (e.g., Enfield), there is no statistically significant effect. However, there are positive effects associated with some boroughs, most notably Hackney. At the other end of the spectrum, there is a negative effect associated with a school being in Hillingdon, Hammersmith and Fulham, Bexley, Bromley, Newham and Redbridge.

To further demonstrate the effect of this geographical inequality in distribution, the multi-level model has then been used to predict the probability for a random group of the same schools (keeping their school and area-level characteristics) that it would have a School Street if it were (hypothetically) located in Hackney (most positive association), Richmond upon Thames (neutral) and Hillingdon (most negative). Taking one example from the table (see Table 33, Appendix E) – Perivale Primary School: if it were located in Hillingdon, the predicted probability of a School Street is 0.05; in Richmond upon Thames it is 0.38; and in Hackney it is 0.84. This is clear evidence of the way in which the district-level implementation of School Streets has resulted in substantial geographical inequalities in access to School Streets.

6.5. Discussion

6.5.1. Overview

In assessing the equity of School Street measures, this analysis has employed a minimum standards approach, based on school and area-level measures of socioeconomic deprivation, ethnicity, the local road network, and air quality. Combining these variables into one index score there is clearer evidence of a broadly equal rather than equitable distribution of School Streets. From a minimum standard approach to equity, schools that should be prioritised are those with high levels of pollution, car dominance, deprivation, and a non-White population. This research finds that these schools are no more or less likely to have a School Street intervention than schools that would be considered less of a priority. When this same comparison is made between inner and outer London, School Streets in inner London appear

to be more inequitably distributed than those in outer London. This analysis also finds an uneven spatial distribution of School Streets across London's geography that is not accounted for solely by demographic or local area characteristics. Of the 420 School Streets that have been installed since the pandemic, only 103 of these are at schools deemed a priority by our definition of minimum standards (see Appendix A. Table 25).

Our first research question asks how the equity of School Streets varies by different indicators – socioeconomics, ethnicity, and local environment. While overall the analysis has shown more evidence of equality than equity in School Streets distribution, this varies significantly across the different indicators considered. Perhaps the most notable findings are in relation to the local environment, where rates of School Street provision are lower at both the most and least polluted School-areas in London. In inner London, School Street provision is generally lower at schools with higher levels of air pollution from motor vehicles. Consistent with this finding, air quality is also a statistically significant negative predictor of School Street provision in the regression models. This is perhaps surprising given that the local road characteristics – a proxy for car dominance – of School Streets and non-School Street schools are very similar. However, when the effects of districts on School Street variance is accounted for, the ratio of main to minor roads becomes a significant negative predictor. This reveals that once the uneven spatial School Street provision by districts is accounted for, School Streets are more likely to be implemented at schools in less car-dominated local environments.

At the school-level, there is agreement with the findings of Hopkinson et al (2021) - that School Streets tend towards more deprived schools (by FSM). Pupils from more deprived households are somewhat more likely to benefit from School Streets, implying a more equitable distribution at this level. In contrast, there is more tentative evidence of inequitable effects on the local area population, where, after accounting for other characteristics, more deprived areas are less likely to receive a School Street intervention. This repeats the complex picture found in the literature review, with both Covid-19 road reallocation schemes, as well as wider active travel infrastructure reporting contrasting findings on the equity of interventions in terms of deprivation.

For ethnicity, there is limited evidence of significant differences between student bodies at School Street and non-School Street schools and little evidence of a particularly equitable distribution, reflected in the non-significance of pupil-level ethnicity in the

regression analysis. At the area-level, there is some evidence that School Streets favour Black/Black British residents, with the category remaining a significant positive predictor even once the effect of district areas is accounted for in the multi-level model. This supports findings in Aldred et al (2021) that Low Traffic Neighbourhood measures installed in London during the initial stages of the pandemic also favoured Black residents, with Asian residents under-represented – a tendency also present in our descriptive findings. This is a positive finding in relation to ethnic equity, given that research has found Black children are over-represented in London's road traffic injury statistics (Steinbach *et al.*, 2007).

Overall, the inequitable distribution of School Streets in relation to air pollution and to some extent the car dominance of local environments is perhaps the clearest finding of this research. By ameliorating air pollution and supporting children and carers' active mobilities, School Streets have the potential to attend to existing transport inequities. However, ensuring that they are also distributed equitably is central to the effectiveness on the policy writ-large both in terms of fairness but also the more prosaic scheme goals of facilitating children's safe and unpolluted active travel. Targeting, whether through School Streets or through complementary measures at city- or street-level, the schools most in need of mitigation against the effects of automobile dominance, as well as on socio-demographic groups most disadvantaged by transport goods and burdens, will likely see the greatest population benefit while attending to issues of transport justice.

Studies of transport equity have tended to focus on the relationship between socio-demographic variables either in relation to access to transport infrastructure or to environmental exposure of its negative effects (Lucas and Jones, 2012). However, the environmental context of car dominance and its effects on air quality is also a key element of equity when assessing interventions targeted at children's active transport. When assessing these variables, the equity of the local environment is found to be at least as significant as many socio-demographic indicators.

6.5.2. Barriers and Potential Solutions to Achieving School Street Equity

There are two primary barriers to achieving an equitable distribution of School Streets in London. The first is that temporary closures are not a suitable intervention at all schools, with authorities unable or unwilling to close the most highly trafficked roads for a School Street. Although the least polluted schools in London also have lower-levels of School Streets, and

with perhaps as many as 42%³¹ of state primary schools likely suitable and still without School Streets, the air quality and car dominance inequity observed can still be in part attributable to the most polluted and most main-road heavy schools being less suitable for School Streets. A limitation of this research is that it does not define a measure of school suitability³² and assess the extent to which suitability drives the overall findings of equity on different dimensions. It also reflects a limitation with School Streets measures as they are currently construed, and it may have long-term equity implications for the policy at the very least in terms of supporting the active mobility of all children.

Possible solutions to this issue of suitability may include expanding the scope of measures used to improve the streets at schools so that more schools can be treated. In Barcelona for example, for schools on busier streets, single lanes, parking spaces or non-essential sections of the main vehicle lanes have been reclaimed and protected from motor traffic to provide space for informal play. In addition, improved crossing facilities may attend to road danger issues, and the use of vegetated green screens have shown some evidence of limiting air pollution at schools (Tremper and Green, 2018). In addition, transport authorities could be bolder with regards to the streets they consider suitable for a temporary School Street closure, including some less essential 'B' class roads in London.

The second critical barrier to achieving equitable distribution in part addresses our second research question asking at which geographies the distribution of School Streets is (in)equitable. This analysis has shown that the distribution of School Streets across London is spatially uneven, with some districts having much more extensive School Street policies than others. It is clear from the multi-level model that these district-level effects are not simply attributable to sociodemographic differences at school or area-level.

This discrepancy is likely in part a consequence of the UK's multi-level governance approach to transport policy, with local governments holding considerable power over key domains (Marsden and Rye, 2010). In London, this tendency intersects with what has been

³¹ Calculated from estimates on eligibility in Hopkinson *et al.* (2021).

³² While it is possible to identify the road classification of the main entrance of most primary schools, any measure of suitability would need to consider how many other school entrances there are, if they are located on minor roads and the variation in traffic levels even within school roads that are classified as 'A', 'B' or 'local or minor'.

called ‘ungovernability’ of global city-regions – the process whereby fragmented local policy dynamics thwart regional efforts to develop metropolitan areas as a whole (O’Brien, Pike and Tomaney, 2019). As compared with other global cities, London local regional governments have significant power over certain policy areas with different local priorities often dictating city-wide spatial patterns of provision. Policy efforts could therefore be directed not only towards achieving a more equitable distribution of School Streets within each district, but also towards addressing issues in local government capabilities and resources that might mitigate these between-district discrepancies. Providing funding for specific schools identified as in-need within non-participating districts may help. City-wide efforts to improve air quality such as London’s recently expanded Ultra Low Emissions Zone will also go some way to help air quality issues at many schools in districts currently under-served by School Street policies.

6.6. Conclusion

By the minimum standards approach to equity used in this chapter, School Streets appear to be equitably distributed *only* in terms of the deprivation of London’s school population as well as for some ethnic groups. Some areas in London have significantly more extensive School Street schemes than others and School Streets are under-represented at schools with the highest levels of air pollution from motor vehicles in London.

This finding demonstrates the importance of considering the wider environmental context into an analysis of equity. Who is doing the travelling also matters in studies of transport infrastructure equity. For interventions that support the mobility of children, air pollution is a key dimension of equity, as children are more exposed to air pollution at an area level, and it is more damaging to their health. Existing research has reported the inequity of children’s’ exposure to air pollution and road danger. Less, however, is known about the (in)equity of measures to ameliorate these effects. This chapter contributes to this growing research, focusing on a novel and promising urban intervention and extending a conception of equity beyond a focus on socio-demographic indicators.

These findings should be of interest to policymakers introducing active travel infrastructure at schools or assessing the outcomes of Covid-19 road space reallocation schemes. This chapter proposes that more flexible typologies of School Street-style interventions suitable for busier roads may be needed to better serve a wider range of

schools, and to alleviate some of the air-quality based inequity found here. Furthermore, research and policy development may help to better understand and address the under-participation found in several of London's districts and improve equality across London's administrative geography.

Measures like School Streets have the potential to address the wider inequities in transport systems that undervalue the mobility of children and mobilities of care. However, as interventions in urban space they too must be distributed equitably. This research finds promising signs but by some measures there is work still to be done. Further research on the topic should seek to measure the benefits of London's School Streets. The equity of this policy could then be assessed not only in terms of the distribution of investment but also in terms of its actual outcome.

Theories of behaviour (change) in School Street implementation

7.1. Introduction

Opening the second major theme of this dissertation, this chapter looks more closely at the relationship between School Streets and behavioural change. As outlined in Chapter 3, School Streets are schemes with multiple purported benefits many of which are derived from the simple removal of cars from the street. However, their potential impacts on decarbonising the school trip, significantly increasing physical activity, or ameliorating the effects of congestion on the wider area rely on the School Street to also instigate behavioural change away from private motor vehicles (PMV) and towards active school travel (AST). The mechanisms for the direct benefits of the closure are more intuitive (see Figure 7), the removal of the cars directly reduces both danger to pedestrians and air pollution and creates allowances for other uses of the space. However, how the School Street actually achieves modal shift from PMV to AST is much less immediately obvious, and there is no published guide setting out a proposed logic-map for how this might be achieved. Given the centrality of behavioural change to achieving key aims of a School Street, particularly around tackling the health impacts of sedentary lifestyles, two key research gaps remain. First, what is the mechanism for behavioural change, a question considered here, and second, are School Streets actually succeeding in achieving modal shift from PMV to AST – a question examined in the next chapter.

Within the existing literature, there are two potential ways to approach these issues. First, one could look to the literature on the determinants of AST and studies of past interventions to understand in greater detail which of these known factors a street closure might also intervene in – something considered in more detail in the next chapter. The second approach is to consider theories of behaviour and of behavioural change to understand how a School Street might intercede in the transport behaviours of parents/carers and children. This is the goal of this chapter. Many of the dominant models of human behaviour are derived from social psychology, with a parallel effort on the part of health psychology and public health to operationalise these concepts in the design of treatments or interventions with the general aim of modifying people's behaviour. These principles are especially common in the literature around health behaviours such as tobacco use or diet, but, as transport behaviour is increasingly framed as a co-determinant of rates of physical activity, it too has been

interpreted within this framework. Given the prevalence of the public health logic in active travel policy (Bloyce and White, 2018), this literature bears further consideration in the study of School Streets.



Figure 30 – A sign designed by primary school children outlining the benefits of School Streets - including the uptake of active modes of travel. Source: Transport for London

However, as we will see in more detail, the use of social psychological theories to understand travel (and indeed health) behaviour is by no means straightforward. With critiques from sociologists and geographers highlighting the way in which the dominance of these models in certain policy areas – related in part to the increasing number of life-domains understood through the framing of health (Crawford, 1980) – has led to a narrow conception of ‘intervention’. Critics contend that this has supported the primacy of what I will refer to as the ‘choice promotion’ paradigm of policies. In general terms these are policies or interventions which target individual choice through persuasion, education, and information. In the area of AST policies these are represented by, amongst others, school travel planning (STP), bikeability training, and curriculum initiatives like Walk to School Week.

The prevalence of these choice promotion initiatives, which together have come to be termed ‘behaviour change’ in the parlance of UK transport planning, have come under wider criticism (Bonsall, 2009; Spotswood *et al.*, 2015). This has focused both on the efficacy of such processes in achieving long-term and widespread change, and on their emphasis on individual responsibility and choice without due consideration to the multiple environmental and social contexts within which such behaviours are conducted. This individualism has further been connected to wider neoliberal tendencies in policymaking and governance. These criticisms of the choice promotion paradigm and its behavioural science foundations have also come from *within* public health, with an increasing emphasis on the ‘wider determinants of health’ and social-ecological models of health as well as a greater plurality of theoretical backgrounds included in new frameworks for health intervention design.

These debates provide an essential context for understanding the role of School Streets in changing travel behaviour. The rise of small-scale street-based interventions to alter travel behaviour could be read as a partial departure from the choice promotion paradigm, emphasising the quality of the environment over the provision of education, information, or persuasion. Although these recent changes coincide with wider shifts in the scientific thinking around public health intervention design away from choice promotion and towards more socially and environmentally embedded understandings of health, it remains unclear what theoretical grounding, if any, is being applied to the design and promotion of School Streets. A small but growing literature has explored the use of behaviour change theory within local government, finding inconsistent uses of theory amongst practitioners. However, to date, this work has not explored the specific issues facing the application of theory to interventions easily comparable to School Streets. To this end, this chapter sets out to answer two questions:

1. How are School Streets understood by practitioners to lead to a change in transportation mode choice?
2. Do practitioners use formal models of behaviour (change) in this understanding, and if so, which models are they and how are these models applied?

These questions are answered through interviews conducted in the summer of 2020. Although very few formal models of behaviour were detected, the analysis identified several more informal models of behaviour change that were in use by practitioners. There were also several important themes concerning the way these tacit theories of change informed the design and implementation of School Streets, with wider relevance to changes in

transportation policy in the UK. In all, this chapter finds a heterogeneous understanding of why a School Street might instigate changes in travel behaviour. From a public health perspective transport mode shift in these and similar approaches is under-theorised, but more informal practices of theory-making are prevalent. This distinction might reflect a gap between theory and the practice of actively amending urban environments. This chapter begins with an extensive review of the debates surrounding behavioural change in transport and public health policy, then presents the study design, the research findings, and closes by placing these results in the context of current discussions around theory use and public health intervention design.

7.2. Literature Review

As with many active travel interventions (Bloyce and White, 2018), School Streets are interpreted as both public health and transportation interventions. Although primarily designed and implemented by transport planners and highways engineers, the potential benefits of improved air quality, road safety, and increased physical activity also give them a strong public health rationale, something that is often cited by policymakers and politicians. Transport, but especially public health, has relied on a number of different theoretical frameworks – often from adjacent disciplines – to understand the causes of and possible ways to change certain behaviours. Supporting this chapter’s aim of better understanding how local authority practitioners understand School Streets to impact travel behaviour, the purpose of this review is to explore key debates surrounding the use of behavioural change theory in the domains of transport and health, and how such theory has been applied to policy and intervention development in the UK. This review will cover four key topics. First, meta-studies of the generic use of theory in public health and its impacts on intervention efficacy. Second, the key debates around the dominant theories in use, with a particular focus on the theoretical background to choice promotion interventions and their dominant critiques from proponents of social-ecological models and practice theory approaches, considering their implications for school travel policy. Third, more recent influential developments in intervention-focused frameworks and theories like the COM-B model and Nudge theory are considered. Finally, the review considers the limited existing research on the way theory has been used in policy practice at different levels of government, to which this chapter

contributes. The relevance of these debates to emerging street-based interventions is also considered throughout.

7.2.1. Health promotion and the role of theory in interventions

In addition to common topics like smoking cessation and diet, research on 'health promotion' has also increasingly focused on the use of active modes of travel to increase physical activity. A key preoccupation of the discourse within health promotion research has been with the application of theory to the study of health behaviour and the design of interventions. Here theory is generally understood as the concepts that describe or define the causal mechanisms for a given behaviour (Abraham and Michie, 2008; Glanz and Bishop, 2010), with Davis et al. adding that it should also encompass "the a priori assumptions about what human behaviour is, and what the influences on it are" (2015, p. 324), although this latter element is not always acknowledged in the wider literature.

A number of systematic reviews and meta-analyses of health promotion research have sought to collate and taxonomise models of behaviour and behaviour change as well as their implementation in the design of interventions (Abraham and Michie, 2008; Michie *et al.*, 2008; Glanz and Bishop, 2010; Davis *et al.*, 2015). This literature is important to consider here. Several studies have looked at the role of theory use in the efficacy of interventions with some reviews finding strong positive relationships between theory use and intervention efficacy, others less so. For example, although Glanz and Bishop's review of systematic reviews finds a positive relationship (2010), Davis et al's more recent research includes several studies that have found no effect or even a negative relationship between theory and efficacy. They point out that even if a theory is specified, not all interventions are necessarily adequately designed around those principles. Based on this inconsistency Abraham and Michie draw a distinction between interventions 'inspired' by a theory, and interventions 'driven' by a specific theoretical framework where its constructs are well-specified and central to the design of the intervention (Abraham and Michie, 2008). Thus, the consensus in this health promotion literature is that although theory is important to the efficacy of interventions, care must be taken in its application. This point has largely been internalised in public health policy with the UK's Medical Research Council providing clear guidelines for theory development in its resources for the design of any complex public health intervention (Craig *et al.*, 2019).

In spite of this, theory use in intervention designs more closely related to School Streets remains somewhat patchy. Investigating both the extent of theory use and its quality,

Prestwich et al. (2014) found that only half of physical activity and dietary interventions reviewed reported a theoretical basis, and only 10 percent clearly linked the behavioural change technique to specific constructs of the theory. The two main systematic reviews of interventions to promote Active School Travel (ATS) have found low levels of theory use in their design and implementation (Chillon *et al.*, 2011; Pang, Kubacki and Rundle-Thiele, 2017). Therefore, when, as is often the case, School Streets are viewed from the perspective of health promotion, an important question arises around not only which theory is being employed and if it is being employed effectively, but also whether theory is in use at all. It follows from this work that use of generic theory may influence the efficacy of School Streets in achieving behavioural change.

However, reflecting on Davis et al.'s insistence that theory must also posit an understanding of what behaviour is and what might influence it, the use of theory should not just be read as the dispassionate or technical application of concepts to interventions, but also an understanding that with theory also comes a specific worldview in which the assumptions of disciplinary traditions are likely embedded. This implies also that *which* theories are in use are also of the utmost importance.

7.2.2. The theoretical basis for choice promotion and its critique

A wide range of different theories have been used to develop health promotion interventions (Abraham and Michie, 2008). Typically, these have originated in social psychology (Davis *et al.*, 2015) with theories like the Theory of Planned Behaviour (TPB) (Ajzen, 1985) and the Health Belief Model (Rosenstock, 1977) particularly common among many other. Although there is a great deal of diversity within these social psychological theories, there is a tendency to view behaviour as at least partially the outcome of premeditated thought and the attitudes individuals hold. Not dissimilarly to theories in classical economics this orientation emphasises the role of conscious deliberation in human behaviour. These approaches have had a significant influence on wider transportation policy in the UK (Marsden *et al.*, 2014), something that is palpable in documents like the Department for Transport's *Behavioural Insights Toolkit* (Savage *et al.*, 2011) and *Smarter Choices* report (Spotswood *et al.*, 2015) which highlight theories like the TPB. In practical terms transport policies derived from these theories have tended to have favoured the choice promotion paradigm. If a theory assumes that people change their behaviour on the basis of increased motivation or modified attitudes,

then interventions will understandably tend to be designed around promoting a desired behaviour, as opposed to significant physical changes to their environment, for example.

This orientation is also prevalent in interventions focused on school travel. Pang et al.'s recent international review of interventions to encourage AST found these kinds of behaviourally-orientated 'preparation and promotion' methods to be much more numerous than more interventionist 'policy and physical projects' that introduce restrictions or actively alter the environment (Pang, Kubacki and Rundle-Thiele, 2017).

This approach is not without criticism, both in terms of the effectiveness of resultant interventions and the wider political implications of a focus on deliberative individual action. Although some degree of efficacy is often observed in interventions based on these theories³³, Shove (2010) along with others (Bonsall, 2009; Pooley et al., 2011; Spotswood et al., 2015) have questioned whether this is commensurate with the scale of change required to tackle complex and pressing problems. This criticism questions the extent to which individual decisions are meaningfully related to values and attitudes, highlighting research on value-action gaps; or the tendency for people to express certain values or intentions that contradict their actual actions (Blake, 1999; Southerton, 2013), often defaulting to habitual behaviours despite stated attitudes to the contrary. Mode-choice – particularly for routine travel (like the trip to school) – is one such area where habit is a prevalent driver of behaviour (Verplanken *et al.*, 1998, 2008; Bamberg, Rölle and Weber, 2003; Bamberg and Schmidt, 2010), implying that choice promotion interventions designed primarily around deliberative theories may be ineffective in providing deep and lasting changes to regular mode of travel.

Further critiques of the theoretical basis for choice promotion have also been made from the tradition within public health that emphasises its 'wider determinants' (Dahlgren and Whitehead, 1991, 2021). Taking cues from the World Health Organisation's Ottawa Charter, which recognises that "political, economic, social, cultural, environmental, behavioural and biological factors can all favour health or be harmful to it" (World Health Organisation, 1986), this approach is best represented by social-ecological theories of health behaviour (McLeroy *et al.*, 1988). The basis for social-ecological theory is born out of the observation that health outcomes are correlated with several socio-economic and environmental factors. Here, rather than individual choice or one's attitudes, health

³³ See for example discussions around the TTSI in the Chapter 2 and Chapter 8.

behaviours are influenced by an individual's immediate social surroundings (family, close acquaintances), institutional engagements (work, school), wider community (neighbourhood unit or wider social net), as well as the socio-political or policy context (McLeroy *et al.*, 1988). This approach emphasises the importance of context and provides a theoretical basis for the influence of the physical environment on health behaviour. In a social-ecological understanding of health, interventions that aim to improve public space like a School Street become a plausible policy for influencing behaviour.

However, theories of the wider determinants of health have themselves received critiques, particularly from proponents of Practice Theory. Cohn (2014)³⁴, argues that focusing purely on structuring factors also reproduces a simplified conception of health where behaviour is isolatable and linearly related to a number of identifiable and measurable determinants. Blue and colleagues (2016) add that operationalising which aspects of context are actually doing the influencing in such models is often very difficult. These authors instead suggest rejecting the centrality of behaviour in theoretical understandings of health (or indeed transport), and instead advocate for social *practices* as the object of theoretical elaboration. In simple terms practices are the socially established and recurring activities built up through tacit knowledge from past experiences and the interaction with other practices, institutions, and social structures (Shove, Pantzar and Watson, 2012). Drawing both action and context into relation, practice theory highlights the way in which debates around behavioural change relate to a central problematic in the social sciences on the relative role of agency and structure. A number of studies have explored the use of practice theory in relation to transport (Southerton, 2013; Marsden *et al.*, 2014; Spotswood *et al.*, 2015; Kent, 2022), and specifically transport to school (Smeds, 2019; Egan and Hackett, 2022), often providing important insight into the entrenched nature of practices of automobility through the enmeshment of technology (vehicles), meanings, and the learnt techniques for navigating both the city and logistical constraints of one's life.

With School Streets often attributed the goal of changing travel behaviour, they enter a lively debate around the centrality of behaviour as a locus of change in a given intervention. The central lesson of these debates is that although theory use is clearly important in

³⁴ Who also provides a very helpful history of the concept of 'health behaviour' and its grounding in rational action theories.

intervention design, theories themselves are not value-neutral. Certain disciplinary assumptions around the nature of 'behaviour' (or even its importance as a category) can impact the kind of interventions and policies which are designed with implications for their efficacy in changing what are often complicated and socially embedded patterns of action.

The prevalence of the choice promotion paradigm should be read as originating from a contested worldview which centres individual deliberation as the locus of social change. However, approaches like practice theory, and to a lesser extent the social-ecological model, have more ambiguous implications for intervention design than their social-psychological counterparts. Highlighting the importance of social contexts expands the scope of necessary measures beyond what is often possible or preferable to policymakers, which suggests why these have been historically less actively pursued in intervention design. As a departure from choice promotion, but on a relatively small scale, street-based measures like School Streets sit somewhat ambiguously here, with no obvious theoretical basis within this debate. Recently, however, attempts have been made to circumvent these central theoretical debates by folding psychologically grounded theories into more pluralistic and pragmatic frameworks for designing interventions, potentially providing a more obvious theoretical basis for School Streets.

7.2.3. Theories of change and the co-production of theory and policy

Another key thread in understanding the theoretical basis for behavioural change stems from more recent attempts to develop pragmatic frameworks for intervention design. Perhaps the best known of these is Nudge (Thaler and Sunstein, 2008), which also presents a critique of rational action models, but from the perspective of behavioural economics instead of sociology. This highly mediated theory has ascended to rare heights of public consciousness and has had a significant influence on public policy in the United States and UK since the early 2010s. Another, much less well known but increasingly influential approach can be broadly characterised as 'theory systematisation' and encompasses models like COM-B (Michie, Atkins and West, 2014), Theoretical Domains Framework (TDF) (Atkins *et al.*, 2017), and the most recent 'behaviour change intervention ontology' (Michie *et al.*, 2020). These are united by an attempt to systematise the wide range of theories available across several disciplines, the different behavioural constructs they are known to target, and the interventions that they can be used in, with the aim of creating a framework for evidence-based intervention. Although coming to quite different conclusions, these two models share a pragmatic focus on

the role of theory in intervention design and are thus relevant to understanding how theory is operationalised in policy.

7.2.3.1. *Theory systematisation*

The aim of recent theory systematisation frameworks has been to attend to the problems of appropriately matching theories and interventions (Davis *et al.*, 2015) and is primarily targeted at public health practitioners. Among these COM-B, is the best known. Developed from a systematic analysis of a wide range of theories – crucially not just from social psychology, (Michie, van Stralen and West, 2011; Michie, Atkins and West, 2014) it has also been integrated into a framework for intervention design called the Behaviour Change Wheel (Michail *et al.*, 2021) which suggests different intervention types that are likely to influence the specific domains of capability, opportunity, and motivation which are theorised to influence behaviour. Although many choice promotion interventions feature here, the list of potential interventions also includes environmental changes (which would likely cover the introduction of a School Street or similar), as well as the provision of new services, regulation, fiscal measures, and crucially environmental/social planning – giving it much greater scope beyond the choice promotion paradigm of interventions.

Perhaps because of this greater scope, recent research that has used this model has had much more to say about street-level interventions than the previous models discussed, highlighting ‘built environment restructuring’ as a potential behaviour change measure (Wilkie *et al.*, 2018). Recent work has also assessed the response to School Streets and LTNs in London from online consultations and interviews with COM-B. This found opportunities and motivation to be affected both positively and negatively by the schemes, facilitating behaviour change in some, and limiting it in others – implying possible ways these schemes could be amended to include a wider subset of the local population in desired behavioural changes (Lunetto *et al.*, 2023). Working with school children in Newcastle, Michail *et al.* used a similar approach to understand which domains of COM-B future interventions should target based on their experiences and preferences on their trip to school. Key focuses again include improving the environment on the route to school. These studies represent a small but growing literature using this framework to link individual behavioural determinants with interventions in the urban environment, and are perhaps the closest the existing literature comes to positing a theory of change for School Streets and associated interventions.

However, the implication for designing schemes is remains ambiguous. The most prominent critique of theory systematisation, and COM-B specifically is that it removes elements of intuition and creativity from the process of intervention design, diminishing the importance of responding to case-specificity and making this a more dispassionate and technical process (Ogden, 2016). Although this critique from Ogden draws from the perspective of a health practitioner, it has relevance to the context of designing interventions that intend to improve urban space. They describe an inevitable ‘gap’ between individual patient variability and the inherently abstracted nature of theoretical frameworks, with the practitioner ideally filling this with their expert knowledge and judgement. An equivalent characterisation might relate to the specificity of a given urban environment, and the need to adapt interventions to accommodate the different access needs, existing traffic flows, surrounding road networks among others when designing something like a School Street. This reflects one of several tensions that arise from the framing of active travel infrastructure as ‘health’ promotion.

Although COM-B advocates a pluralism of measures and theoretical backgrounds, opening the door for physical infrastructure or environmental improvements to be implemented as a health measure, it potentially minimises the practical difficulties of designing such measures to a high standard. This framework is certainly applicable to interventions which, like a School Street, seek to modify the environment, and though COM-B model is influencing central government policymaking for active travel in the UK (Arden *et al.*, 2022) it is unclear the extent to which these frameworks are dominant in the practice of intervention development and design on the local governmental level³⁵.

7.2.3.2. *Nudge*

Nudge theory on the other hand (Thaler and Sunstein, 2008) advocates a much more specific kind of intervention. Drawing from behavioural economics, Nudge starts from a critique the rational action models of behaviour favoured by classical economics, pointing out that people often make decisions which are irrational. Diverging from theories emphasising conscious

³⁵ One known example is Hertfordshire County Council which has established its own behaviour change unit with COM-B as its basis (Hertfordshire Behaviour Change Unit, 2020). However, this does not appear to be a widespread approach.

deliberation, several common cognitive biases and heuristics are identified as the primary drivers of individual decision making. The solutions suggested, however, are distinctly narrower than that in COM-B; instead, Thaler and Sunstein promote non-regulatory 'prompted choice' solutions to change behaviour (House of Lords Select Committee Report on Behaviour Change, 2010, p. 12). These micro-changes seek to rearrange the 'choice architecture' of a given situation; the aim being to influence decision-making but without penalising or mandating certain choices, instead using suggestions or prompts based on known cognitive biases such as the urge to conform to social norms (Riggs, 2017). The ambition of these 'nudges' is summarised best by the authors themselves when they clarify that "putting the fruit at eye level counts as a nudge. Banning junk food does not" (Thaler and Sunstein, 2008).

Numerous accounts have described the rising influence of the Nudge approach within UK and US governments in the early 2010s, including the establishment of the cross-departmental Behavioural Insights Team under the Cameron administration in the UK (Halpern, 2015). As of 2013 the evidence base for the effectiveness of this approach at the level of population health was deemed shaky (Hollands *et al.*, 2013), and the concept itself has received several high-profile critiques (Standing, 2011). Coining the term 'neoliberalism' critical geographers have also connected its advocacy of targeted, low-cost, behavioural interventions to the context of state withdrawal and neoliberal governmentality (Jones, Pykett and Whitehead, 2011, 2013). Although Thaler and Sunstein distinguish their approach from both neoliberalism and 'statist' intervention – instead characterising it as a new third-way (Leggett, 2014) – the same charges which practice theorists have levelled against choice promotion paradigms remain relevant here. Namely that interventions which reify individual choice as the locus of social change inevitably favour piecemeal interventions amenable to a neoliberal emphasis on personal responsibility.

Although one can assume that banning cars from the street outside a school is too punitive to count as a nudge in its conventional sense, the emphasis on small-scale targeted interventions also resonates with the scale of change proposed by a School Street vis a vis its purported benefits.

7.2.4. School Streets and Behaviour Change

In 2010 the House of Lords Select Committee Report on Behaviour Change warned that a perceived preference for non-regulatory approaches had led to an overly narrow conception of behaviour change within government – limiting it to low-cost, low-intervention approaches. Thus while approaches like COM-B or indeed Practice Theory provide strong rationales for policy approaches beyond the choice promotion or Nudge paradigms, they have historically had to contend with governmental contexts hostile to regulation and investment. The contention of critical scholars is that prevalence of Nudge and choice promotion in UK policy making is in part a result of its amenability to a neoliberal model of governance as opposed its efficacy vis other approaches. Similar critiques have been made in health policy.

There have, however, been efforts to introduce more varied sources of theory in government. For example, the Department for Transport's *Behavioural Insights Toolkit* (Savage *et al.*, 2011), has somewhat incongruously listed social practice theory alongside Nudge and the Theory of Planned Behaviour among its suggested methods. This same principle arguably underpins the principle of theory systematisation in COM-B. However, given the enduring criticism of choice promotion approaches in UK transport policy, it appears diversity of thought has not necessarily led to diversity of practice. This particular point is supported by Marsden and colleagues' (2014) research on behavioural change in national and regional-level transportation policy. This research, which took a similar methodological approach to the one adopted by this chapter, explored the operationalisation of such ABC or choice promotion approaches through interviews with policymakers. They found that many participants were indeed sceptical towards non-regulatory 'behaviour change' measures despite also overseeing their widespread adoption. This was in part because more radical measures were seen to lie in opposition to stated goals of economic growth.

Mills and colleagues (2023) have examined the use of behaviour change theory in personal finance initiatives in a UK local authority, finding only vague references to known frameworks and an over-reliance on educational approaches in the resulting interventions. To date similar research has not yet been applied to transport policy. Given the importance placed on theory by public health scholars, a key gap in the existing literature on the relationship between theory and policy pertains to its use in street-based active travel interventions like School Streets. The quasi-infrastructure, quasi-regulatory orientation of a School Street, which represents at least a partial departure from choice promotion paradigm,

does not suggest an obvious theoretical framework. Although the wider determinants of health and theory systematisation provide potential models within which School Streets could be interpretable as behavioural change interventions, it is unclear how widespread these approaches are at the level of local government. Understanding the current use of theory in this area, or lack thereof, is an important first step in understanding the mechanisms of change in these increasingly prevalent interventions, but also represents a contribution to the ongoing debates outlined here. This is something examined in closer detail by the research here.

7.3. Study Design and Methods

The data for this chapter was collected as part of a qualitative research project conducted during the early stage of the Covid-19 pandemic in the spring and summer of 2020. During this period many School Streets projects were being implemented either for the initial reopening of schools following the first lockdown or, in most cases, were being planned for the start of the next school year in September. Chapter 5 gives more context to the way that School Streets were scaled rapidly as part of the pandemic response and draws on the same data. This context presented a unique opportunity to speak to several practitioners as they were working in a new context. A range of practitioners who were or had been involved in School Streets in some capacity were recruited and interviewed for the project. This section will outline this research process in more detail. Taking a roughly sequential approach, the preparation, interview, and analysis phases will be set out with a brief discussion of the epistemological orientation, and how this is integrated into the method of interview and analysis.

7.3.1. Developing a topic guide and question list

This project began with a review of models of behaviour and behaviour change that practitioners might rely on in their understanding of how a School Street prompts change; this informed the section of this research on theory use. Eight models were selected to be part of this concept guide and were researched in advance of interviews so they could be easily identified during the analysis stage. These were selected on the basis that they had either consistently arisen during the review of the debates covered in the previous section or had been referenced explicitly in relation to transport behaviour change elsewhere in the literature. This was not a systematic review, rather the intention was to create a more

subjective list that included paradigmatic models, as well as ones with growing relevance in UK policy conversations and a general applicability to transport. As these theories were identified, a description of each theory was developed including plain-language versions of how it might be described during an interview (See Appendix H - Table 36). During the selection there was also an attempt to ensure that theories from a variety of disciplinary or theoretical backgrounds were represented, these included specific models that make up the wider approaches outlined in the literature review.

An early hypothesis was that several of these models might be somewhat less well known in the practitioner context. To address this, four informal behaviour change approaches were developed. These summarised dominant approaches in less technical terms, in some cases combining similar models into a dominant approach such as 'attitudes-based change'. The aim of this exercise was, along with the formal theories, to create a guide to help recognise models and informal theory-making during the interviews and the initial phases of analysis. The framework of both formal and informal theories of change created prior to the research is outlined in Appendix H - Table 37. The list of interview questions was also developed (Appendix G, Section 10.7) in advance. These focused on three primary topics. First, explicit questions about the rationale for a School Street and any theory of change the interviewee used were asked. This was followed by a set of supplementary questions which focused on both how the design of a School Street was developed and the process of implementation. These latter questions were partially in service of research questions relating to the policy process theme (See Chapter 5), but also with the aim of gaining insight into how theoretical frameworks might be operationalised in the design or engagement processes of a scheme.

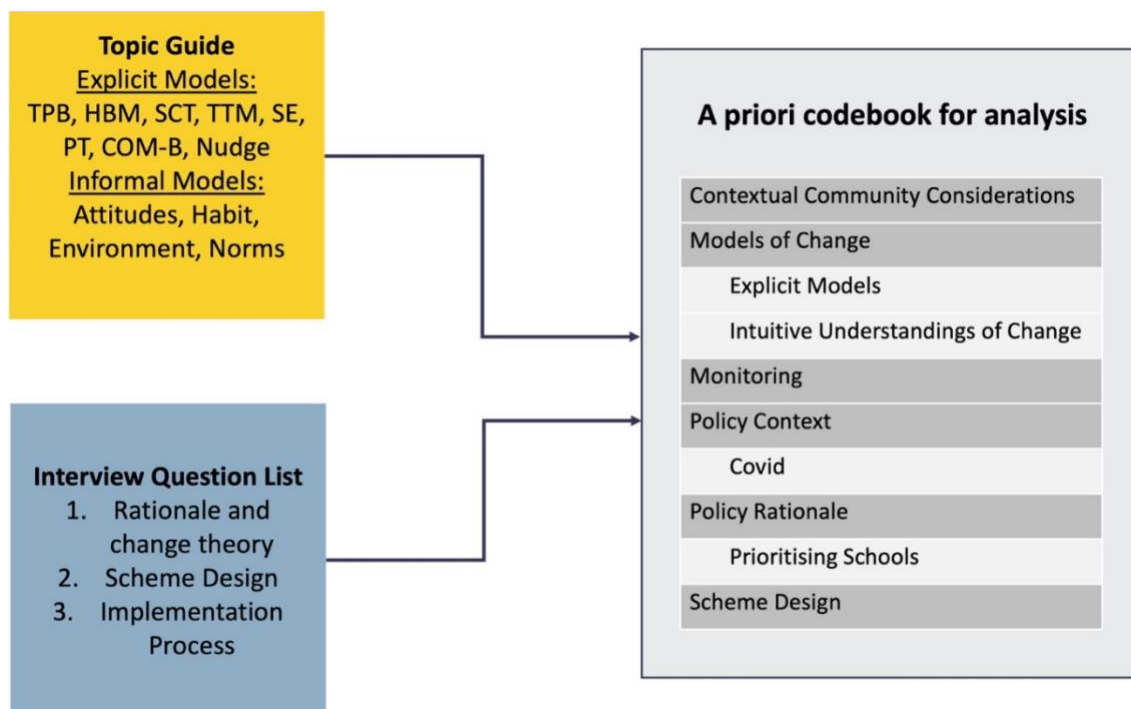


Figure 31 – Summary of the role of the topic guide and question list in the research preparation process.

7.3.2. Conducting interviews

The 18 interviewees were recruited through several ad hoc methods. The starting point was a list of London boroughs that had already implemented School Street measures to identify potential target participants. Personal networks as well as contacts in the funding organisation were used to approach relevant officers in several of those boroughs. The same networks were used to contact practitioners in a handful of third sector organisations. These initial introductions also ‘snowballed’ (Noy, 2008) into additional contacts, with prior interviewees suggesting other relevant practitioners. In terms of sampling there was an intention to balance the data in favour of local government officers who were more directly involved in the development and practical implementation of School Streets. Other contributors from third sector organisations rounded out the sample and provided a higher-level view of the development of School Streets policies across different contexts. The general profile of interviewees can be defined as professionals involved in the implementation, design, or promotion of School Streets measures. Most interviewees had been aware of and involved in the implementation of School Streets prior to their rapid expansion during Covid-19. See Table 3 for a breakdown of the balance of interviewees by type of organisation.

Table 15 – Interviewees segmented by sector of employer

Organisation Type

London Borough Authorities	10
Of which Inner London	6
Of which Outer London	4
Transport Authority	1
Third Sector/Charities	5
Independent Experts	2
Total	18

Participants were interviewed concurrently with the recruitment process and in all cases interviews were conducted remotely due to the Covid-19 restrictions. This was mostly by video conferencing and in some cases over the phone. The average interview length was 44 minutes. The interviews themselves were semi-structured, with a ‘script’ of questions produced for each interviewee prior to the interview. These scripts were edited from a standard set and adjusted for relevance to the individual expertise of the interviewee (while maintaining the primary research questions). During the interviews, the script was used primarily as an initial starting place, and invariably conversations went in different directions with interviewees sometimes addressing the questions without specific prompting. Often the script was used as reminder to cover the primary research questions in each interview – especially around the mechanism for change or use of theory in policy. Using this semi-structured interview technique facilitated greater flexibility which allowed participants to make potentially revealing lateral connections between the core topics which might have been hindered by a more prescriptive set of prompts.

Once the interviews were complete, the recordings were transcribed using an online automatic transcription software and manually checked for errors. All recordings and transcripts were pseudonymised and uploaded into a project file on the Nvivo software package for final analysis.

7.3.3. Analysing data with Template Analysis

This process of review and codification prior to the development of the interview questions represents a semi-systematic approach to qualitative research in that a priori assumptions were explicitly outlined before the commencement of the interviews. This diverges from some methods of thematic analysis which prioritise a purely inductive approach with minimal assumptions made prior to the analysis of interview data. However, this method also differs from more positivistic qualitative methodologies that approach the collection and analysis of data in a highly structured way. The epistemological approach for this interview project could

be described as favouring a 'contextual constructivist' position (Madill, Jordan and Shirley, 2000) in that theory – or at least an a priori conceptual framework – is clearly implemented, but the collection and analysis of data is an iterative approach to amend and adjust this conceptual framework rather than an exercise in formally testing its veracity.

The underpinning of this epistemological position is an assertion that knowledge about the world is to an extent constructed through the operation of investigation, and it is contextual in that it arises from the specificity of the interaction between the researcher and the object of study. Although positivist notions of objectivity are generally rejected in this formulation, the use of clear methodological parameters and an a priori framework provides an element of repeatability. This semi-systematic approach is perhaps more evocative of Stiles' notion of 'permeability' which they argue should replace notions of objectivity in qualitative research. Here permeability means the "capacity of theories or interpretations or understandings to be changed by encounters with observations" ((Stiles, 1993): 602 quoted in (Madill, Jordan and Shirley, 2000, p. 9) – echoing the approach taken here which sits in between 'testing' the veracity of theories and inductively developing themes. This is a helpful perspective when researching something like theory use. Theories exist as a (relatively) stable set of concepts prior to research but the way they are understood or used is still unknown and requires inductive thematic development.

Unlike with some more radically constructivist approaches to qualitative research (Grounded Theory for example), there is not a specific methodology or analytical technique that necessitates or is necessitated by the adoption of a contextual constructivist epistemology. Nevertheless, a method of thematic interview analysis that resonates well with these principles is template analysis (King, 2012; Brooks and King, 2014; Brooks *et al.*, 2015). Template analysis is a technique developed in qualitative psychology and is a process for analysing interview data whereby an initial set of codes is established in advance and tested first on a subset of the data. After this point amendments are made to the code book based on the themes that the researcher develops from this initial subset. In this case a threshold of two independent references by different interviewees was used as the baseline for the inclusion of a new theme. The new code book is then tested on another subset of data and amended again if new themes or arrangements of themes are developed. This process is repeated until the code book reaches a stable form. This final code book is then applied to the entirety of the dataset and used as the basis of the final analysis. Clusters of concepts are

then analysed and visualised, with connections within and between codes (integrative themes) established and explored. Template analysis is amenable to contextual constructivist epistemology due to its iterative approach to concept development and its ‘tentative’ (King, 2012) use of a priori conceptual frameworks.

Table 16 – The evolution of the code book through Template Analysis. Top level codes are left justified with a darker background, and their constitutive lower-level codes are indented below them.

A PRIORI	A PRIORI + INDUCTIVE 1	A PRIORI + INDUCTIVE 2
Round 1 (50% of sample)	Round 2 (50% of sample)	Round 3 (100% of sample)
Contextual Community Considerations	Achieving Mode Shift	Achieving Mode Shift
Models of Change	Designing a scheme for Modal Shift	Enforcement
Explicit Models	Enforcement	Engagement
Intuitive Understandings of Change	Engagement	Policy Approach
Monitoring	Intellectual Frameworks	The Built Environment
Policy Context	The Built Environment	Intellectual Frameworks
Covid	Policy Rationale	Policy Rationale
Policy Rationale	Our Policy Goals	This Is How We Chose Schools
Prioritising Schools	This Is How We Choose Schools	We Design It Like This Because...
Scheme Design	We Design It Like This Because...	

This methodology acknowledges the role of the researcher in constructing the thematic structure through their own subjective interaction with the topic of study. The advantage of this is that it makes explicit the assumptions underpinning the approach to the content and creates an audit of how these change throughout the process of interpretation and thematic development. Table 16 presents the codes for each stage of the analysis process, showing how this grouping evolved as more and more of the data was analysed. The first code book was developed prior to analysis and was very explicitly constructed from the concept guide and question list. The organisation of these ideas within the actual data became clearer through careful reading and repeated application of the codes. This iterative approach means

the final code book is a hybrid set of concepts, consisting of part a priori assumptions and part inductive development. Therefore, even prior to the identification of integrative themes and concept clusters, the organisation of the final code book is informative and provides the basis for the overarching findings of this project which were touched on in Chapter 5 and are explored further in more detail in the next section.

7.4. Results

As outlined in the previous section, the interviews did not just focus on models of behavioural change but also included questions concerning the implementation of School Streets, their development as policies within a local authority or organisation, as well as other lines of enquiry. Much of what was discussed during these other sections of the interviews was related to how a School Street might achieve its goals, including modal shift to active modes of travel. Although not strictly about behavioural models, the centrality of this topic in conversations reflected a more abstracted engagement with the question of how a School Street leads to change in behaviour, where the efficacy of individual schemes was considered alongside the efficacy of the concept of a School Street. This section considers the multiple levels on which practitioners conceived of behaviour change, both in terms of formal models and more tacit understandings of the mechanisms of change. Additionally, it covers the relevance of these schemes to parallel choice promotion interventions and the way schemes were designed to 'achieve mode shift'.

7.4.1. Formal models of behaviour change

Although no interviewees directly challenged the premise that behavioural change was an important element of a School Street, during the interviews it quickly became apparent that there was little active engagement with formal theories. Of those identified in the literature review and outlined in the concept guide (Table 36) only Nudge was explicitly mentioned. Three interviewees cited it during our conversations. A fourth practitioner mentioned the importance of life events³⁶. As it was not frequently cited in the broader literature on theories

³⁶ In the interview this was referred to as 'states of change', which is often used to refer to Prochaska and colleagues' Transtheoretical model of change approach (Prochaska, Norcross and DiClemente, 2010). However, of their actual description of the theory quite clearly related to the life events literature as opposed to the approach of Prochaska et al. As one of the most highly cited theories of behaviour change, the transtheoretical model of change was included in the topic guide.

of behaviour change it was not included in the initial concept guide, it is however mentioned in the more domain specific literature on transportation mode shift (Waerden, Timmermans and Borgers, 2003; Chatterjee, Sherwin and Jain, 2013). This theory proposes that people are most likely to change how they behave (particularly for habitual behaviours), when there is disruption to or a change to their life situation. This could be precipitated by starting a new job, moving house, or particularly in this case, when a child begins going to school. Although this is interesting to note, because it was mentioned by only one interviewee it did not meet the threshold for inclusion as a theme within the research.

Patricia³⁷, a local authority officer, lamented the overall lack of theory use in their intervention design, emphasising constraints on time:

“We probably don't put as much emphasis into background learnings and theories than we could. And I'd like to be having more of that. So that's kind of the first thing to say. I think that our council and from my interactions and experience with other councils, there isn't as much embedded theory. I think that that is something that is missing both in our council and in councils across London. And to my experience, across the UK as well. So that's something that's a bit disappointing; that there isn't that time made to be discussing what are the different theories and which theory are you working in”

This sense of not being able to embed theory extended even to those who explicitly cited Nudge. There was little clarity on how the term was being used in this context and how it might be applied. These references were off-hand, and there was no evidence of a systematic use of the theory in the design of interventions. Due to their firm restrictions and penalties, School Streets³⁷ are not faithful examples of Thaler and Sunstein's conception of a Nudge. The prevalence of Nudge above other, possibly more immediately relevant models in this context also supports the work of other researchers who have found Nudge to be very well known but poorly understood model in policy making contexts, and a shorthand for a certain genre of small-scale, targeted interventions (Marsden *et al.*, 2014; Gigerenzer, 2015) whether or not they accurately reflect Thaler and Sunstein's concept. All in all, discussion of explicit theories of behaviour and behaviour change formed a very small part of the interview data collected.

³⁷ All names are pseudonyms.

7.4.2. Tacit theories of behaviour change

During the creation of the topic guide (Table 36), several tacit models of behaviour were also developed. This was to capture other intellectual frameworks that might have been developed by interviewees to theorise a mechanism of change without necessarily relying on a specific named model derived from the academic research. The need for this kind of approach was confirmed during the analysis, where due to the lack of formal models, these tacit ideas formed the majority of the data concerning the intellectual engagement with behavioural change that interviewees emphasised. However, the tacit theories identified during the development of the concept guide did not always line up with the frameworks found during analysis. For example, 'improving the built environment' resonates with some of the narratives outlined by the policymakers I spoke to. However, during coding it became clear that not only was this about making the environment more appealing to those walking and cycling, but that it was also connected to making driving more difficult. The operation of a School Street was often articulated in terms of the intervention acting as either 'carrot' or 'stick'. Some emphasised the closure making driving less convenient as key determinant of change:

"But if we just make it like you can't do it, you can't drive through, you have to reverse and go all the way around, there's nowhere to park. It just becomes so inconvenient that people then choose to not do it." - Zaida

"There will hopefully be those that just switch entirely just saying, you know what this actually isn't worth it anymore. This isn't as convenient." - Terence

Susan felt that by creating a more pleasant space for active travel these modes would be encouraged.

"In order to get more children walking to school, you've got to make it more inviting, and a key thing about making it more of an attractive proposition is getting the cars out of the equation."

Although the School Street was not explicitly framed in these terms by any of these interviewees, the idea of improving the local environment could be interpreted as an aspect of a wider socio-ecological understanding of behaviour.

Other tacit/intuitive theories centred the importance of building positive transport habits for children. This was interesting as changing habits were included in the a priori outline of models, but in the concept guide this was assumed to be from the perspective of

entrenched parental behaviours as opposed to the habits of children. This represented a longer-term perspective and School Streets as a smaller part of a large package of policies (including the softer 'behaviour change' measures at school).

"Kids are forming adults. They're moving towards a state where they're more set in their ways. Basically, adults are carrying on driving because that's what they were doing when they were young adults. If you can get enough people for who walking and cycling being the norm, then they're likely to carry those behaviours through to adult life." - Winston

This sentiment was also repeated by several interviewees who emphasised the need to change the normative basis of travel for children, in some cases so that they would pressure their parents or carers to adopt more active modes of travel. There is some support for this in the existing literature, with studies examining the way parental affordances for and perceptions of different modes of travel are interrelated with the positive or negative preferences expressed by children towards active travel (Pont *et al.*, 2011; Curtis, Babb and Olaru, 2015). This focus on the social dynamics within families and their role in the development of children's travel habits resonates with understandings in practice theory of the way certain competencies are developed and become embedded as practices. However, again, this was not explicitly mentioned by participants and does not represent a systematic use of the theory.

In all, there was evidence of habitual, normative, and carrot/stick understandings of change expressed by interviewees. Although not extensively articulated, these frameworks do represent a conceptualisation of how a temporary recurring closure may contribute to behavioural change. They also touch on some debates covered within the literature concerning more formal theories. The framing of carrot/stick framework could be interpreted as relying on understandings of behaviour derived from classical economics, where the balance of costs and benefits are altered – traditionally through subsidy or taxation – with the expectation that this will be rationally interpreted by the user who will amend their behaviour accordingly. However, the nature of the incentives is different than carrot and stick. The disincentives derive from the added inconvenience of parking up and perhaps a small time penalty, while the benefits are associated with a change in the experience of walking down the street. These are not as easily quantifiable and, as mentioned, perhaps reflect an understanding closer to social ecological theories, or the wider determinants of health. They

are also interpretable within a COM-B framing which sees the physical environment as impacting the opportunities for a particular behaviour.

These different theories were occasionally connected, with individual interviewees citing more than one of these mechanisms. For example, changing norms were connected to the habit formation for children, with the idea that children did not have “preconceived notions” of how travel *should* be and thus were able to establish new normative understandings of desirable travel modes and thus habits. Overall, the tacit or intuitive conceptualisations of change were much more extensively elaborated than the more limited engagement with the formal models outlined prior to the interview process. Although they have clear resonances with more formal theories, the tacit models do not match exactly. Social ecological models for example might also emphasise the improvement of the environment but would traditionally also be accompanied by greater attention to socio-economic factors which were not commonly referenced by practitioners. These tacit frameworks are in part messy amalgamations, containing partial fragments from more formally elaborated theories, but often framed in pragmatic terms. These tacit or informal models of change that were developed inductively through the analysis process and are summarised in Table 17. This an updated version of the tacit theories of change identified prior to the research in the topic guide (Appendix H Table 36) as they have been developed through the template analysis process.

Table 17 – Tacit models of change described by interviewees

Inductive Informal Frameworks of Change	Description
Forming positive life-habits for children	School Streets create long-term change by creating new habits based on active travel
Carrot, stick, and carrot-stick	Change is created by either improving the conditions for active travel (by removing traffic), or by the decreased convenience of driving. For some it was the interaction between these two.
Altering norms around school travel	School Street serves as a signal to children and their parents that they should be prioritising active modes of travel. Active modes more visible and children may pressure their parents towards changing behaviour as they want to join in on walk/scoot/cycle.

Integration into other behavioural change measures

The closure augments 'softer' behaviour change measures like school travel planning, locking in change with an enduring and daily intervention.

7.4.3. School Streets as distinct from behaviour change

Table 17 includes a fourth mechanism for change not yet mentioned. This is on the integration of a School Street into what participants characterised as “behaviour change” measures, which generally referred exclusively to what I have called choice promotion policies here. These could include measures mentioned earlier like STP, participation in events like ‘Walk to School Week’, or bikeability training. In this formulation a School Street and its operation was seen by some participants as separate from efforts to promote “behaviour change” in a school even if the stated goal of the scheme was to affect modal shift away from PMV use. However, echoing the findings of past studies (Marsden *et al.*, 2014) several interviewees framed the choice promotion “behaviour change” efforts as poorly performing, and failing to achieve significant or long-lasting changes in mode of travel to school. This distinction was interpreted in both complementary and antagonistic ways. For some the School Street was a needed escalation of existing choice promotion efforts, characterising a School Street as a departure from and improvement on more traditional choice promotion “behaviour change” approaches, with Ana saying:

“I was at a meeting ... and there was a woman who worked on walk to school and cycle to school programs for 20 years and she said every program we've ever delivered, as soon as the walking to school week or the promotional activity is over, everyone goes back to driving to school just because it's easier. And that School Streets was the only thing that had actually delivered a sustained change in people's travel behaviour.”

However, rather than understanding School Streets as antagonistic to existing choice promotion policies, although maintaining a distinction, most saw the ‘harder’ restriction as complementary to the ‘softer’ in-school activities.

“...it came through quite strongly that behaviour change work isn't enough, that the perceived risk of danger to children on their school journey was enough of a barrier to stop parents letting them travel actively. So I suppose then we started to look at, okay, is it worth us just running behaviour change projects in schools. Or do we need to be bringing together our built environment and our behaviour change teams and look at how we put those together?” - Nicola

Although this kind of distinction was not made by all practitioners (five in total), these quotes imply an understanding of some of the critiques that have been brought against choice promotion/ “behaviour change” interventions outlined in the literature review. Here participants saw the alteration of the environment as necessary, either alongside or instead of choice promotion approaches which were understood to be the default approach to changing school travel behaviour. An interesting dynamic here is that even though changes in behaviour are understood to be a key outcome of a School Street, a semantic distinction is maintained between “behaviour change” as choice promotion and the School Street, even when interpreted as complementary. This could be because School Streets are viewed as a paradigm shift in AST policy rather than an iterative development of past approaches. Reflecting on possible connections to more formal theories, the perception that a change in environment is complementary to more psychologically informed choice-promotion activities gels with the perspective of COM-B and its nascent use in the study of the built environment and transport. Here modifying the environment affords opportunities, with other (likely choice promotion) activities potentially targeting capacities and motivation. Overall, this reflection on the relationship between choice promotion and a School Street was more common amongst non-profit and consultancy participants than local-authority officers, suggesting that differing points of view may have informed this assumption. This could be to do with the more strategic perspective many of these participants took as compared with the on-the-ground concerns expressed by local authority officers.

7.4.4. Achieving mode shift

The more pragmatic perspective of local authority officers highlights a final thematic development concerning behavioural change. During the thematic analysis it became clear that practical understandings of how a School Street ‘achieved mode shift’ were considered separately from the conceptualisation (either tacit or explicitly theoretical) of how a School Street might directly influence behaviour. This was because – contrary to the assumptions in the initial code book – questions around change in modes of travel often prompted responses that focused on the practicalities of successfully implementing an effective School Street as opposed to direct reference to theories or concepts of behavioural change. It often took more probing beyond the question list to prompt participants to consider the actual mechanism employed by the School Street to change behaviour. In general, it was taken as given that the School Street as a concept led to mode shift, and thus ensuring modal shift was a matter of

designing a 'good' scheme. Thus, for most interviewees the success of a School Street in realising its goal of behavioural change was contingent on more factors than simply the introduction of a closure, but also encompassed factors such as the engagement process and the design of the scheme. This emphasis on the practical over the theoretical was touched on in Chapter 5, particularly in relation to the role of engagement, but it is worth considering again here in the context of how the design of different schemes was related to behavioural change.

The practical factors that practitioners deemed critical to the success of a scheme, at least as it related to behaviour modification, was coded under the term 'achieving mode shift' (see Table 16). These could broadly be described as enabling factors through which School Street schemes could be optimised such that an assumed mechanism of behavioural change could take place. Within this code two major themes were discernible. First was the importance of best practice in scheme implementation and policy development (represented by the 'Policy Approach' and 'Engagement' sub-codes), which was considered in Chapter 5. The second was how the scheme was designed (represented by the 'Enforcement' and 'The Built Environment' sub-codes). All sub codes had significant levels of engagement across many of the interviewees with no single one dominant.

In this theme the design of School Street schemes was a consistent topic of discussion. Many of the design variables related to the role of a School Street as either carrot or stick. For example, some, like Karen, emphasised that larger closure areas were more advantageous as they meant that the School Street closure constituted a larger proportion of the trip to school, making driving even less convenient:

"The one we've recently launched is much bigger. We know that some families in that school are using the car for very short journeys and now with this zone that we have in place, for a few of them it probably won't be worth getting in the car because they still have to walk a fair distance and you might as well not bother. I think that's the only way it works. It doesn't work with the small School Street. So ideally it will be bigger."

Others saw an overly large closure area as potentially compromising the integrity of the closure as it was likely more exemption permits would need to be given, meaning that there would be more vehicle movements during the closure period. As Pierce outlines:

“One of the things that might be suggested is that sometimes the smaller the scheme, the better, the smaller the road closure, the fewer exemptions you have to provide to residents or people passing through, so the scheme could potentially be much more effective because you could almost end up with zero vehicles passing through if there are no houses within that closure.”

This was also reflected in debates around the kind of enforcement used. Methods like ANPR traffic cameras were popular amongst participants because they allow for exempt drivers to exit the closure without the need for active management by volunteers, while providing a significant enough penalty to deter transgressing drivers. However, less permeable methods like a modal filter which completely removed traffic from the streets were felt to provide the greatest improvement to the conditions of the street and doing so for the entire day (not just an hour in the morning and afternoon). However, this approach could only be used on small closures Figure 10 and it might not be enough to deter parents/carers from driving to near the entrance of a closure to drop their children off. There are therefore trade-offs between different design philosophies affecting how large an area can be covered, how long the closure can be in place for, and how much exempt residual traffic can be eliminated.

Focusing on making driving less convenient (the stick element) implies a different set of design priorities than those focused on making the closure space as pleasant as possible for active modes of travel. They also represent different tacit understandings of what drives transport behaviour already discussed. For example, increasing the time penalty associated with driving as opposed to altering the experiential context of the street outside the school. Although Nudge was the only formal theory explicitly mentioned, the actual way in which design philosophies differed reflects an implicit and sometimes hybrid engagement with other formal theories. Focusing designs on improving the active travel experience through maximising the removal of residual traffic resonates with a socio-ecological emphasis on the importance of environmental quality. Targeting convenience engages with more classical economic theories commonly used in transport to (dis)incentivise certain modes.

However, differences in design philosophies also reflected the constraints of intervening in quite radically different built environment contexts with their own pre-existing mobility issues, resident access needs, road layouts as well as the rapid implementation schedules and budgetary constraints within different local authorities. Although many of the design choices were spoken about in terms of how they might optimise the effectiveness of a School Street

in achieving one scheme goal or another, there were also many more prosaic reasons for their choices. In one officer's case, a scheme had to close seven road segments, which was more of a function of the school's multiple entrances and the nature of the road layout as opposed to a particular theory of change. This reflects the difficulty in translating specific psychological models of behaviour into interventions that must also compromise with the constraints of specific locations. Although a School Street can be designed with greater or lesser emphasis on certain ends, like reducing the convenience of driving, or the maximal reduction of traffic in front of the school gate, these are far from the only considerations when designing these spaces. This echoes Ogden's critique of theory systematisation and COM-B, where an inevitable gap between theory, however pragmatically articulated, and case-specific implementation must be filled by the expertise of practitioners.

7.5. Discussion

The first key observation from these results was also the point most clearly connected to the first research question; namely that there was very little engagement with formal models of behaviour change by interviewees. Most did not cite a named model directly, and of the few that did only one outlined how it was operationalised, albeit vaguely. However, this is not to say that there was no consideration of the mechanisms that might underpin School Street-derived travel behaviour change. The thematic analysis found four discernible informal frameworks for behaviour change that were expressed by interviewees. These are forming positive life-habits for children, carrot-stick (dis)incentives, altering norms around travel, and integration with other behaviour change interventions. These were employed somewhat disparately with some participants evoking multiple theories and others none at all. It was also not always clear how an informal theory like positive habit formation for example, was directly operationalised in the School Street itself. In all there is no clear formal theoretical basis for School Streets, and more tacit understandings (though developed) are heterogeneous and not universally applied. Given research connecting clearly identified theories of change with greater intervention efficacy (Glanz and Bishop, 2010), for public health scholars this lack of clear theoretical elaboration would be a point of concern. However, it should be acknowledged that the tacit frameworks used also have resonances with more formal theories, particularly theories emphasising the wider determinants of

health. Taken together these informal theories represent a nuanced picture of the different ways a School Street might affect change.

This is further elaborated by the second observation which is that many practitioners drew a distinction between what was seen as 'behaviour change' – i.e. choice promotion interventions, and the School Street which was generally characterised as something different. Although theories like the social ecological model and frameworks like COM-B emphasise the role of environmental conditions in individual decisions around transport and health, this connection is made only partially by those actively implementing such policies. While it is not completely rejected as a framing, for many participants the term 'behaviour change' remains a metonym for choice promotion, rather than something which might also include the alteration of the environment. Although no participants contradicted the premise that School Streets should and could change travel behaviour, the idea that a theoretical framework would be necessary to explain this mechanism was not intuitive. This distinction between the School Street concept and 'behaviour change' as choice promotion presented an added difficulty during the interviews. As not all participants had conceptualised them together, it took careful steering to focus discussions on the actual mechanics of how a School Street would change parental transport decisions. Although primarily semantic, this is reflected the tendency toward the development of themes around 'achieving mode shift' as opposed to 'behavioural change' during the template analysis, as this later framing arose more naturally in discussions.

This dissonance among some participants between the acceptance that School Streets can and should change behaviours, and the sense that they were separate from what is commonly understood as 'behaviour change' perhaps reflects the novelty of School Streets. With dominant paradigms in AST historically defaulting to choice promotion, School Streets may not yet be fully conceptualised within this broader policy domain. Building on this further, other participants were highly conscious of the dynamics between the School Street and choice promotion, with some perceiving it as a positive departure. Here the actual disruption associated with the change to the environment showed greater efficacy in creating lasting changes in behaviour. Others attributed the increased efficacy to the augmentation of existing choice promotion work (as seen in the tacit theories of change). Both positions perhaps reflect a growing acceptance in practitioner communities of criticisms centred on the efficacy of such choice promotion approaches (at least when considered in isolation). This

may also reflect what Marsden and colleagues (2014) observed to be a scepticism towards such approaches amongst practitioners who even themselves were tasked with implementing them. In their research, scepticism was accompanied by a realism around the scope of policy deemed acceptable or possible by politicians. Although this political dynamic was not present in this research, in general these results support Marsden et al.'s findings that despite widespread adoption, practitioner attitudes towards choice promotion measures are heterogenous and often sceptical.

Given this scepticism expressed by some, it is perhaps interesting that Nudge remained one of the few models with name recognition amongst participants. Interventions associated with Nudge theory tend towards minimalist prompts and non-prescriptive suggestions which cuts against the logic of a street closure that places strict limits on a specific behaviour. The invocation of Nudge perhaps reflects the general understanding of the School Street as targeted intervention, and the wider importance placed on the value for money that it represented as compared with more highly infrastructural traffic calming schemes. As Terence said "getting the access restriction in is by far the most important thing... once you've taken away those heavy volumes of traffic at the time when you've got them most vulnerable road users using it, then you've largely achieved the goals". This sense of an outsized benefit from a small, targeted change is a hallmark of both the 'tactical urbanist' perspective outlined in Chapter 5 as well as Nudge³⁸. As with tactical urbanism it is in part this logic of 'efficiency' that has led critics to connect Nudge to the wider process of state withdrawal under neoliberal austerity, highlighting connections to prevailing concepts of 'smart governance' purporting to do more with less (Jones, Pykett and Whitehead, 2011; Leggett, 2014; Carter, 2015). With local governments in the UK at the forefront of this process it is possible that the prevalence of Nudge, beyond just its high profile in wider media, reflects a concern with achieving the greatest impact with limited budgets through efficient and targeted policy.

Despite its identification by a hand-full of practitioners, there was not much evidence that Nudge or other formal theories were actively operationalised in the design or implementation of these schemes. What was mentioned, however, were several more informal understandings of behavioural change. The relative influence of carrots (incentives) through the improvement of the environment and sticks (disincentives) represented by the

³⁸ Indeed Lydon and Garcia cite Nudge as one of their intellectual touchstones in *Tactical Urbanism* (2015)

reduced convenience of driving is particularly important. This theme was identified not only as an informal theory of change but was also reflected in the design choices that participants emphasised as central to achieving mode shift. This in part evokes classic framings in transport economics of balancing incentives and disincentives for different modes. But the focus on attracting the use of active modes through the improvement of the environment also reflects more social ecological understandings of behaviour. Recent research (Piatkowski, Marshall and Krizek, 2019; Xiao *et al.*, 2022) has specifically focused on the role of carrot, sticks, and carrot-sticks (combined) interventions in promoting uptake of active travel and discouraging car use. The findings of these studies both point towards greater efficacy for schemes that seek to combine incentives and disincentives. Xiao *et al.*'s systematic review (2022) highlights the reallocation of road space to create improved public space as one such approach; arguably a category that would include many School Street schemes. Therefore, although formal theories of behaviour were not extensively used, one of the main intuitive understandings of these mechanisms could still be described as evidence-based and framed within more long-standing concepts in transport economics.

When prompted about the mechanism through which a School Street would achieve change, local authority participants often focused on the practical elements of 'best practice' in implementing a School Street. These ranged from closure size to enforcement methods. Resonating with Ogden's critique (2016) of theory systematisation in public health practice, this tendency is perhaps characteristic of the difficulty of translating theoretical frameworks into real-world street-level interventions which must also attend to the constraints of a specific site and local needs. Psychological constructs are more easily operationalised in interventions focused on messaging or education where the output is more easily replicable across different iterations – something not possible in a School Street. Thus, extensive theoretical elaboration might be an unfair expectation for such schemes³⁹. However, emerging frameworks like COM-B recognise a need to integrate environmental changes into public health intervention design alongside choice promotion activities. School Streets, when

³⁹ It should be noted that the Healthy Streets approach put forward by TfL (see Chapter 2), is an explicit attempt to translate the findings of a number of studies of health and the built environment into a practical framework for non-public health practitioners to implement these principles in their projects, although in mechanistic terms it generally takes a socio-ecological approach.

accompanied by in-school activities could represent an example of this kind of integrated model, but this was emphasised only tacitly and only by small number of participants. Indeed, this raises the question of how far ‘upstream’ theory should be. Public health scholars often speak of designing ‘complex’ interventions (Craig *et al.*, 2019). Here School Streets might be a small part of a higher-level theory-driven health policy approach. Hints of this can be seen in the GLA’s School Superzones project (Town and Country Planning Association, 2021) which looks at health determinants such as the prevalence of fast-food establishments alongside the travel environment of a school’s surrounding area. However, in general it appears this kind of integrated approach to school travel and health is far from the norm. Furthermore, if the theory is further upstream, a knowledge gap remains around what exactly is driving behavioural change at the scale of a School Street, irrespective of whether such psychological theories are best placed to answer this or not.

7.6. Conclusion

Of the different rationales for a School Street, public health has by far the most elaborated theoretical understanding of behaviour and behavioural change, but this is not the way that these interventions are understood by those that implement them. Focusing in part on issues of causation, of which more will be said in the next chapter, Næss (2015) has argued that the relationship between the built environment and transportation mode choice is under-theorised with present understandings generally driven by correlative research on its multiple determinants. This sentiment is also reflected in the work of public health researchers who have looked to the built environment and its alteration through the lens of health behaviour modification. This concern over the under-theorising of this relationship from public health researchers makes sense within a wider discourse around the importance of theory specification to intervention efficacy – perhaps best reflected in recent efforts around theory systematisation. Although these interventions are often interpreted as targeting health behaviour, the utility of this body of theory in actually designing streets is not necessarily intuitive. Pragmatically, these schemes also require the knowledge of several other professions including urban design, transport planning, and highways engineering, leaving it unclear exactly how such knowledge would be operationalised. Although frameworks like COM-B or the wider determinants of health draw on more pluralistic domains of knowledge and advocate for environmental modification, as Ogden (2016) argues in relation to health

practice, they do not necessarily make it any easier to design theory-driven interventions that respond to case-specificity. Therefore, theorised causal mechanisms more closely related to the actual criteria around which schemes can be designed like convenience or environmental quality, are perhaps of more practical use to practitioners in converting knowledge about behaviour (whether tacit or formal) into a physical intervention or a new traffic regulation.

It is also important to note that School Streets, as a partial departure from prior choice promotion activities can be interpreted within a wider paradigm shift in active travel policy which, in documents like the DfT's *Gear Change* (2020a) strategy places an increasing emphasis on infrastructure quality and the reallocation of road space (Dudley, Banister and Schwanen, 2022). Given that the term 'behaviour change' is more closely associated with the choice promotion paradigm in UK transport policy, this wider paradigm shift provides some context to the perception among some participants that a School Street having a 'theory of behaviour change' was not necessarily intuitive. Although the emphasis on Nudge shows that for some, these schemes *are* perhaps being interpreted within an individualised 'choice promotion' framework, as outlined earlier this could also relate to longer histories of austerity, covered to some extent in relation to tactical urbanism in Chapter 5.

However, this does not amount to a rejection of the idea of theory in urban intervention design, or indeed the utility of integrating psychological theory into non-choice promotion policies. What this highlights is that important knowledge gaps on the causal mechanisms between street alterations and behavioural change remain. Despite the detailed informal theory-making that is taking place around the design of these schemes, these perspectives are heterogenous and occasionally contradictory. Given concerns about the difficulty of implementing more abstract theory, such research projects might do well to start with the tacit understandings of scheme dynamics elaborated by practitioners. This is especially the case as with School Streets, where, given their widespread use in London, the intervention is already arguably 'designed' and concerns relate more to their optimisation.

School Streets and modal shift on the trip to school

8.1. Introduction

While recent data in London (Mayor of London, 2022) has shown an increase in walking to school, in many countries and cities in the Global North there is a trend towards declining rates of AST, often dating back to the 1970s and beyond (Sirard and Slater, 2008; Buliung et al., 2017; Rothman et al., 2018). This includes England for which 2014 was the first year more primary age children were driven to school than walked (Department for Transport, 2014). Policy efforts to remedy this situation ramped up in the early 2000s with the aforementioned TTSI in the UK beginning in 2003 and the United States' federally funded Safe Routes to School (SRTS) programme starting two years later. The different emphases in these two approaches reflects two dominant paradigms in AST policy. The TTSI, which, as with policy efforts in Canada (Mitra, 2013), has emphasised school travel planning and has generally focused on efforts within the school to encourage behavioural change. SRTS policies on the other hand, have focused more on the provision of pedestrian and cycle infrastructure on the route to school, aiming to increase objective safety⁴⁰. This to some extent reflects the generally worse conditions for pedestrians in North American contexts, with SRTS policies often funding basic infrastructure like pavements. Despite evidence of local successes, on national scales neither policy has been particularly successful in stemming the ongoing motorisation of the school journey, with negative trends generally continuing after these increased investments (Atkins, 2010; Rothman et al., 2018).

As has been outlined at several points throughout this dissertation, School Streets represent a departure from these dominant paradigms in transport policymaking. This has been discussed through the increasing acceptance of policies that seek to be both carrot and stick, the increasing attention paid to the quality public space in mobility exemplified in the Healthy Streets approach, and the increasing use of tactical and experimental approaches to altering streets. The net result is a quasi-regulatory, quasi-infrastructure intervention that centres the reduction of traffic and consequent effects on the quality of public space as the

⁴⁰ Both the TTSI and SRTS programmes have involved both 'soft' behaviour change and 'hard' infrastructure measures to some degree. This characterisation represents the respective emphases and funding allocation of each project. Most TTSI costs were associated with employing School Travel Planners, most funding in SRTS was ringfenced for capital projects

focus of its efforts. The embrace of this approach, as seen in London has preceded the research, with high-quality evidence for behavioural change still thin on the ground. This is to some extent a product of the highly pragmatic, ‘tactical’, or experimental approach to implementation (as outlined in Chapter 5) which has sought to emphasise prompt intervention over deliberation. The safety and direct air quality benefits of closing a street to cars can be achieved without ‘modal shift’ being strictly necessary, making this evidence perhaps less critical for justifying their adoption than would be the case for schemes in which behaviour change is the sole goal. However, modal shift remains a key part of the stated objectives of these schemes, and in the effort to expand them rapidly as part of the emergency response to Covid-19 extensive monitoring and evaluation was generally not conducted.

However, this tendency to act first, and allow the evidence base to build later reflects more fundamental difficulties in translating the increasingly extensive knowledge on the wider determinants of AST into practical interventions. As will be discussed in the next section, many of the findings of these studies – for example the dominance of residential proximity to school as a determinant – have ambiguous and sometimes contradictory implications for intervention design. As policymakers embrace more iterative and pragmatic modes of operating, and indeed eschew more formal theories of behaviour, beginning from these first principles of ‘determinants’ appears more anachronistic. With an increasing interest in the study of (particularly novel) interventions (Smith *et al.*, 2017; Kärmeniemi *et al.*, 2018; Aldred, 2019), transportation research has had a similar pragmatic pivot of its own. The literature review section outlines the more fundamental methodological debates behind this and examines research that has adopted this approach in the study of AST. Although other experimental measures similar to School Streets have been studied in this way, to date intervention studies focusing specifically on AST have mostly examined the effects of ‘softer’ choice promotion measures at schools, with only a handful of studies concerning infrastructure led SRTS policies, and nothing to date on School Streets.

Acknowledging this gap in the literature, this chapter seeks to answer two primary research questions:

1. Have London’s School Streets led to an increase in active travel on the trip to school?

2. have London's School Streets led to decreases in private motor vehicle use amongst pupils on the trip to school?

Using pre-existing secondary data collected by TfL on the modal split of 527 schools, this chapter adopts a quasi-experimental study structure. It treats the large number of School Streets installed in London during Covid-19 as a natural experiment. The analysis compares the change in mode share before and after the installation of a School Street with the mode share changes of those that did not have a School Street installed. In all this chapter finds modest but positive changes in patterns of mobility associated with the introduction of a School Street, with a decrease in PMV use and increase in AST detected. It also indicates that these changes were counter to a prevailing trend of increase in PMV use in other schools. Implications of these findings for practitioners and for the wider literature on the determinants of AST are considered alongside the potential for future research on this topic.

8.2. Evidence on the determinants of and interventions for AST

As established in Chapter 7, several psychological theories have identified individual characteristics as determinants of transport behaviour, while researchers that emphasise the 'wider determinants of health' have focused on the role of built environments as well and socio-economic factors. Studies within transport geography and cognate disciplines have also often taken these external factors as the primary object of study. Many studies have examined these characteristics on city and regional scales, traditionally focusing on mode of travel for commuting. However, as part of attempts to understand the diversity of different travel patterns, activity-specific studies of transportation have also proliferated (Jones *et al.*, 1983). As a result, there has been increased focus on how these socioeconomic and built environment determinants affect different categories of travel. As a trip type with several characteristics that are notably distinct from travel for employment or leisure, the study of the determinants of mode of travel to school, and active school travel (AST) in particular, has attracted growing academic attention. This section will examine some of the primary findings of both generalised and school-specific studies of the determinants of active and sustainable travel, focusing primarily on the role of the built environment. Several criticisms of these dominant approaches will also be considered, and a more recent trend towards quasi-experimental and intervention-studies will be explored in more depth.

This review will emphasise that cross-sectional studies have limits in helping to understand how small-scale street-level interventions like School Streets may impact active travel to school and that quasi-experimental and intervention study structures are required to capture how people's behaviour responds to the modification their environments on this scale.

8.2.1. Wider determinants of active travel and AST

A significant trend in research in public health and urban planning has sought to understand which characteristics of the urban environment have supported the behaviours of walking and cycling. In some cases this has been framed as a way to test the principles of planning approaches like New Urbanism, or Transport Orientated Development (Cervero and Kockelman, 1997; Mitra, 2013). This tradition in the literature is perhaps best represented by the 3Ds approach which, using a large cross-sectional study of the San Francisco Bay Area, identified three primary built environment variables (Diversity of land use, Density, and Design) which correlate with the demand for active modes of travel. Subsequent research (Ewing and Cervero, 2010) has built on this, proposing additional 'Ds' (Destination Accessibility and Distance to Transit) (Saelens, Sallis and Frank, 2003; Saelens and Handy, 2008; Le, Buehler and Hankey, 2018). Similar research efforts have sought to outline various metrics for understanding the 'walkability' of different urban environments (Frank *et al.*, 2010; Stockton *et al.*, 2016; Lam *et al.*, 2022). These models have demonstrated several strong connections between dense, mixed use urban environments and the use of active modes of travel, broadly supporting the dense pedestrian-centric designs advocated by New Urbanism. However, this research has predominantly focused on the mobility of adults. As Mitra (2013) has pointed out, the variables that serve as determinants of active travel in children may be notably different.

This has in part led to a parallel literature which has sought to understand the travel behaviour of children in similar terms, often focusing specifically on the trip to school (Ewing, Schroeder and Greene, 2004; McMillan, 2005, 2007; Schlossberg *et al.*, 2006; Mitra and Buliung, 2014; Curtis, Babb and Olaru, 2015; Ikeda *et al.*, 2018). The findings of these studies have some similarity to those in adults, including several studies that have found the 3 original D-indicators to correlate with rates of AST (Ewing, Schroeder and Greene, 2004; McMillan, 2005, 2007; Ikeda *et al.*, 2018). However, there are some important differences between the

literature on adults' travel behaviour and the literature on children's travel behaviour. The most consistent finding in the research on AST is the strong negative correlation with distance travelled to school (Page *et al.*, 2010; Waygood and Susilo, 2015; Yu and Zhu, 2015; Ikeda *et al.*, 2018), which in terms of ubiquity in the literature has no equivalent in studies of the mobility of adults. Furthermore, indicators like land-use diversity which correlate positively with walkability for adults show inconsistent findings for children (Yu and Zhu, 2015; Ikeda *et al.*, 2018), with the presence of commercial uses sometimes correlating negatively with AST. This inconsistency is also found in measures of the directness of the walking routes, which negatively correlates with AST (Panter *et al.*, 2010, 2013; Mitra and Buliung, 2014). In both cases this discrepancy is thought to be explained by the co-association of these variables with higher-traffic environments, which might present a more significant barrier to the mobility of children than adults. This is further corroborated by the extent to which small-scale built environment features like crossings (Rothman *et al.*, 2015, 2021; Ikeda *et al.*, 2018), cycle infrastructure (Panter *et al.*, 2010; Ikeda *et al.*, 2018; Rothman *et al.*, 2021), and traffic management measures like crossing guards (Rothman *et al.*, 2015, 2021) have been identified as positive correlates for AST.

There are, however, additional complexities associated with the mobility of children. In the present context of decreased independent mobility (see Chapter 2), mode choice is often determined by parents, and thus potentially mediated by factors such as parental availability (Potoglou and Arslangulova, 2017), parental mode preference (Henne *et al.*, 2014; Waygood and Susilo, 2015), as well as socio-economic status (Page *et al.*, 2010; Panter *et al.*, 2010, 2013). Studies of the individual characteristics of children such as age (Lopes, Cordovil and Neto, 2014) and gender (Guliani *et al.*, 2015) of the child have also revealed important differences, with boys often given more affordances to travel actively than girls and children in urban environments travelling independently at an older age than those in rural areas. Trip-specific variables like the direction of the journey (to or from school) (Herrador-Colmenero *et al.*, 2019) and weather add additional nuances (Børrestad, Andersen and Bere, 2011; Mitra and Faulkner, 2012; Helbich *et al.*, 2016). Perhaps the most important contribution of this research is on parental perceptions of the safety of the journey to school, which alongside proximity serves as the other most consistent positive predictor of AST, partially as a function of its role in determining independent mobility (Panter *et al.*, 2013; Henne *et al.*, 2014; Lu *et al.*, 2014b; Giuliani *et al.*, 2015; Rothman *et al.*, 2015a; Helbich *et al.*, 2016; Ikeda *et al.*, 2018).

A review of studies examining perceived barriers to active travel to school found fear over traffic safety to be a unanimous factor (Lu *et al.*, 2014b). However, there are some contradictory dynamics within how perceived traffic relates to AST. For example, some environments that are perceived to be lower-traffic have also seen lower levels of AST – perhaps a consequence of greater driving convenience (Panter *et al.*, 2010; Waygood and Susilo, 2015). Thus, although important, parental perceptions interact with the built environment in complex ways.

This picture presents issues for practitioners seeking to design interventions around existing evidence of the determinants of AST, and the findings of this body of research are sometimes at odds with the School Streets approach. On one hand, given the consistency of findings around the role of proximity to school, it might appear that promoting street-level interventions is somewhat futile. Aside from policies around limiting school choice and longer-term planning policies for school siting and residential density, there is limited scope to modify the environment to alter residential proximity in the short to medium term. On the other hand, the prevalence of parental perceptions of safety, and the way this converges with the objectively measured features like crossings and crossing guards supports the logic behind Safe Routes to School policies which seek to address specific barriers in the built environment on popular routes to school. This is further supported by evidence from Rothman *et al.* (2015) that parental perception of the danger of the route to school was a much greater determinant of AST than their perception of the danger of the environment directly around the school itself.

However, there are certain factors that are under-studied in this area that complicate a simple endorsement of SRTS measures. Objectively measured traffic levels are not commonly included in these studies (McCormack and Shiell, 2011), although when recorded higher traffic exposure near the school has been shown to negatively correlate with rates of independent as opposed to accompanied walking (Buliung *et al.*, 2017). Additionally, very few studies beyond Panter *et al.* (2010) have examined the role of the relative convenience of AST as compared with driving in these studies. This latter point is particularly important considering the emerging research around the combination of carrots and sticks in policy making outlined in the previous chapter, and to some extent represented in the School Streets approach. Additionally, there is a geographical element to this. Much of the most exhaustive research has been conducted in North America (particularly Canada), with urban

environments often quite different to that of cities in the UK. Despite the dominance of proximity and parental perceptions, these limitations in the current research on determinants of AST highlight that intervention designs need not necessarily target the consensus findings of the existing evidence base to be valid.

8.2.2. The case for studying interventions to understand travel behaviour

A potential alternative to understanding transport behaviour through its determinants (however helpful) is to flip the question around and either study the causes of existing examples of behavioural change – as has been done in studies on ‘life events’ (Chatterjee, Sherwin and Jain, 2013), or to study specific interventions and their impacts. This latter approach has been adopted in wider calls for longitudinal and quasi-experimental study structures in transportation research. This has been born in part of a practical need to inform practitioners and improve the evidence base for certain dominant and emerging interventions – a research agenda driven more by a pragmatist framing of studying ‘what works’. However, this has also been justified in terms of methodological criticisms levelled against past approaches to studying the determinants of transport behaviour. The first primary critique is the collinearity of measured and unmeasured variables in cities, which can make disentangling the causes of observed effects more difficult. This is especially problematic for design characteristics, with a ‘walkable’ street network often containing many of the same indicators in concentrated areas (Cervero and Kockelman, 1997; Vale, Saraiva and Pereira, 2016, p. 212). This is reflected in the inconsistency of land-use diversity in AST, with high levels of traffic co-associated with traditional measures of a (adult) pedestrian-friendly environment but not necessarily measured. This reflects the challenge of accurately specifying and measuring all the potentially influential aspects of the urban environment. The use of grouped variables like walkability scores as well as statistical methods like exploratory factor analysis has mitigated this somewhat (Cervero and Kockelman, 1997), but as Handy (1996) and others (Aditjandra, Mulley and Nelson, 2013) have pointed out, these relationships between individual built environment indicators and transport mode choice may still be artefacts of undetected socio-economic and demographic factors which also correlate with dense urban centres.

Current debates around the issue of residential self-selection in transportation research can also help unpick these issues further. The concept of residential self-selection

posits that people with certain transport preferences are likely to choose to live in areas that support that preference (Kitamura, Mokhtarian and Laidet, 1997). This contrasts with the implied direction of causality in many studies on built environment determinants, which assume that people alter their transport mode because of the characteristics of the places they live. Studies have attempted to control for this by using a transport attitudes indicator. However, this is difficult to do using aggregate data for travel in a neighbourhood or city as behaviours must be linked to the attitudes of specific individuals (Handy, 2018). The relative importance of residential self-selection is, however, subject to debate (Næss, 2014; van Wee and Boarnet, 2014), particularly over whether travel preference is even an important category for residential choice in the first place. Other criticisms question whether people are free to choose their place of residence without constraint – something not captured by a transport ‘attitudes’ indicator⁴¹. The theory of residential self-selection has been extended to school travel, however, in a recent study Yu and Zhu (2015) found that even when controlling for a preference for living near a school, distance remained a statistically significant determinant of AST.

The issues of multi-collinearity and residential self-selection are of interest here as they identify concerns over causation in the relationship between the built environment and travel behaviour. A key component of attributing causation is that the expected cause (in this case the built environment), happens prior to its hypothesised effect (travel behaviour) – what is called ‘time precedence’ (Næss, 2015). If people are choosing where to live according to a priori preferences then this condition of causality is not met, even if there is an observed correlation. Alongside the pragmatic motivations for researching interventions to understand their impacts, these methodological concerns provide additional incentives to adopt intervention studies on transport behaviour. The necessary (but not sufficient) conditions for causality of time-precedence and non-spuriousness are often resolved through the use of longitudinal data and control populations (Singleton and Straits, 2005). Although the methodological best-practice of randomised control (RCT) trials are not possible in the study of the built environment (although potentially possible for AST interventions targeting

⁴¹ There is a further interesting argument that residential self-selection is less important in places like the UK and western Europe where suburbs still have a high level of public transport service as compared with North American contexts where choice might be more binary (Aditjandra, Mulley and Nelson, 2013)

individual factors as demonstrated in Rowland et al. (2003)), a quasi-experimental study structure with multiple time periods and intervention-control groups is a common approach. When longitudinal studies on residential self-selection have been possible (van de Coevering, Maat and van Wee, 2021) its role has been questioned, instead finding evidence for what is referred to as the reverse causality hypothesis which states that over time people's travel attitudes and preferences align with the environment they have chosen to live in.

Despite the advantages of longitudinal studies and quasi-experimental studies, there are barriers to conducting this kind of research. Sample sizes are often smaller than for cross-sectional studies, which despite reductions in sample bias can lead to issues of generalisability as a representative sample is more difficult to obtain (Aldred, 2019, p. 310). Ensuring that panels are consistent, with few drop-outs presents other complexities, and in the context of more expedient 'tactical' approaches to intervention ensuring that adequate baseline data is captured is often a challenge.

8.2.3. Studying interventions to promote AST

Although there are clear benefits to studying transport behaviour through longitudinal and quasi experimental studies, perhaps in part to do with the additional cost often associated with conducting these studies, research on the determinants of AST have generally favoured cross sectional structures. Some exceptions include Panter et al.'s (2013) longitudinal study of school travel behaviour amongst older primary school children (ages 9-11) in the UK. This study looked at a large number of built environment and socio-economic variables that might impact the uptake (or lapse) in AST over the course of a year. Although not quasi experimental (there was no intervention to speak of), as with other studies (Faulkner *et al.*, 2010) they found that alongside proximity, parental perception of convenience of driving was an important correlate of AST⁴². This might imply that interventions like School Streets or LTNs which intervene in the relative convenience of driving vs other modes might increase rates of AST. In a slightly different approach Mitra, Papaioannou, and Habib (2015) have looked at changes in the built environment in Toronto, Canada and its relationship to the odds of children undertaking AST. They found that although the correlates of AST have changed over

⁴² Lower socio-economic and lower parental education level were also positively associated with uptake in AST.

time, distance has remained a consistently important indicator; this is despite shorter trips increasingly also being driven.

These studies are complemented by research that has instead focused on the influence of specific interventions aimed directly at promoting AST. In the United States the SRTS programme has been the subject of several relevant studies, although many evaluations do not use quasi-experimental study structures, with the lack of control groups a frequent issue (Möser and Bamberg, 2008; Buttazzoni *et al.*, 2018). For example, Gutierrez *et al.* (2014) found no effect in AST or parental perception of safety in a quasi-experimental study of the introduction of crossing guards at 14 schools in Miami. Bungam, Clarke, and Aguilar (2014) observed increase in AST after a one-day promotional event at a school but characterise the changes as ephemeral. Outside North America, McKee *et al.* (2007) studied a curriculum-based intervention to promote AST in one school in Scotland, noting significant increases in walking to school and decreases in car use, compared to baseline and the control school, albeit with a small sample size. Christiansen *et al.* (2014) found very little change associated with a similar programme that also included small built environment changes at a group of Danish schools. The only randomised control trials in this area looked at a School Travel Planning scheme across several schools in the in the Camden area of London, finding no effect (Rowland *et al.*, 2003).

Chillon *et al.*'s 2011 systematic review of intervention studies and AST, found 10 studies using quasi-experimental structures, with only half using control groups. Of the papers examined by Chillon *et al.*, only Boarnet *et al.*'s two papers (2005; 2005) investigated interventions that involved physical changes to the street, in this case improvements to crossings. A more recent review (Pang, Kubacki and Rundle-Thiele, 2017) similarly found the majority of studies focus on non-physical interventions, despite those that did showing greater efficacy in promoting AST⁴³. No studies to date have looked at AST directly in relation to School Street style interventions, in spite of their recent international proliferation (Clarke, 2022).

⁴³ However, Hoelscher *et al.*'s ongoing longitudinal study of SRTS programmes in Texas looks promising and will hopefully add to this.

8.2.4. Intervention studies and researching the School Street

Both systematic reviews emphasise the inconsistency of the outcome variables used, which presents challenges for conducting a meta-analysis of the reported effect sizes. This makes benchmarking an effect-size for the direct comparison of School Streets to other approaches more challenging. As many papers have emerged from public health backgrounds, physical activity has generally been emphasised as the primary outcome variable. However, given the interconnection between automobility and the wider environment, reduction in private motor vehicle use is arguably just as important an indicator as uptake of AST. Focusing specifically on other policies in London, the London Assembly (2011) published an official figure of a 6.5% reduction in motor vehicle use associated with School Travel Planning efforts. However, very little information has been given about the methodology used for this, and the results contrast significantly with the finding of Rowland et al's RCT study (2003) and the national evaluation of the TTSI. Other attempts to meta-analyse the effect of AST interventions in the UK have stated similar effect sizes for School Travel Planning across the grey literature, with some 'best practice' schools showing significantly higher changes than the London Assembly's 6.5% (Cairns *et al.*, 2019). In terms of the existing evidence for School Streets, as outlined in the Chapter 2, the evidence for modal shift is particularly patchy. The only existing estimate for it comes from Hopkinson et al. (2021) which conducted a meta-analysis of 27 local authority monitoring reports, estimating a 3 to 6 percentage point reduction in PMV use associated with a School Street.

Other potentially relevant literature has been the use of experimental study structures to study other street experiments during Covid-19. London's emergency LTNs are a good example. Recent research has looked at whether potential negative effects of these schemes have been observed (Goodman, Furlong, *et al.*, 2021; Goodman, Lavery, *et al.*, 2021; Nello-Deakin, 2022; Thomas and Aldred, 2023), as well as their impact on driving (Goodman *et al.*, 2023). This research to date indicates that schemes to restrict car traffic on smaller residential streets have not had significant negative outcomes, and that some reduction in the level of driving has been observed for those who live within the schemes. Overall, this points to evidence that these schemes have to some extent had the intended effect of discouraging car use during the emergency period in which they were introduced. Nonetheless, it remains to be seen whether similar effects will be observed in relation to School Streets.

This review has outlined the key findings of research on the determinants of AST, and has made the case for approaching this question through the pragmatic study of interventions. Despite a growing literature in this area, significant research gaps remain. Studies of AST interventions to date have focused much less on physical interventions to improve the environment near to the school. This is somewhat surprising given that 80% of the initial \$650 million (USD) US SRTS programme, which makes up a great deal of the current evidence base, was ringfenced for infrastructural changes (Mitra, 2013). In general, research on policies and interventions which focus on urban environmental quality, or road safety infrastructure as a way to increase AST are few and far between. As discussed in the previous chapter this might reflect a prevailing focus in practice on a narrow view of what constitutes 'behavioural change' in school travel policy. It may also reflect the comparative complexity of studying interventions in urban space which are often heterogenous and can be difficult to determine levels of exposure. This chapter seeks to contribute directly to this research gap, increasing the reliability of current estimates of the behavioural impact of School Streets, and furthering the study of transport behaviour through the quasi-experimental study of interventions.

8.3. Methodology

8.3.1. Study structure

This part of the research uses secondary data on mode of travel to school to conduct a retrospective quasi-experimental study of the impact of School Street closures on rates of active travel and private motor vehicle transport to primary-phase schools in London. The data used for this analysis was collected by TfL as part of their sustainable and active travel programme with schools in the city. This programme, named STARS (Sustainable Travel: Active, Responsible, Safe), involves over 2000 educational institutions in the city (66% of which are state primary schools) and requires most to submit an annual 'Hands Up Survey' collating how each child arrived at school on that day. Starting in 2007 and continuing to present, STARS is a voluntary scheme that provides support to schools to promote active and sustainable modes of travel including an accreditation system to recognise best practice and improvement in this area. Their activities also include interventions like school travel planning. This survey data is recorded at school-level, with the number of students reporting

having taken each of several possible modes of travel on that day recorded. Since the statutory requirement for schools in the UK to report each child's usual mode of travel to school was removed several years ago this STARS dataset is the only up to date dataset recording this information over multiple years.

In combination with data collected on the locations of each School Street and when they were implemented (a process outlined in more detail in Chapter 6), this data allows for the comparison of the mode-share in a sample of schools before and after the closure has started. It also allows for all schools that have recorded surveys but have not had a School Street to act as a comparison group. This is especially important as the vast majority of School Streets in London have been installed since the beginning of the Covid-19 pandemic, which saw major disruptions to patterns of transportation. This quasi-experimental approach allows for the data to be analysed using a difference in differences analysis, providing a simple comparison between the average change in the comparison group to that in the intervention group. This allows for the effect of the intervention (if any) to be estimated. More complex versions of this analysis will also be conducted to account for the effect of exposure to a School Street.

8.3.2. Survey method, its limitations and sample characteristics

The STARS dataset is extensive, with nearly 18,000 surveys recording the mode of travel for pupils at over 1400⁴⁴ state-funded primary schools. Each class in a school records the mode of transport taken for each pupil on the same day⁴⁵ by putting their hands up for different modes. This has recorded over 6 million trips to school from the beginning of the scheme in 2007 up until April 2022⁴⁶. Most schools involved are primary-phase schools with students aged 4-11 but some nursery and secondary phase schools are also part of the programme. As a secondary data set, there are some known issues with data quality. The voluntary nature of the scheme means that schools are not necessarily representative of the entire city – of which more will be said shortly –, and schools also self-submit their surveys without direct

⁴⁴ Schools which have submitted a survey within the last 5 academic years.

⁴⁵ Days differ between schools.

⁴⁶ Data has continued to be recorded after this date, however this cut off is used as it is also the last month for which the dataset of all known School Streets locations is accurate.

observation by researchers. This has led to varying year-to-year and within-school response rates (either due to incomplete surveys or surveys submitted with samples larger than the recorded student body), as well as occasional dropouts (surveys not submitted for every year).

Additionally, some practitioners have also expressed a more general concern with the accuracy of hands up survey as a method. This relates in part to whether younger children can comprehend the question correctly as well as concerns over double counting if the survey is not carefully monitored to ensure that each participant only raises their hand once. Evenson *et al.* has studied the test-retest reliability of children's recollection of their mode of travel compared with their parents' accounts finding almost perfect agreement, albeit with slightly older primary-age children (Evenson *et al.*, 2008). More recently researchers in New Zealand tested the validity of a similar hands up survey method with a larger sample that also included younger children (de Wit *et al.*, 2012). They reported a high level of validity but with direct supervision from researchers. Thus, relying on children's same day recall and the use of a hands-up counting method both have validity in past examples. However, it is not known what effect the lack of direct researcher supervision might have here. Teachers receive guidance on how to conduct the survey but varying time constraints and organisational emphases on the survey may affect the care given to data collection.

Unsupervised hands up surveys have been used previously in AST research with Mammen and colleagues (2014) assessing the impact of a School Travel Planning intervention in a large sample (53) of Canadian schools. The size of the sample in this research speaks to the advantage of conducting an unsupervised survey in terms of resources and scalability of methods. This is also true of the STARS dataset, which is significantly larger sample of schools than those used in other studies and then would have been possible with direct researcher supervision. Although variability in data collection is likely, there is no known reason that the data would be collected systematically differently between the intervention and comparison groups or at the before or after time periods, making this close to a like-for-like comparison. In sum, the STARS data provides breadth suitable for a comparative study, if not the depth needed to draw conclusions on individual cases.

As the scheme is voluntary, the generalisability of results to the city scale depends on how representative the STARS schools are to those in the rest of London. Differences in the characteristics of the schools in the STARS dataset vis the rest of the city is recorded in Table

18. In general, the STARS schools have similar demographic profiles to other state-funded primary schools in the city. They are slightly larger, less deprived (2.1 percentage points fewer eligible for free school meals), have lower proportions of pupils from Black, Black British, Caribbean, or African backgrounds (2.7 percentage points fewer), and higher proportions of white pupils (2.9 percentage points more). They are also quite significantly more likely to be in outer London than inner London. This may partly be a result of the exclusion of schools from the ethnically diverse inner-London borough of Hackney, which have their own equivalent scheme and thus do not participate here.

When comparing intervention and comparator groups within the STARS dataset (after the data cleaning process detailed below), schools with School Streets have slightly higher rates of deprivation (1.6 percentage points more eligible for free school meals), have higher proportions of pupils from Black, Black British, Caribbean, or African backgrounds (2.5 percentage points more) and most significantly a lower proportion from Asian backgrounds (6.2 percentage points less). They are also more likely to be in inner London. This reflects previous findings in Chapter 6 on the equity of School Streets in London, showing that the sample of 107 intervention schools used here is generally representative of the population of schools with School Streets more widely. However, the differences, particularly in the proportion of students from an Asian/Asian British background, may introduce confounding factors due to differing travel behaviour by socio-demographic characteristics. This is difficult to eliminate given that data is recorded at the school level, and data on the school trip by different socio-demographic variables in London is limited.

Table 18 – Comparison of survey and non-survey schools as well as intervention and comparator schools by several school and socio-demographic characteristics. All figures refer to state-funded primary schools.

	Schools included in Study	All other state-funded Primaries	Control Group	Intervention Group	STARS Schools w/ Rejected Surveys	All London state-funded Primaries
Mean Pupil Headcount	423.2	386.0	421.5	430.0	387.2	397.0
% Free School Meals Eligibility	20.8	22.9	20.5	22.1	22.8	22.2

% White	43.3	40.4	43.2	43.7	40.8	41.3
% Mixed or multiple ethnic groups	11.0	12.0	10.8	11.9	12.0	11.7
% Asian or Asian British	23.7	22.4	25.0	18.8	21.9	22.8
% Black, Black British, Caribbean or African	14.8	17.5	14.3	16.8	17.5	16.7
% Other	5.5	5.8	5.2	7.0	5.9	5.7
% Unclassified	1.6	1.9	1.6	1.8	1.9	1.8
Median Pupil Headcount	409.0	372.0	407.5	410.0	374.0	384.0
Median % Free School Meals Eligibility	20.3	22.5	19.7	23.3	22.3	21.9
Median % White	45.9	41.0	47.1	43.5	41.5	42.3
Median % Mixed or multiple ethnic groups	11.3	12.2	11.1	11.8	12.2	11.9
Median % Asian or Asian British	12.4	11.5	12.7	11.3	11.2	11.8
Median % Black, Black British, Caribbean or African	11.3	13.9	10.7	13.4	13.9	12.9
Median % Other	3.5	3.8	2.8	5.9	3.8	3.7
% in Inner London	28.7	43.4	26.9	35.5	44.8	39.0
% in Outer London	71.3	56.6	73.1	64.5	55.2	61.0

8.3.3. Survey data cleaning process

Given the size and variability of this dataset, a significant data cleaning process was undertaken to render a subset that was suitable for the purposes of this analysis. This was conducted as follows:

1. Surveys from before the 2015/16 school year were excluded from the dataset. This cut-off was chosen as in the UK most students attend primary school for 7 years. A student entering school in September 2015 would be in their final year of school in the academic year 2021/22, which

is the most recent survey year available in the STARS dataset. As surveys taken any earlier would not include any of the same students when followed-up in 2021/22, this was deemed as a reasonable cut-off (10998 surveys excluded).

2. Surveys from schools other than state-funded primary schools are excluded from the dataset. To date School Street schemes have been almost exclusively focused on these schools. Although there are some exceptions with secondary-phase schools sharing a School Street with a neighbouring primary school, these schools tend to have much larger catchment areas and thus significantly different travel geographies (further 2097 surveys excluded).
3. The vast majority of School Streets in London were installed after the initial Covid-19 lockdowns when travel patterns were significantly disrupted (see Figure 32). To help account for the destabilising effect of the Covid-19 lockdowns, only surveys from schools that have had at least one survey in either of the 2020/21, or 2021/22 academic years were included (further 2258 surveys excluded). Additionally, all surveys from schools that had School Streets installed prior to March 2020 were excluded from the dataset so that every 'after' survey in the School Street intervention group was also after the initial Covid-19 lockdown (further 128 surveys excluded). To conduct a like-for like analysis, all schools (whether they had a School Street or not) would need at least one survey from after the initial lockdowns which commenced 23/03/2020, and one from before this period. The importance of this to the difference in differences analysis is outlined in section 8.3.4.2 below.

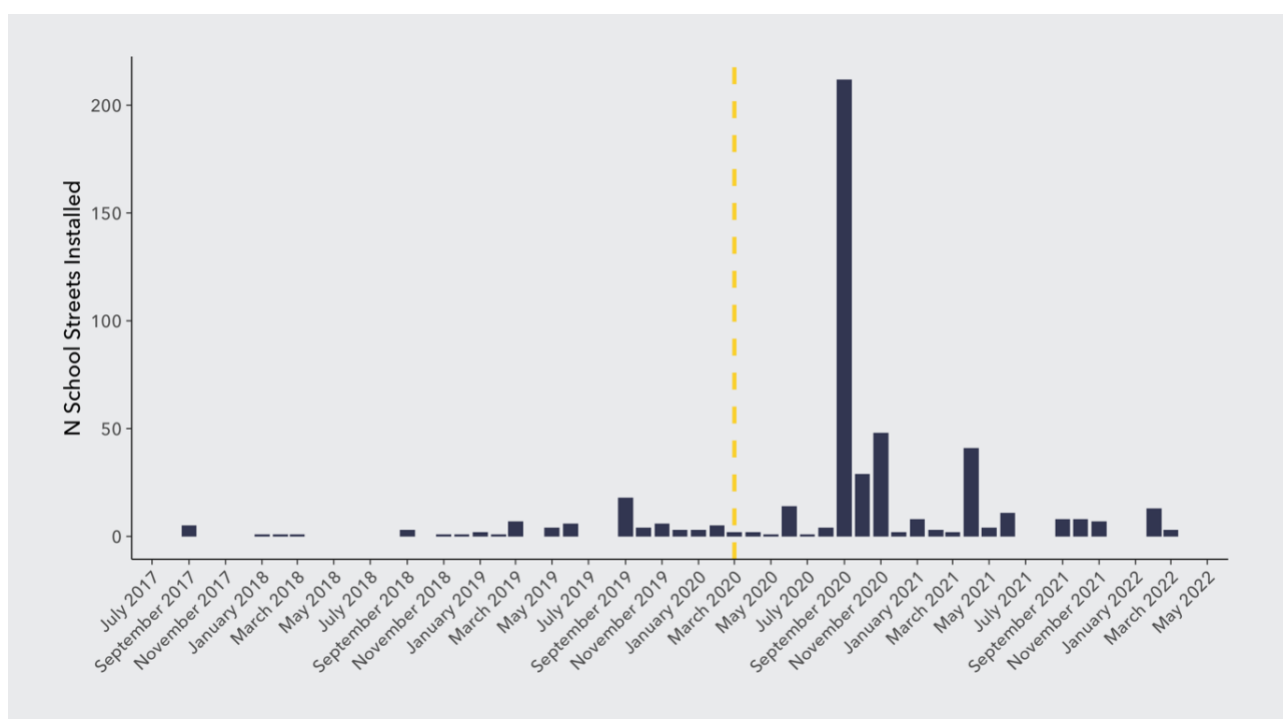


Figure 32 – Chart showing the number of School Streets installed per month from September 2017 onwards, yellow dashed line indicates the beginning of the first Covid-19 lockdowns in the UK.

4. All surveys from schools where the installation date of a School Street was unknown were excluded from the analysis. In these cases, it is impossible to know which of a school's surveys were before or after the School Street (25 schools in total). Additionally, all surveys from schools where a School Street had been installed but had been subsequently removed or suspended were excluded from the analysis. In some cases these streets have been reinstated

but assuring the time precedence of any survey was often difficult (27 schools). This resulted in the exclusion of a further 29 surveys.

5. As most School Street installation dates only indicated the month of installation, all surveys that were within 50 days of an installation date were manually checked to ensure time-precedence. When it was impossible to tell whether a survey was before or after the School Street, or if a survey was less than 14 days after a School Street was introduced, they were excluded. Only 5 surveys were excluded in this way. The 14-day threshold was chosen because for camera enforced schemes local authorities often chose to not issue fines during the first two weeks of a scheme, only sending warning letters. In this case the full effects of the School Street might not yet have been felt.
6. Surveys with response rates either less than 50% or more than 150% of their school's stated student body were excluded. Response rates varied, with some surveys recording only a small fraction of their student body (likely the result of most classes not reporting), or with response rates significantly larger than their student body. The response rates were calculated using the DfE's annual head count data for each school from the year of the survey. However, some leeway has been maintained to allow for genuinely acceptable circumstances where response rate exceed or falls below 100%. For example, some schools contain multiple 'units' that are sometimes counted as different institutions by the DfE but may be submitted together to the STARS database as they share facilities. In these cases, all are highly likely to all be affected by the School Street. This threshold was chosen to reject surveys that clearly have errors. Figure 33 shows the distribution of response rates, with the most extreme outliers eliminated by the 50-150% cut off. A sensitivity analysis is also conducted with a tighter 75-125% threshold. This is to ensure that the choice of this threshold does not affect the validity of the findings. The results of this are presented in Appendix I (10.9). The use of the 50-150% threshold resulted in the exclusion of a further 542 surveys.

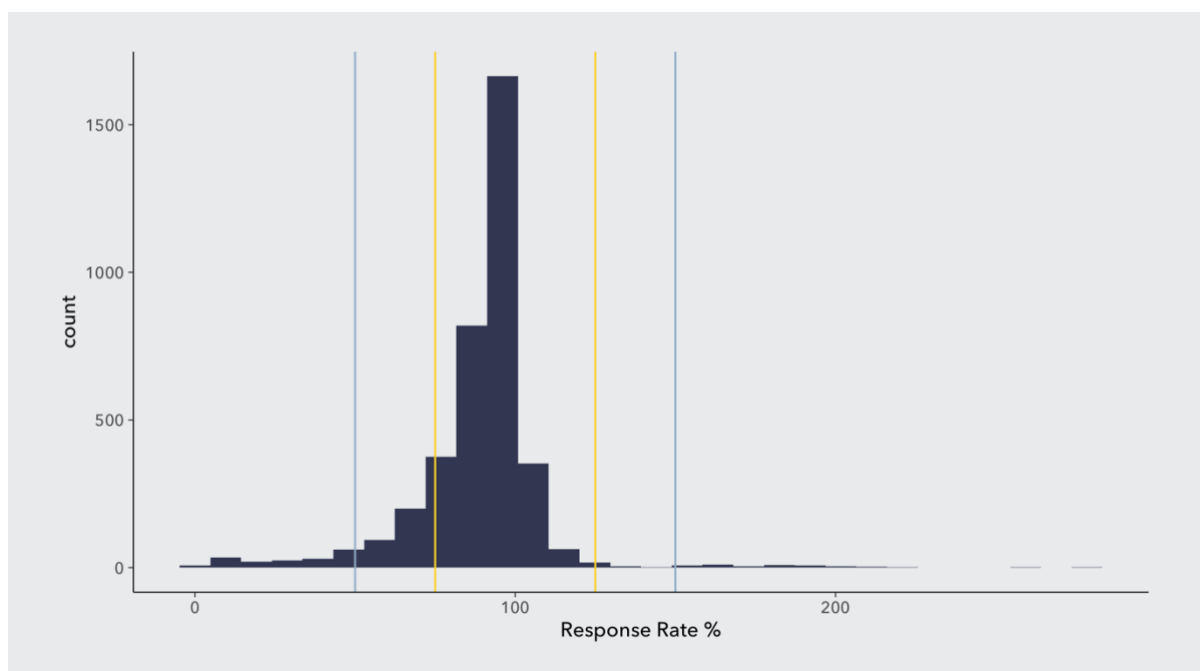


Figure 33 – Histogram showing the frequency of different response rates. Yellow vertical lines indicate the 75-125% inclusion threshold, teal lines indicate the 50-150% inclusion threshold.

This process results in a usable dataset, of 1791 surveys from 527 different schools in London. Table 19 gives a full breakdown of the final analysis dataset. Although this data cleaning

process has removed erroneous and irrelevant data, some biases may also have been introduced. Table 18 shows the socio-demographic variables for the schools eliminated through the entire data cleaning process. Generally speaking, the differences reflect that between the survey group and the rest of the city’s primary schools, as many institutions have submitted a survey at one point in the history of the scheme even if not currently actively involved. Although the sample of 107 of the city’s School Streets schemes used here is substantial, the schemes rejected due to lack of accurate start-dates could change the findings if included. This is especially the case as many are from the inner-London borough of Lewisham which if included would go some-way to addressing the outer-London bias in the current sample. Follow-up research with subsequent years data and more schemes will be needed to confirm whether this is the case or not.

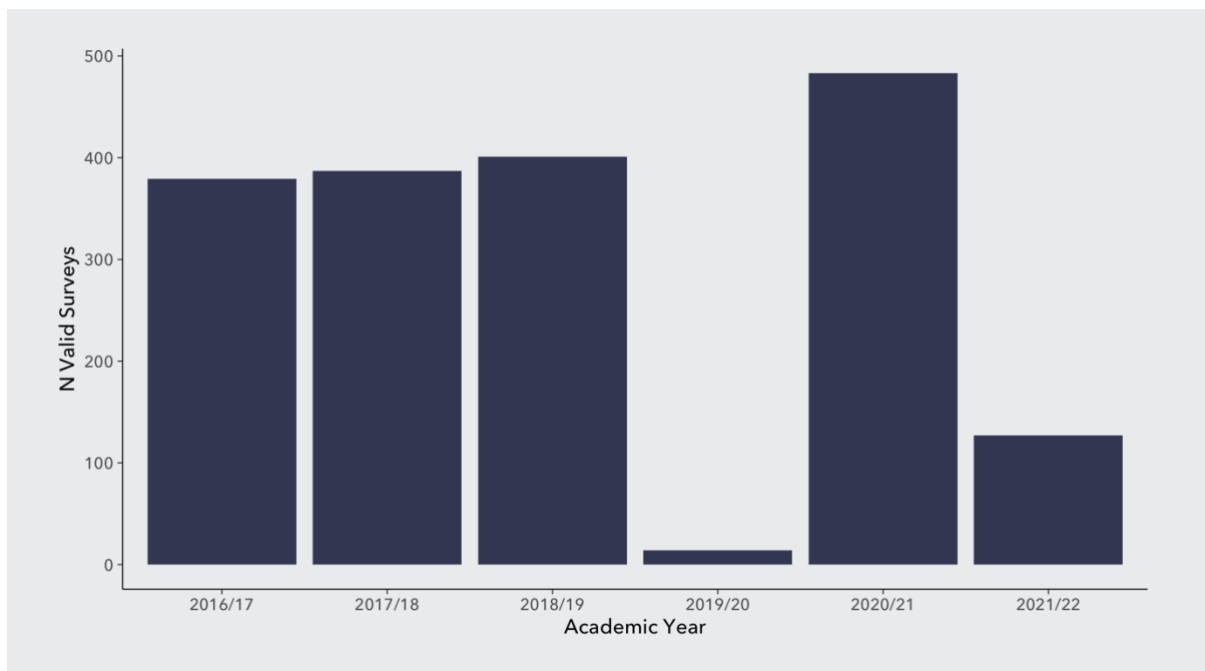


Figure 34 – Number of valid surveys by Academic Year after data cleaning

Table 19 – Description of dataset used in analysis.

Total n Surveys in Dataset	17960
Total n Surveys incl. in analysis	1791
Total n Schools	527
Total n Schools w/ School Street	107
Total n Schools w/o School Street	420
Total n Surveys before March 2020	1180

Total n Surveys after March 2020	611
Total n Surveys after School Street installed and after March 2020	121
Total n child trips recorded by all surveys in analysis	690137

8.3.4. Analysis

8.3.4.1. *Descriptive statistics*

This paper presents an initial descriptive analysis of the key outcome variables and individual modes of interest. The primary outcome variables concerned are both the mode share of private motor vehicles (PMV), and the mode share of active modes of travel to school (AST). Active modes of travel include walking, cycling, and scooting, all of which are recorded separately in the surveys. Reduction in private motor vehicle use is the more important outcome from schemes like School Streets, given the goals of improving quality of space and antecedent road safety and air quality outcomes. This is especially so given the significant reductions in public transport use during Covid which affects the observation period. Although increases in active travel are important in achieving the physical activity goals that are often mentioned in relation to School Streets, a rise in AST alone might not reflect a net transition to more sustainable modes if not also accompanied by a reduction in PMV use. In the descriptive statistics section the background trends of PMV, AST, and individual active modes (walking and cycling) are reported, as are changes before and after March 2020 for all surveys, and before and after the introduction of a School Street for the intervention group.

8.3.4.2. *Difference in Differences analysis*

A difference in differences analysis is used as the primary analysis method. This approach has a long history dating back to John Snow's analysis of cholera outbreaks in London (Goodman-Bacon, 2021) but recently it has become a common approach in economics and public policy. In its most simple form, the difference in the mean of a given outcome variable is compared at two points in time for two groups, one exposed to an intervention and one not. The difference between the change in the control and the intervention group provides the estimate of the average intervention effect. In general, its utility is in identifying the average effect of an intervention where a control group is present but where randomisation cannot be conducted. This makes it particularly suited for this analysis where randomising which school receives a School Street is not possible. Two difference in differences approaches are

used here. Firstly, a 'canonical' or 2x2 diff in diff approach is used on a subset of the data from years either side of the initial Covid-19 lockdowns in the school year 2019/20 and the most significant wave of School Street installations. This subset of the dataset contained before and after surveys for 363 schools, 60 (out of 107 included in the full dataset) of which had School Streets.

As not all intervention schools are in the sample of data from these years, a follow-up analysis is then used on the entirety of the dataset to include these schools and account for the multiple years of 'pre' data it introduces. This follows the method outlined by Gardner (2022), whose 2-step difference in difference is part of a more recent development in the methodological literature. In studies such as this a two-way fixed effects model with an additional group time treatment effect is often used (Butts and Gardner, 2022). However, recent scholarship in econometrics has questioned whether this two-way fixed effects approach provides an accurate estimation of the typical treatment effect of a given intervention (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021; Gardner, 2022). This is in part because these approaches assume that the effects of treatment are homogenous across observations and time periods. This is most often not the case in the study of interventions like School Streets, where, as already discussed, the length of exposure may impact outcomes with changes potentially fading away. Gardner's 2-step difference in difference approach first looks at group and time effects in the untreated observations before calculating average effects by comparing intervention to comparison groups with the group and time effects removed. This method is appropriate when studying datasets with staggered intervention times and heterogeneous intervention effects. In doing so it allows for exposure effects of a School Street to be assessed.

The primary assumption of difference in differences analysis is known as the assumption of parallel trends. This assumes that if no intervention had taken place both groups would have continued to change along the same trend. This is examined using the 2-step difference in differences approach in the results section. The other primary assumption is that all time-variant differences unrelated to the intervention are experienced equally across the intervention and comparison groups. The effects of the Covid-19 lockdowns are significant time-variant changes. In the broadest sense this has been experienced evenly across schools in that all schools were closed for similar periods of time. However, some mobility-related differences will remain; for example, the percentage of parents who were

able to work from home may vary between schools. Care has been taken to ensure all post observations straddle both the introduction of the School Street and the beginning of the pandemic, a process made easier by the fact that the majority of schemes were installed during September 2020 (see Figure 32) with most valid post surveys conducted the following spring. However, there is no dataset for rates of parental home-working to control for such variation. The other primary time variant feature are other interventions installed during the same period. Several of the Local Authorities in London which had significant School Streets programmes also installed Low Traffic Neighbourhoods around the same time. These are likely to have some impact on mobility patterns and could augment the effect of a School Street. However, only 25 of the 527 schools in the study are within LTN areas (Active Travel Academy 2020) and of those only 8 have School Streets. Although children travelling to schools outside of an LTN area may still go through LTNs to get there, by this more crude metric there does not appear to be a significant bias towards the intervention group which might confound any observed AST increases.

8.3.4.3. Sensitivity Analysis

Finally, a sensitivity analysis is conducted on a subset of the data. The headline descriptive statistics and the regression model for the canonical difference in differences approach are re-run using stricter requirements for response rate. In terms of descriptive statistics and difference in difference estimated effect sizes, the results for this are broadly in line with the findings for the 50-150% threshold; however statistical power is lower. This is outlined in 10.9 (Appendix I).

8.4. Results

8.4.1. Background Trends

Examining the average rates of different modes of travel to school year to year provides a general picture of the background trends in London's school travel. Prior to Covid-19 changes are generally small and schools that would go on to have a School Street have similar trajectories to those which do not. This is particularly the case with active modes of travel (Figure 35), although interestingly, these schools start from a higher rate for all modes of active travel. This implies that factors that might make a School Street possible, or attractive in a specific location may also already facilitate higher than average use of active modes.

Generally, it appears that the very slight overall trend towards increasing rates of active travel level off or even slightly decline after 2020/21 although this effect is much smaller for School Street schools, most of which would have their schemes in place at this point. Care should be taken with interpreting the 2021/22 data as it has a much lower response rate than previous years, see Figure 34 (2019/20 has been removed as almost no surveys were conducted due to Covid-related disruption).

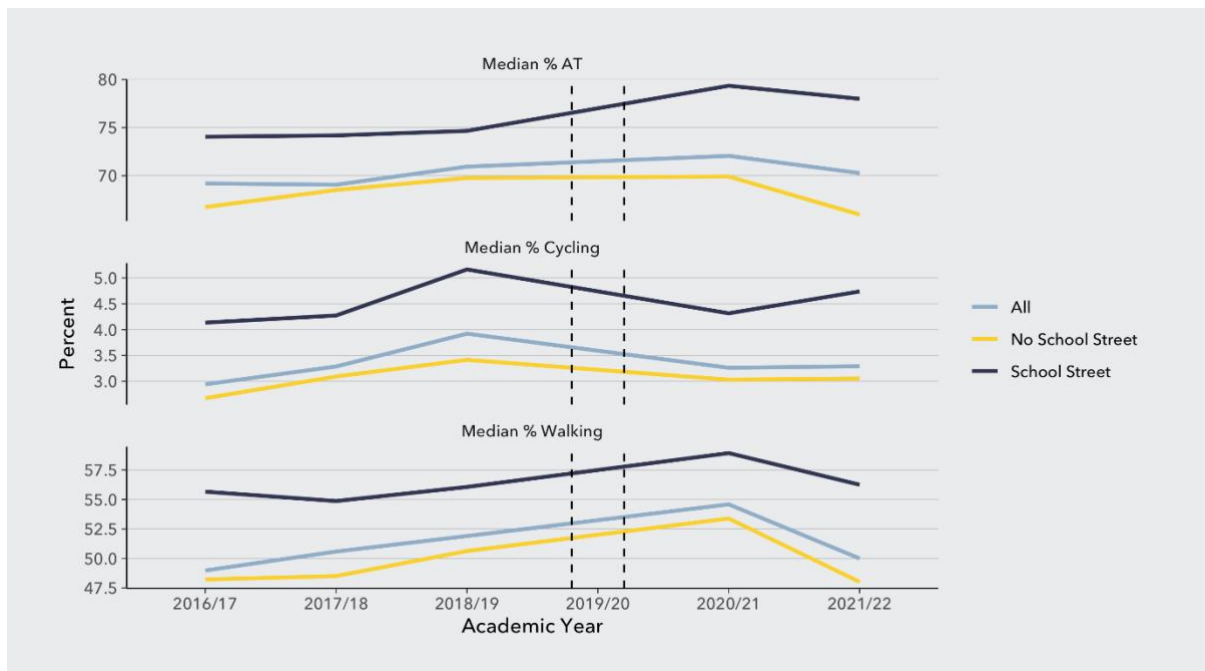


Figure 35 – Background trends in rates of active modes of travel to School, split by whether a School Street was eventually installed at a school or not. Dashed vertical lines highlight the 2019-20 initial Covid-19 year where due to low response rate (Figure 3) data has been imputed to demonstrate the longer trend.

These background trends are more mixed when considering public and motorised modes of transportation (Figure 36). School Street schools start from lower rates of motorised trips to school and similar levels of public transport use (although this is much more variable). Across all schools, rates of PMV use prior to the Covid-19 pandemic were mostly flat, with perhaps a slight tendency towards decline. This has since changed to a noticeable increase, although this is less so for School Street schools. Although altogether more variable, as would be expected, the use of public transportation declines rapidly after the beginning of the Covid-19 pandemic. What is perhaps surprising is that this decline is steeper for schools with a School Street than it is for those without.

Overall, these background trends show that schools that received School Streets in the period following the beginning of the Covid-19 pandemic started from higher pre-existing levels of sustainable and active mode share than those that did not. It also demonstrates that more stable trends in changing mode share were to some extent disrupted by the pandemic, especially for motorised and public modes of transport.

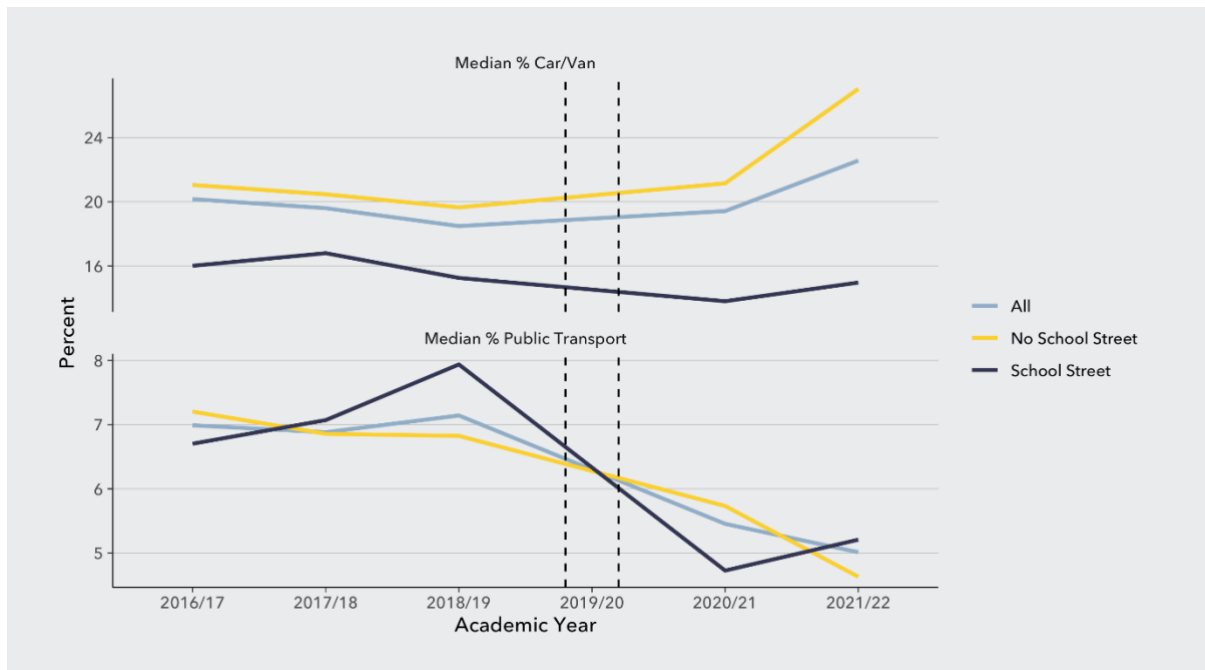


Figure 36 – Background trends in rates of non-active modes of travel to School, split by whether a School Street was eventually installed at a school or not. Dashed vertical lines highlight the 2019-20 initial Covid-19 year where due to low response rate (figure 3) data has been imputed to demonstrate the longer trend.

8.4.2. Descriptive Statistics

Overall, active travel remains the dominant form of transportation to school for primary aged children in London, with walking the primary mode. The median mode share for AST before March 2020 is 69.6%. Analysing the surveys on either side of the initial Covid-19 lockdowns shows small changes in the overall travel patterns. Small increases in Active Travel mode share (+2 percentage points), mostly driven by walking (rates of cycling are unchanged), with minor increases in motorised travel and expected decreases in public transport use. Comparing the subset of the surveys from the intervention group before and after the introduction of a School Street shows more significant changes with median Active Travel mode share increasing by over 4.8 percentage points, and the use of private motor vehicles showing a

decline (as compared with the slight increase in the overall dataset over the same period). This provides positive early indications of the impact of as School Street on changing mobility patterns on the trip to school.

Table 20 – Average rates of different modes of travel to school in the different survey groups.

		Average	% AT	% Walk	% Cycling	% Motorised	% Public Transport
All Surveys	Before March 2020	Median	69.6	50.5	3.4	19.5	7.0
	After March 2020		71.6	53.4	3.3	19.8	5.4
	Difference		2.0	2.9	-0.1	0.4	-1.6
	Before March 2020	Mean	67.7	50.1	4.3	21.4	8.8
	After March 2020		69.8	53.1	4.2	21.8	6.7
	Difference		2.1	3.0	-0.1	0.4	-2.1
School Street Surveys	Before School Street	Median	74.0	56.2	4.2	16.1	7.4
	After School Street		78.6	58.3	4.4	14.2	4.8
	Difference		4.6	2.1	0.2	-1.9	-2.6
	Before School Street	Mean	72.6	55.0	5.3	17.6	8.6
	After School Street		77.4	57.8	4.9	14.9	6.6
	Difference		4.8	2.8	-0.4	-2.6	-2.0
	Total	Median	70.2	51.6	3.3	19.6	6.4
	Total	Mean	68.4	51.1	4.2	21.6	8.1

8.4.3. Difference in Differences

The results of the canonical difference in differences approach can be represented graphically. Figure 37 and Figure 38 show the difference between the counterfactual trend and the observed change in mode share for AST and PMV use. In this case, only data from the school years 2018/2012 and 2020/2021 are used. Here rates of both AST and PMV show notable differences. While AST mode share has increased at all school types, the mean increase at School Street schools is 5.4 percentage points higher than the counterfactual – that is, what we would expect if School Streets schools had followed the same trend as the comparator schools. For private motor vehicles, the post-observation value is some 3.9 percentage points lower than the counterfactual. This implies a possible effect from School

Streets in line with the intended outcome of increased Active Travel and decreased private motor vehicle use.

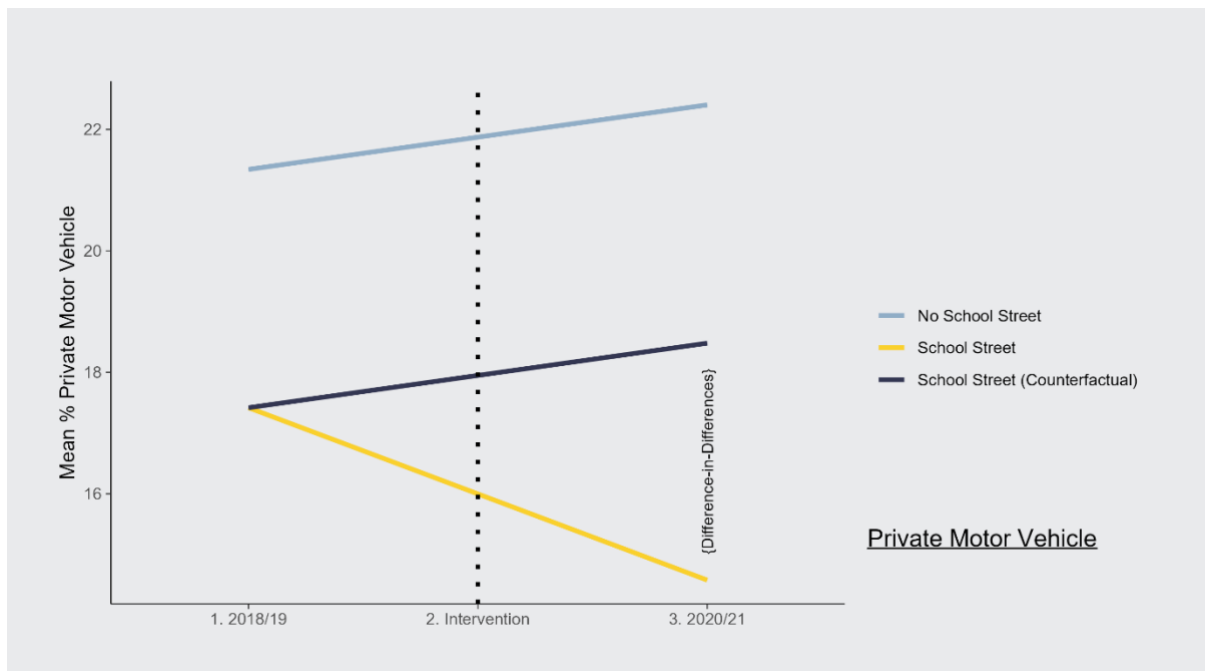


Figure 37 – A Difference in Differences plot for changes in private motor vehicle mode share before and after the introduction of a School Street.

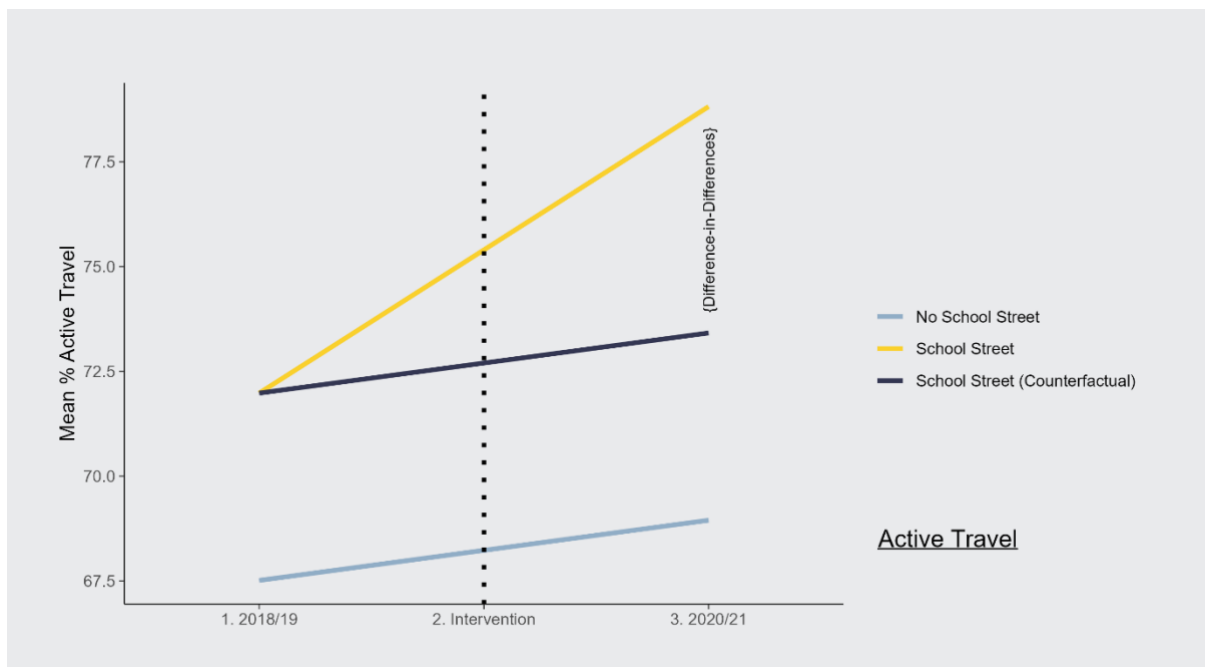


Figure 38 – A Difference in Differences plot for changes in Active Travel mode share before and after the introduction of a School Street

To confirm whether there is a statistically significant effect associated with the School Street intervention, the statistical significance of the difference in differences estimate can be determined through a linear regression model. The estimate is here also the coefficient for the interaction between the before/after and treatment/comparison dummy variables in the regression⁴⁷. Table 3 shows the output for this analysis⁴⁸. Both the estimate of a 5.40 percentage point increase in AST mode share ($p = 0.059$) and the -3.90 percentage point decrease in driving ($p = 0.079$) are not statistically significant at $p < 0.05$. We cannot say therefore that the changes seen in this more limited sample are the result of the introduction of a School Street.

Table 21 – Regression output for canonical difference in differences analysis.

	<i>Dependent variable:</i>	
	% Private Motor Vehicle	% Active Travel
	Outcome	Outcome
Intercept (β_0)	21.34** (0.64)	67.51** (0.82)
Treatment (β_1)	1.06 (0.90)	1.44 (1.16)
Post-treatment (β_2)	-3.92* (1.57)	4.47* (2.02)
Diff in Diff (β_3)	-3.90 (2.21)	5.40 (2.85)

Note: * $p < 0.05$; ** $p < 0.01$

⁴⁷ The equation for this in this case is: $Y = \beta_0 + \beta_1 * \text{School Street} + \beta_2 * \text{Before_After} + \beta_3 * (\text{School Street} * \text{Before_After}) + e$

⁴⁸ Conducted in R using the lm function.

8.4.4. Two-step Difference in Differences with staggered intervention times

The results for the panel study style two-stage diff in diff regression analysis is outlined below. This groups the estimated effect of being in the intervention group by the number of years distance from the intervention date (both before and after). Table 22 shows the results for both Active Travel to School (%AST) and private motor vehicle (%PMV) mode share outcome variables. In this case we see statistically significant estimated effects ($p < 0.01$) for both increase in active travel and decrease in private motor vehicle use immediately following the introduction of a School Street (time to intervention = 0, within the same school year as the intervention date). In the year after the effect is statistically insignificant for AST, but remains at a lower effect size for PMV. This might imply that active travel benefits are short-lived; however, the estimations for one year after intervention are based on many fewer observations (91 obs. for time to intervention = 0 vs. 33 obs. for time to intervention = 1), so more follow-up data would be needed to assess this with certainty.

Table 22 – Regression output from two stage difference in difference panel study, showing estimated treatment effects per year distance from intervention year.

Dependent Variable:	%AST	%PMV
Model:	(1)	(1)
<i>Variables</i>		
time to intervention = -4	-0.0218 (0.5247)	0.4021 (0.4497)
time to intervention = -3	0.7616 (0.4596)	-0.3833 (0.4461)
time to intervention = 0	4.860** (1.057)	-4.564** (0.9871)
time to intervention = 1	2.152 (1.777)	-3.308* (1.357)
<i>Fit statistics</i>		
Observations	1,779	1,779
R ²	0.03144	0.03657

Adjusted R ²	0.02980	0.03494
-------------------------	---------	---------

Custom standard-errors in parentheses, years -5, -1, and 2 removed due to too few obs.

*Note: *p < 0.05; **p < 0.01*

Under the assumption of parallel trends we would expect to see little to no effect in the years preceding the intervention (time to intervention = -4 to -1)⁴⁹. Figure 39 and Figure 40 plots these treatment effects with their upper and lower confidence intervals (at $p = 0.05$). For private motor vehicle use there are no statistically significant effects prior to the intervention point – all error bars cross the 0 line – but there is still notable year-to-year variability. For AST mode share the results are similar. Given that neither show statistically significant effects prior to the intervention point we can assume that it meets the assumption of parallel trends, with some caveats around year-to-year variability, particularly for AST. This is reflected in Figure 35 and Figure 36 in the background trends section, where there is greater divergence in pre-covid trends in AST mode share than for private motor vehicle share which are closer to parallel. For both years following School Street interventions the confidence intervals are very wide, particularly in the case of AST, suggesting that the possible outcomes for School Street schools are highly variable but tend towards a positive a statistically significant change in mode share.

⁴⁹ Note that years -5, -1, and 2 have been removed due to very low observations in the intervention group. Because of this -2 years is used as the reference year in the event study.

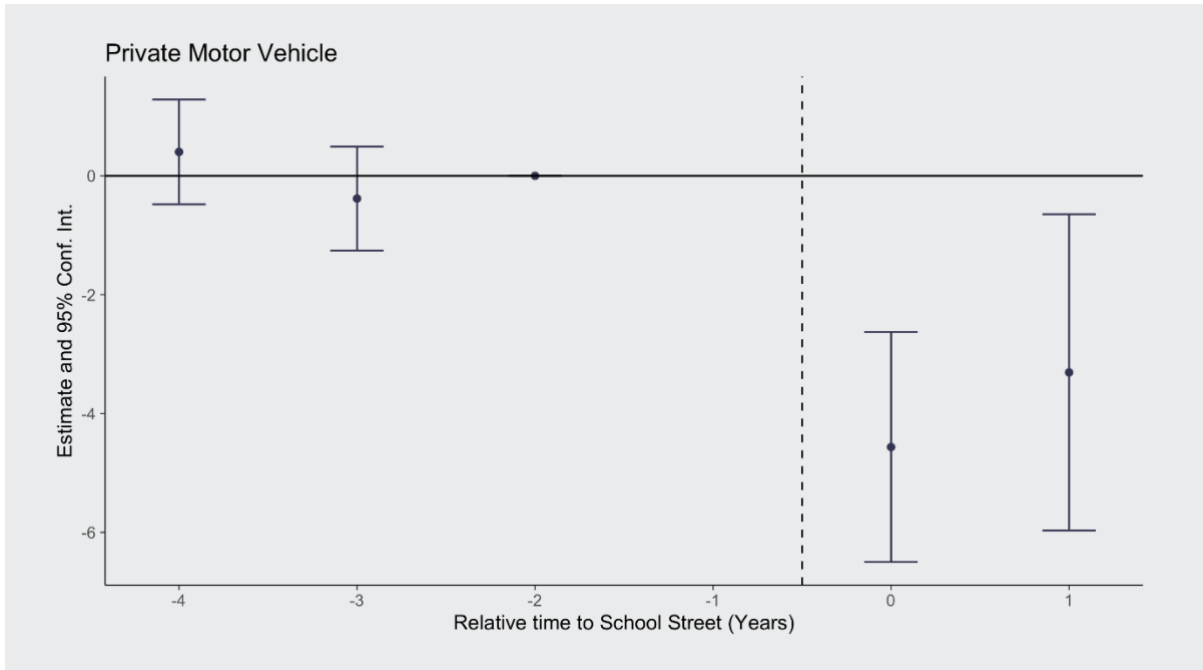


Figure 39 – Event study with staggered treatment, average effect of School Street by year on Private Motor Vehicle mode share

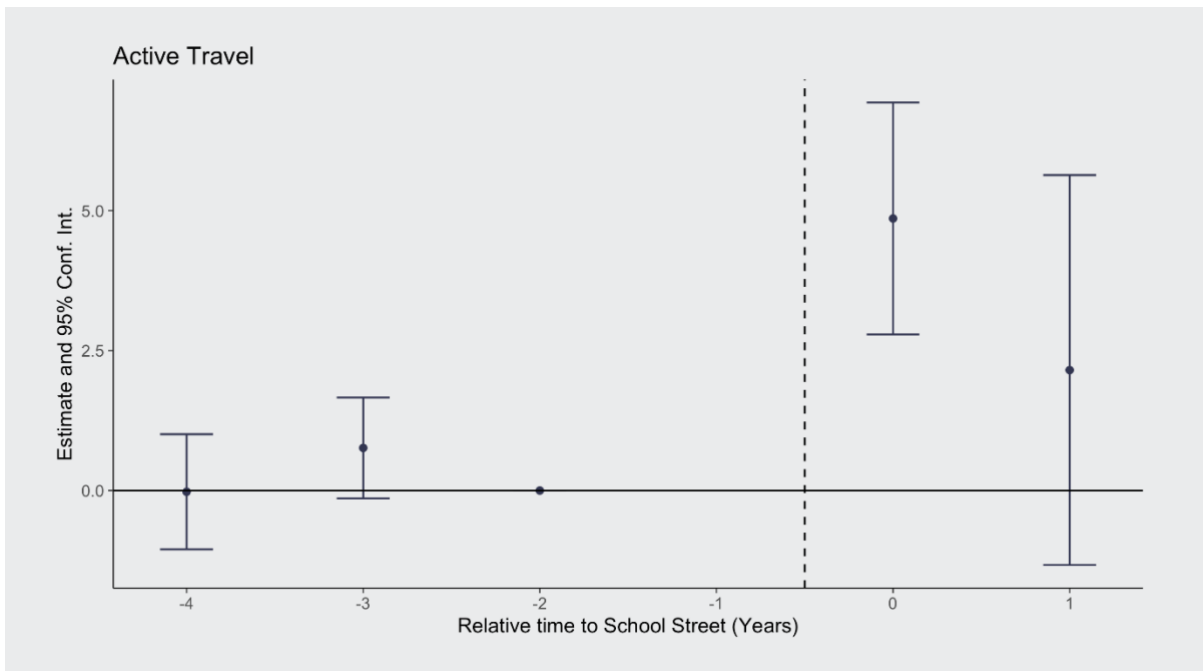


Figure 40 – Event study with staggered treatment, average effect of School Street by year on Active Travel mode share

8.5. Discussion

As a novel (quasi-infrastructural/quasi-regulatory) intervention to promote AST, understanding the impacts of a School Street on modal shift adds to a growing literature on intervention studies focused specifically on this important and unique trip type. Although School Streets confer other more direct benefits on the street, their contribution to

transforming wider mobility systems hinges in part on modal shift. This is potentially even more relevant given the Covid-19 context within which these schemes were introduced. With expected declines in public transport, this research also shows a slight background trend towards increasing use of private motor vehicles over this period on the school trip. Thus, the case for effective interventions to decrease the use of private motor vehicles and increase rates of AST remains just as if not more salient than it has during past policy efforts, of which several have been discussed.

Considering again the first research question (RQ1) addressed by this chapter, a tentative conclusion can be drawn that these schemes *are* resulting in some degree of shift to active modes of travel. However, wider post-intervention confidence intervals in the 2-step difference in differences analysis imply that the scale of this change is variable between schools. Although the canonical difference in differences analysis does not show statistically significant treatment effects on either outcome variables, the two-step difference in differences analysis does, at least in the first treatment period. Considering RQ2, Hopkinson et al.'s previous estimate for School Street-derived reductions in PMV use estimated potential changes at around a 3-6 percentage point reduction in car travel (Hopkinson *et al.*, 2021). The findings from this analysis broadly supports this range, with typical treatment effects for car travel being around -4.6 percentage points across both analysis methods. The evidence for increases in AST show similar effects (+4.9 percentage points) but also suffer from greater variability. This put them slightly below the effect size achieved by 'best practice' school travel planning efforts as reported by Cairns et al. (2019), with -9%-point decreases in PMV use detected in this study. However, as outlined in the literature review, direct comparisons with other interventions are difficult due to the heterogeneity in outcome variables used and the wide range of quality in methods. It is also difficult to establish whether this is in line with other similar interventions, as few studies have examined AST interventions where the primary mechanism for behavioural change is the improvement of public space.

Beyond the presence of the School Street intervention itself, this study does not directly address potential causal mechanisms for this observed mode shift. However, some reflection on resonances with and diversions from previous research on AST does provide potential pathways for further investigation. It is well recorded that in addition to proximity, parental perception of safety is a key determinant of AST. Perhaps counter to the implicit thesis of a School Street, Rothman et al. (2015) find that parental perception of the whole-

route safety is a greater determinant than perception of safety at the school gates, and in general the role of parents' subjective assessments of traffic levels is inconsistent. However, as seen in Builung et al.'s (2017) research, objective traffic levels in the area around a school correlates with independent mobility on the trip to school, providing support for the idea that School Streets might be driving change in part through improvements in parental perception of safety, even if the route to school is largely unchanged. Another potential explanation for this mode shift comes from Panter et al.'s (2013) study, which found the perceived inconvenience of driving – a indicator not often included in prior studies – as a predictor of AST. As with Low Traffic Neighbourhoods, a partial aim of the intervention is that it serves as both carrot and stick; with the improvement in space also accompanying a decrease in the convenience of driving short trips. The efficacy of School Streets shown here suggests that this could be an influencing factor in parental decision making. As Aldred (2019) points out, in such interventions it is difficult to disentangle whether it is the 'carrot' or 'stick' that is driving any observed modal shift. However, existing evidence for the role of both traffic reduction and driver inconvenience in AST implies that one or both factors may play a role in the changes observed here.

8.5.1. Strengths and Limitations

Panter et al. (2019) examine several intervention studies, attempting to meta-analyse potential supporting contexts and causal mechanisms for increases in active travel. Although the causal mechanisms remained elusive, they found increases in active travel associated with interventions with supporting contexts that increase accessibility for active modes, as well as those that increase safety. They argue that studying interventions and their contexts can be a way to gain greater insight into 'what works' in promoting walking and cycling for future intervention development. The strength of the research presented in this chapter lies along these lines. Although we cannot say with confidence what the causal mechanism might be, the quasi-experimental nature of this study provides evidence for the effectiveness of the School Street in instigating behavioural change on the trip to school in London. This is an improvement on the limited previous research on School Street behaviour change and avoids some common problems other studies on AST have faced, particularly around inconsistent use of appropriate controls and sample sizes (Möser and Bamberg, 2008). Considering these findings within a wider discussion of the nature of the School Street intervention and other

similar approaches, we can gain additional understanding of ‘what works’ on the trip to school.

Nevertheless, the nature of the dataset means there are some limits to what can be concluded. For example, this is an unbalanced panel, with each group (school), containing only a few years of data, often with gaps. This reflects the voluntary and unsupervised nature of the survey; if schools are not motivated to submit the data regularly and record it to a high standard then the quality is more limited. Longitudinal school travel data with stricter protocols over how data is collected and at which time of year – as is available in Scotland – would begin to address these issues and help to analyse policies such as this more confidently. Although this research draws on data from 107 School Streets schemes, this is not quite enough to significantly subset the data further and draw conclusions about which school and scheme characteristics may limit or facilitate further mode-shift. For example, understanding whether other interventions like Low Traffic Neighbourhoods or cycling infrastructure augment any observed mode-shift would be helpful in transferring these findings into practical guidance for practitioners seeking to undertake similar street experiments.

Furthermore, the STARS database only includes schools which are engaged with active travel issues through TfL’s accreditation scheme. Although this is the case for both the intervention and comparator groups, it potentially limits the applicability of the findings to schools who are disengaged with promoting active travel. In previous chapters, qualitative interviews with practitioners have highlighted the importance of the complementarity between ‘softer’ work within the school and the introduction of a School Street. The modal shift seen here might well be a product of this synergy, as opposed to the effect of the School Street in isolation. This data is also geographically restricted to London which may also limit its wider applicability.

However, these findings do have some unique benefits. Firstly, the study examines a relatively large number of schools, providing breadth if not depth in terms of data granularity. In addition, and thanks to an effort during the 2020/21 school year, many schools have had recent surveys following a lapse during the acute phase of the Covid pandemic (2019/20). As a result, a difference in differences approach can be used that spans both exogenous changes to mobility patterns caused by the disruption of Covid-19 as well as the installation of many School Streets. This is important as Covid-19, while significantly disrupting travel patterns was also a time of extensive experimentation in urban streets. Access to travel data with enough

geographical specificity to be able to measure the effects of an intervention on the relatively small scale of a School Street is novel. The effects of such interventions may be difficult to detect through city or regional-level mobility surveys and thus their contribution to transforming urban mobility (in addition to public space) may well be understated without similar datasets, however imperfect.

This data is further necessary to understand the persistence of any changes in mobility that might be derived from these interventions. To date, this study does not have enough follow-up data to assess this definitively. Although a slight drop-off is observed, it is in a much smaller sample size of schools than used to measure the immediate effects. Nevertheless, follow-up studies with the same analysis would likely be able to better understand the multi-year exposure effect of a School Street, positive or negative. Given the often-limited scale of investment in street experiments, the use of readymade secondary datasets such as this may provide a way to analyse similar interventions.

Conclusion

The overarching aim of this research project has been to understand the contribution of School Streets to the mobility of children in London, and to connect this novel intervention to wider dynamics in urban policy in this city and beyond. It has also sought to reflect the unique context in which this research has been conducted, and its structure and mode of enquiry reflects the process of methodological adaptation, the embrace of emerging research opportunities, and the profound constraints of researching during Covid-19. Drawing on this ‘bricolage’ approach each core chapter has taken an aspect of the implementation of School Streets and explored its connection to wider academic debates, guided by a set of more specific research questions. The purpose of this section is to reiterate the most important insights from this process, and as much as possible, draw these more diffuse strands together to reflect on common themes across this thesis.

Overall, the contribution of this thesis can be understood within the two major themes that organise it, namely behavioural change and policy process. Filling a research gap in the potential for this emerging typology of interventions to modify travel behaviour, this research shows that in London these schemes are associated with an increase in active travel to school and a decrease in private motor vehicle use. It provides evidence for their effectiveness in attending to long-standing policy goals around challenging the motorisation of the trip to school. It also makes the case for greater consideration of equity in the distribution of these schemes, especially in the context of what has been identified here as an increasingly established mode of pragmatic state-led ‘tactical urbanism’ in local urban governance. These are not, however, isolated observations. The policy processes through which School Streets have been conceived of and implemented have important implications for the outcomes of these schemes. These links between the two major themes of policy process and behavioural change will be explored in more detail here alongside the implications of these findings for policy and practice, the limitations of this research, and the key questions it raises for future inquiry.

9.1. Tactical urbanism and health intervention design

Peck and Theodore (2015) describe what they call ‘fast policy’, whereby with increasing rapidity, “ideas that work” or “silver bullet” solutions to urban problems are transposed from

one context to another through various policymaker knowledge networks. The origins of School Streets outlined in Chapters 3 and 5 share some of these characteristics, with a transnational network of local government officers critical to their initial introduction in the UK. This concept speaks more generally to the spread of street-based interventions during the early stages Covid-19, where temporary pedestrian plazas in Milan or pop-up bike lanes in Paris became international news, watched by and replicated in different cities. The notion of 'fast policy' is also apt in that the emergency context of Covid-19 necessitated the rapid adoption of 'ideas that work' over slower more deliberative policy processes. Chapter 5 argued that this process could productively be understood through the concept of 'tactics,' with local government actors using a variety of pragmatic methods to implement schemes quickly. Although the dynamics of the central government pandemic response played a critical role in the expansion of School Streets, it marked a notably different mode of policy implementation than that of prior approaches to school travel policy in England. Along with an explicit focus on planning, the TTSI in the early 2000s represented a more comprehensive and centrally orchestrated approach to the problem of school mobility with clearly unified goals across the initiative. As Chapter 5 has shown, this contrasts notably with the action-centric orientation of practitioners during the implementation of School Streets.

This context of increasingly 'fast policy' not only relates to policy processes generally but is also revealing of the kind of knowledge that is drawn on in the development of School Streets policies in particular. Despite the often-cited health motivations for increasing active school travel, and the emphasis on carefully specified theory in public health intervention design (Glanz and Bishop, 2010), Chapter 7 found that formal theoretical understandings of School Streets were not in fact prevalent. Instead, tacit theories were expressed which drew on ideas loosely related to the 'wider determinants' of health and often expressed more pragmatically in terms of successfully adapting the School Street concept to the needs of a specific urban environment. This is understandable given that, as has already been pointed out, the concept of a School Street was not designed from first principles relying on a specific theory but instead through the purposefully less systematic process of state-led tactical urbanism. As argued in Chapter 5 this process should be understood within the political context of neoliberal austerity, new localism, and more recently the Covid-19 response.

This political point raises important questions for public health researchers and practitioners, among whom there appears to be increasing interest in the role of the built

environment and its modification in increasing rates of physical activity. A key question is how best to integrate theoretical understandings into a mode of policy intervention defined more by pragmatism. Tactical urbanism is often cited as a potential bridge for the implementation gap between city strategies and actual change (Vallance and Edwards, 2021). Drawing on Ogden (2016) Chapter 7 also highlights another gap in this case between models of public health intervention design and the need to respond to site-specific demands in the urban environment. The ideal of 'theory driven' public health interventions may require adjustment in the context of policy process which seek to achieve these goals through more iterative and ad hoc means. This requires attention to the different criteria by which the designs of these schemes can be meaningfully adjusted and the trade-offs between them.

However, this not to say that there is no role for designing interventions from the ground up. Chapter 6 argues for a multi-level conception of equity, that incorporates socio-demographics with environmental factors and the wider administrative geography of the city to assess whether a given policy is implemented such that it will meet a 'minimum standard' of provision. This novel approach highlights that in their present form, what is deemed to be a feasible School Street leaves nearly a third of schools in London ineligible, with these sites often also facing some of the worst effects of car dominance. The problems at these schools are unlikely to be solved by a single 'fast policy' or a silver-bullet solution. More challenging tasks of area-wide traffic reduction, improvement of hard infrastructure, and changes to the fabric of the school itself will all likely play a role, complemented by city-wide policies like pollution charging under the soon to be expanded Ultra Low Emission Zone. Some local authorities are turning their 'School Streets' policies towards these problems, but much of the effort is still focused on expanding School Streets to more schools within the existing mould. Many of the pupils, parents, and carers currently disadvantaged by the status quo stand to benefit, particularly in local authorities with less extensive School Streets schemes. However, if, as stated by recent policy announcements, School Streets are to form a key element of the city's policy to increase walking to school (Mayor of London, 2022), a more strategic view should be adopted to ensure an equitable outcome. Potential recommendations along these lines are put forward in Chapter 6, highlighting the potential for helping non-participating boroughs develop schemes, and focusing efforts on designing new interventions for 'non-eligible' schools.

9.2. Mode-shift and its mechanisms

Shifts to active modes of travel on trips to school represent one of the key potential outcomes of a School Street. Reducing car use extends the benefits of these schemes beyond the immediate closure and into the surrounding area, also touching on wider goals around decarbonising the school trip. Chapter 8 finds that School Street schools saw statistically significant increases in active travel and decreases in private motor vehicle use compared with control schools. As well as providing key evidence for policymakers seeking to make the case for these schemes, these findings around mode shift also contribute to a wider international academic literature on the efficacy of interventions to promote active travel to school. To date, this body of research has generally under-considered interventions that focus on the urban environment (Pang, Kubacki and Rundle-Thiele, 2017), focusing more on ‘softer’ choice promotion interventions, with inconsistent evidence for effectiveness to date (Möser and Bamberg, 2008). Systematic reviews have highlighted methodological limitations in this existing body of research with the inconsistent use of control groups being a key issue (ibid; Chillon et al., 2011). The findings in Chapter 8 provide evidence for this under-researched intervention typology, and although not without its limitations, the quasi-experimental study structure used here addresses some methodological concerns within the existing evidence base.

9.2.1. Limitations

Although establishing that these schemes *do* play a role in transport behaviour remains an important contribution of this dissertation, there is still utility in further exploring the question that I set out to participants in Chapter 7, namely *how* do School Streets effect change. As outlined in the chapter on research design (4), key challenges related to researching during the Covid-19 pandemic necessitated the adoption of a more flexible approach to mixed methods research. Methodological bricolage has been used here to work pragmatically with the data and methods that were available to create a set of overlapping research contributions on a single topic. However, without the voices of parents/carers and crucially children there are inherent limits on what this research can reveal. The factors that underpin the behaviour change observed here are one such area. This issue is by no means unique to this study. The under-theorisation of the relationship between the urban

environment and transport behaviour has been well acknowledged (Handy, 1996; Næss, 2015; Panter *et al.*, 2019), and remains an important topic for further research both in general and specifically in the case of School Streets. It is possible that with greater understanding of what aspect of a School Street is driving such change, their contribution to wider mobility transitions might be improved.

9.2.2. Mechanisms and the study of interventions

However, the study of interventions to understand “what works” in terms of influencing travel behaviour also represents an approach with increasing salience in the academic literature (Stappers *et al.*, 2018; Panter *et al.*, 2019). In line with the pragmatist worldview adopted in this project, this literature reverses the direction of enquiry, moving from attempts to understand more general principles of mobility behaviour through the study of its determinants in the environment, to looking for actual instances of behavioural change and elucidating insights from the nature of the intervention. In adopting this stance there are some more speculative insights that can be highlighted here. Although inconsistent and sometimes contradictory, the tacit theories of change expressed by practitioners in Chapter 7 highlight the relative emphasis on the (in)convenience of driving and/or the improvement of the environment for walking and cycling – the ‘carrot’ or ‘stick’ elements of these schemes. The effectiveness of combining these (dis)incentives has some precedent in research (Piatkowski, Marshall and Krizek, 2019; Xiao *et al.*, 2022). However, more research will be needed to disentangle the relative roles of carrots and sticks in such interventions more fully (Aldred, 2019). This will allow in part for a better understanding of what to emphasise in future scheme designs.

9.3. The future of School Streets

The future of more optimised schemes also raises a normative question that relates to some of the central concepts around children’s (auto)mobility raised in Chapter 2. If the health and independence of children are adversely affected by the present ‘structure of auto space’ (Freund 1993, quoted in Sheller and Urry 2000, p744), what does a street designed for the mobility of children actually look like—and perhaps more directly, does it look like the School Streets that have been considered here? This is a separate question to what the is the most

efficacious design for modal shift, instead drawing attention to the wider needs of children in their urban space. Russell and Stenning (2020) point out that while many of the policy responses and government narratives during the initial stages of the Covid-19 pandemic focused on active travel or outdoor recreation for exercise, the needs of children to play and dwell in residential streets were somewhat overlooked. On this basis Wright and Reardon argue that this moment should be seized as an opportunity to explicitly reallocate road space to the benefit of children and their health. School Streets undoubtedly play a role in this, but not all necessarily provide a space for dwelling and play. TfL's recent case studies (Transport for London, 2022) indicate that the use of space by pedestrians is related to the level of residual (exempt or transgressing) traffic on the School Street, with the carriageway more actively used when traffic is lower – indicating that this might be a critical aspect of whether a School Street is able to provide greater pedestrian comfort. Although clearly important in understanding their impact on the wider problematic of children's (auto)mobility, reducing the School Street to its behavioural benefits perhaps obscures what is necessary to create more humane and convivial urban spaces. Thus, even if driver inconvenience *is* the causal mechanism for behavioural change, there is a normative case for more permanently adapting the urban environment for play and dwelling.

9.3.1. Comber Grove

On this point, it is worth considering a specific case to understand how a School Street might attend to these more fundamental questions of the experience of urban space. As I write the final sections of this document in August 2023, the street that runs through the estate I live on in south London is being torn up. The buildings here were built by the London County Council in the 1950s, aside from the school on the street which is the only remaining Victorian building and has been there since the area was predominately dense terraced housing. The mature London plane trees that line the street are perhaps the most magnificent feature of this post-war redevelopment. I do not know exactly when they were first planted, but they have now grown so large that their roots have heaved the flagstones, cracked the asphalt, and pushed the granite kerb stones out in the road. With this growth the gap between these trees and the brick wall of the school yard is now barely wide enough to push a pram through, and the surface is rippled and uneven. The addition of a guard rail in front of the school, likely in the 1990s by the look of its patina, makes the conditions even more confined, funnelling

pedestrians along a narrow channel towards the old arched doorway into the school yard. By virtue of its position in the street network – cutting the corner of a busy triangle of main roads – this was possibly once deemed necessary due to heavy through-traffic.

Perhaps because of these tree-narrowed pavements, Comber Grove was one of the first School Streets that Southwark council introduced in response to the Covid-19 pandemic. In contrast to the paradigmatic School Street defined in Chapter 3, this was created by a pair of removable bollards and a set of painted concrete blocks that stay there twenty-four hours a day, creating a small traffic-free area in front of the school, about 30 meters in length. The old guard rail now feels particularly anachronistic as people no longer walk on this stretch of pavement, opting instead to take the road where there is more space to stretch out. At drop-off time parents sit on the low brick wall across the street, or the concrete blocks, and others stand chatting in small groups on the road. Very occasionally a car will pull up near to the closure, drop off a child and gingerly perform a multi-point turn, returning the way they came.



Figure 41 - Comber Grove in transition. Source: Author

Over the 3 years it has been closed, small weeds have poked out from underneath the big granite kerb stones, flourishing in this newly liminal patch of road. However, they're now being ripped out along with the concrete blocks as the council has decided to make something more permanent and durable here. Although, with the ETO expiring (see Chapter 5), this closure has been officially 'permanent' for over a year, up until now its form has felt charmingly impermanent. The old flaking yellow zig zag road markings remain on the street as a piece of marooned infrastructure, now rendered meaningless by the absence of cars. Although I have not seen the final designs for the new street, as I walk past, I can see that the pavements are being extended, giving space for the trees to stretch their roots and for people

to manoeuvre around without having to step off the kerb. Whether benches to rest on or objects that might attract the play of children will be a part of this design remains to be seen, but the low wall means that there will always be a place to sit and rest if needed.

Here, the simple removal of traffic has created a more humane public space. It may not be Jane Jacobs' Greenwich Village, but our cat uses it to safely cross over to where the pigeons are, parents linger after their children have gone into the school in the morning, at pickup time children play more, and it is easier to coexist with the mature trees that will be central to the amenability of the street as climate patterns shift. Much of this is achieved by the complete removal of traffic, but it seems that the local authority has understood that the removal of cars can also serve as a starting point to reconsider the space with other uses in mind. Other cities have been quicker to this, perhaps Barcelona more so than any other, where the provision of seating and 'playable' designs have been central to their *Protegim les Escoles* (protected schools) programme (see Figure 12). In these schemes, there is a sense that the public life of the street, and children's play, have been the starting point for the design rather than a happy coincidence of traffic reduction.

9.4. Final thoughts

This account highlights a final recommendation for policymakers, which is to also attend to the public life of the street when designing and appraising schemes. As the practitioner interviews in this research (particularly Chapter 5) attest, modal shift is in part dependent on the 'success' of a School Street both with the school and wider community. This is supported by Smeds and Papa's research (2023) which highlights that within the broader context of urban street experiments, rationales for improving 'public life' have greater salience among local residents than those focused purely on mobility. Mode of travel is only one aspect of the complex of children's (auto)mobility. Taking seriously the idea of a child's right to the city, where they are able to participate in life outside the home on their own terms, means looking more fundamentally at the essential characteristics of the street environment and people's experience of it.

Appendices

10.1. Appendix A – District Borough Distribution

Table 23 – The distribution of School Street and non-School Street state primary schools across Greater London's boroughs (April 2022)

Local Authority	Schools				Pupils			
	Counts		Percentages		Counts		Percentages	
	Non-School Street	School Street	Non-School Street	School Street	Non-School Street	School Street	Non-School Street	School Street
Barking and Dagenham	38	5	88.37	11.63	21,424	3,575	85.7	14.3
Barnet	80	10	88.89	11.11	27,060	3,766	87.78	12.22
Bexley	59	0	100	0	22,935	0	100	0
Brent	33	25	56.9	43.1	14,588	10,964	57.09	42.91
Bromley	73	4	94.81	5.19	26,515	1,484	94.7	5.3
Camden	27	11	71.05	28.95	6,799	3,358	66.94	33.06
City of London	1	0	100	0	270	0	100	0
Croydon	64	11	85.33	14.67	22,103	4,981	81.61	18.39
Ealing	52	16	76.47	23.53	23,392	7,935	74.67	25.33
Enfield	54	14	79.41	20.59	23,761	7,546	75.9	24.1
Greenwich	53	6	89.83	10.17	21,649	2,735	88.78	11.22
Hackney	11	39	22	78	3,375	12,745	20.94	79.06
Hammersmith and Fulham	36	0	100	0	9,928	0	100	0
Haringey	38	24	61.29	38.71	12,422	8,705	58.8	41.2
Harrow	38	3	92.68	7.32	20,141	1,755	91.98	8.02
Havering	56	4	93.33	6.67	22,021	1,751	92.63	7.37
Hillingdon	67	1	98.53	1.47	28,624	616	97.89	2.11
Hounslow	27	21	56.25	43.75	12,281	10,471	53.98	46.02
Islington	14	19	42.42	57.58	4,678	5,146	47.62	52.38
Kensington and Chelsea	23	3	88.46	11.54	5,593	924	85.82	14.18
Kingston upon Thames	27	7	79.41	20.59	10,195	3,420	74.88	25.12
Lambeth	37	23	61.67	38.33	11,663	9,444	55.26	44.74
Lewisham	32	33	49.23	50.77	9,946	14,168	41.25	58.75
Merton	18	23	43.9	56.1	7,050	9,345	43	57
Newham	57	6	90.48	9.52	29,190	3,946	88.09	11.91
Redbridge	45	4	91.84	8.16	25,759	2,114	92.42	7.58
Richmond upon Thames	33	12	73.33	26.67	12,698	4,614	73.35	26.65
Southwark	50	16	75.76	24.24	15,163	5,409	73.71	26.29

Sutton	29	11	72.5	27.5	12,932	6,082	68.01	31.99
Tower Hamlets	44	24	64.71	35.29	15,427	10,036	60.59	39.41
Waltham Forest	35	13	72.92	27.08	15,369	8,488	64.42	35.58
Wandsworth	42	20	67.74	32.26	12,652	7,168	63.83	36.17
Westminster	26	12	68.42	31.58	5,937	2,991	66.5	33.5

Table 24 – The difference between the counts and proportions of actual School Street schools and an equitable distribution of the same number of School Street schools in different district boroughs (based on the Index of Equity)

District	Actual School Street Schools				Predicted School Street Schools				Difference	
	Count		Percent		Count		Percent		Percentage point	
	Schools	Pupils	Schools	Pupils	Schools	Pupils	Schools	Pupils	Schools	Pupils
Merton	23	9345	56.1	57	6	1762	14.63	10.75	41.47	46.25
Lewisham	33	14168	50.77	58.75	15	4520	23.08	18.74	27.69	40.01
Sutton	11	6082	27.5	31.99	0	0	0	0	27.5	31.99
Hackney	39	12745	78	79.06	23	7746	46	48.05	32	31.01
Waltham Forest	13	8488	27.08	35.58	5	1838	10.42	7.7	16.66	27.88
Richmond upon Thames	12	4614	26.67	26.65	0	0	0	0	26.67	26.65
Wandsworth	20	7168	32.26	36.17	9	2153	14.52	10.86	17.74	25.31
Hounslow	21	10471	43.75	46.02	11	4799	22.92	21.09	20.83	24.93
Kingston upon Thames	7	3420	20.59	25.12	2	944	5.88	6.93	14.71	18.19
Islington	19	5146	57.58	52.38	13	3459	39.39	35.21	18.19	17.17
Haringey	24	8705	38.71	41.2	17	5756	27.42	27.24	11.29	13.96
Brent	25	10964	43.1	42.91	20	8393	34.48	32.85	8.62	10.06
Enfield	14	7546	20.59	24.1	10	4766	14.71	15.22	5.88	8.88
Lambeth	23	9444	38.33	44.74	24	7652	40	36.25	-1.67	8.49
Havering	4	1751	6.67	7.37	0	0	0	0	6.67	7.37
Barnet	10	3766	11.11	12.22	4	1500	4.44	4.87	6.67	7.35
Harrow	3	1755	7.32	8.02	1	420	2.44	1.92	4.88	6.1
Bromley	4	1484	5.19	5.3	0	0	0	0	5.19	5.3
Barking and Dagenham	5	3575	11.63	14.3	5	2711	11.63	10.84	0	3.46
Hillingdon	1	616	1.47	2.11	3	1056	4.41	3.61	-2.94	-1.5
Greenwich	6	2735	10.17	11.22	8	3425	13.56	14.05	-3.39	-2.83
Bexley	0	0	0	0	3	979	5.08	4.27	-5.08	-4.27
Ealing	16	7935	23.53	25.33	26	9446	38.24	30.15	-14.71	-4.82
Westminster	12	2991	31.58	33.5	15	3691	39.47	41.34	-7.89	-7.84
Camden	11	3358	28.95	33.06	15	4275	39.47	42.09	-10.52	-9.03
Redbridge	4	2114	8.16	7.58	8	4890	16.33	17.54	-8.17	-9.96
Croydon	11	4981	14.67	18.39	23	8014	30.67	29.59	-16	-11.2
Southwark	16	5409	24.24	26.29	39	10811	59.09	52.55	-34.85	-26.26
Hammersmith and Fulham	0	0	0	0	11	2814	30.56	28.34	-30.56	-28.34
Kensington and Chelsea	3	924	11.54	14.18	12	3149	46.15	48.32	-34.61	-34.14
Tower Hamlets	24	10036	35.29	39.41	53	20195	77.94	79.31	-42.65	-39.9
Newham	6	3946	9.52	11.91	38	20734	60.32	62.57	-50.8	-50.66
City of London	0	0	0	0	1	270	100	100	-100	-100

Table 25 – The counts and proportions of predicted schools with School Streets (according to an equitable distribution) that are actual schools with School Streets in different district boroughs

District	Predicted School Street Schools		Predicted Schools That Are Actual School Street Schools			
	Counts		Counts		Percentage	
	Schools	Pupils	Schools	Pupils	Schools	Pupils
Hackney	23	7746	17	5300	73.91	68.42
Lewisham	15	4520	7	2480	46.67	54.87
Brent	20	8393	9	4130	45	49.21
Waltham Forest	5	1838	2	879	40	47.82
Tower Hamlets	53	20195	18	7795	33.96	38.6
Enfield	10	4766	3	1740	30	36.51
Islington	13	3459	5	1038	38.46	30.01
Camden	15	4275	4	1257	26.67	29.4
Southwark	39	10811	10	2993	25.64	27.68
Lambeth	24	7652	7	2105	29.17	27.51
Westminster	15	3691	3	929	20	25.17
Haringey	17	5756	4	1354	23.53	23.52
Hounslow	11	4799	2	648	18.18	13.5
Ealing	26	9446	4	1251	15.38	13.24
Merton	6	1762	1	225	16.67	12.77
Croydon	23	8014	2	936	8.7	11.68
Newham	38	20734	4	2417	10.53	11.66
Wandsworth	9	2153	1	198	11.11	9.2
Barking and Dagenham	5	2711	0	0	0	0
Barnet	4	1500	0	0	0	0
Bexley	3	979	0	0	0	0
City of London	1	270	0	0	0	0
Greenwich	8	3425	0	0	0	0
Hammersmith and Fulham	11	2814	0	0	0	0
Harrow	1	420	0	0	0	0
Hillingdon	3	1056	0	0	0	0
Kensington and Chelsea	12	3149	0	0	0	0
Kingston upon Thames	2	944	0	0	0	0
Redbridge	8	4890	0	0	0	0

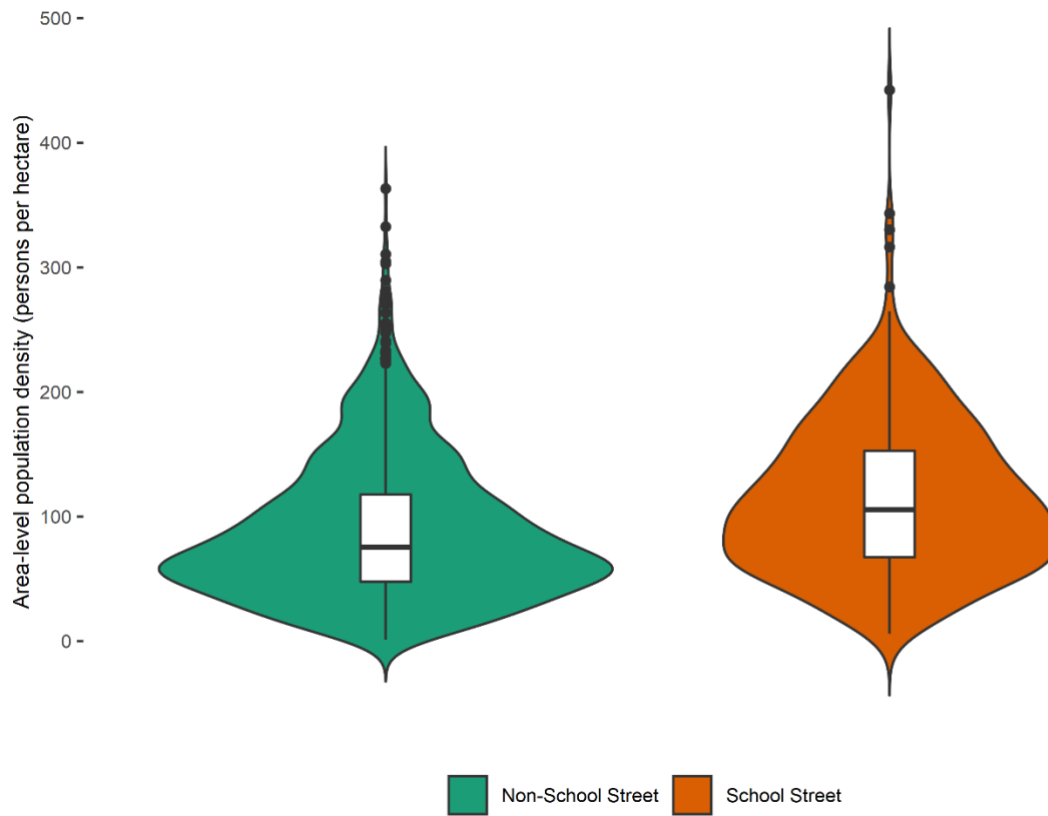


Figure 42 – The distribution of population density in LSOAs surrounding School Street and non-School Street schools

Table 26 – Summary statistics: population density by school status

School status	n	min	Q0.25	mean	median	Q0.75	max	sd
School Street school	420	6.1	67.4	114.2	105.4	152.8	442.2	61.3
Non-School Street school	1318	1.2	47.7	88.1	75.4	117.7	363.1	57.1

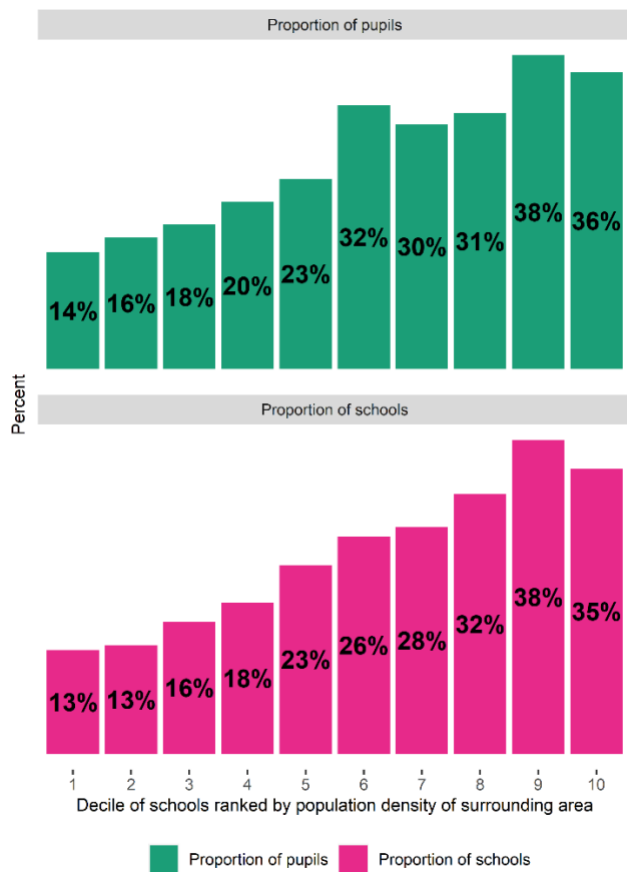


Figure 43 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by population density of the surrounding LSOA

10.2. Appendix B – Socioeconomic Equity

Table 27 – Total and proportion of pupils eligible for FSM by school status (inner and outer London)

Geography	School status	Total pupils	Total pupils eligible for FSM	Percent of pupils eligible for FSM
Inner London	Non-School Street	143,043	41,690	29.1
Inner London	School Street	84,040	24,737	29.4
Outer London	Non-School Street	370,497	69,202	18.7
Outer London	School Street	91,642	16,175	17.7

Table 28 – Total and proportion of pupils eligible for FSM by school status and district borough

District borough	Non-School Street			School Street		
	Pupils	Pupils eligible for FSM	Percent pupils eligible for FSM	Pupils	Pupils eligible for FSM	Percent pupils eligible for FSM
Barking and Dagenham	21,424	4,951	23.1	3,575	693	19.4
Barnet	27,060	4,496	16.6	3,766	874	23.2
Brent	14,588	2,332	16	10,964	1,875	17.1
Camden	6,799	2,478	36.4	3,358	1,297	38.6
Croydon	22,103	6,395	28.9	4,981	1,170	23.5
Ealing	23,392	5,126	21.9	7,935	1,625	20.5
Enfield	23,761	5,521	23.2	7,546	1,828	24.2
Greenwich	21,649	5,540	25.6	2,735	451	16.5
Hackney	3,375	1,039	30.8	12,745	4,760	37.3
Haringey	12,422	2,578	20.8	8,705	1,948	22.4
Hounslow	12,281	2,375	19.3	10,471	2,052	19.6
Islington	4,678	1,844	39.4	5,146	1,884	36.6
Kingston upon Thames	10,195	1,406	13.8	3,420	322	9.4
Lambeth	11,663	4,066	34.9	9,444	2,741	29
Lewisham	9,946	2,236	22.5	14,168	2,980	21
Merton	7,050	1,676	23.8	9,345	1,724	18.4
Newham	29,190	7,581	26	3,946	948	24
Richmond upon Thames	12,698	1,409	11.1	4,614	437	9.5
Southwark	15,163	4,910	32.4	5,409	1,940	35.9
Sutton	12,932	2,395	18.5	6,082	687	11.3
Tower Hamlets	15,427	5,325	34.5	10,036	3,712	37
Waltham Forest	15,369	3,179	20.7	8,488	1,572	18.5
Wandsworth	12,652	2,925	23.1	7,168	1,619	22.6
Westminster	5,937	2,019	34	2,991	729	24.4
Total	351,754	83,802		167,038	39,868	

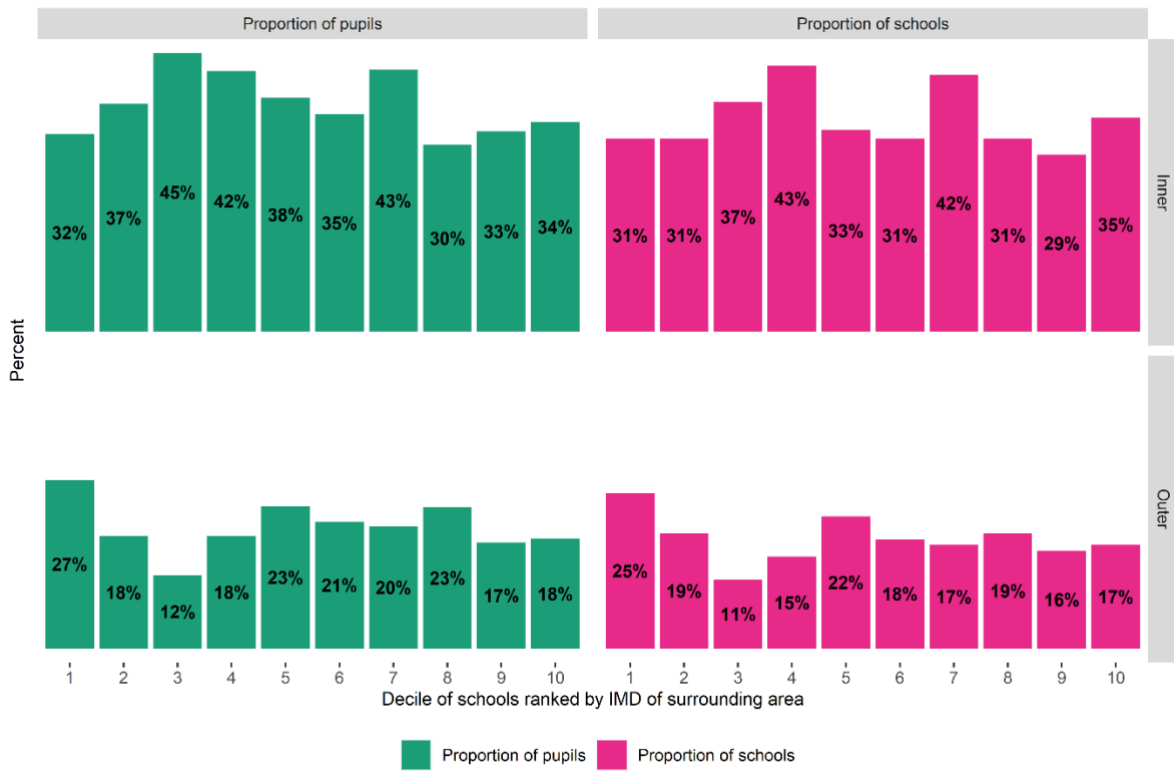


Figure 44 – The proportion of pupils attending a school with a School Street and the proportion of schools with a School Street by decile of school ranked by IMD score of surrounding area (inner and outer London)

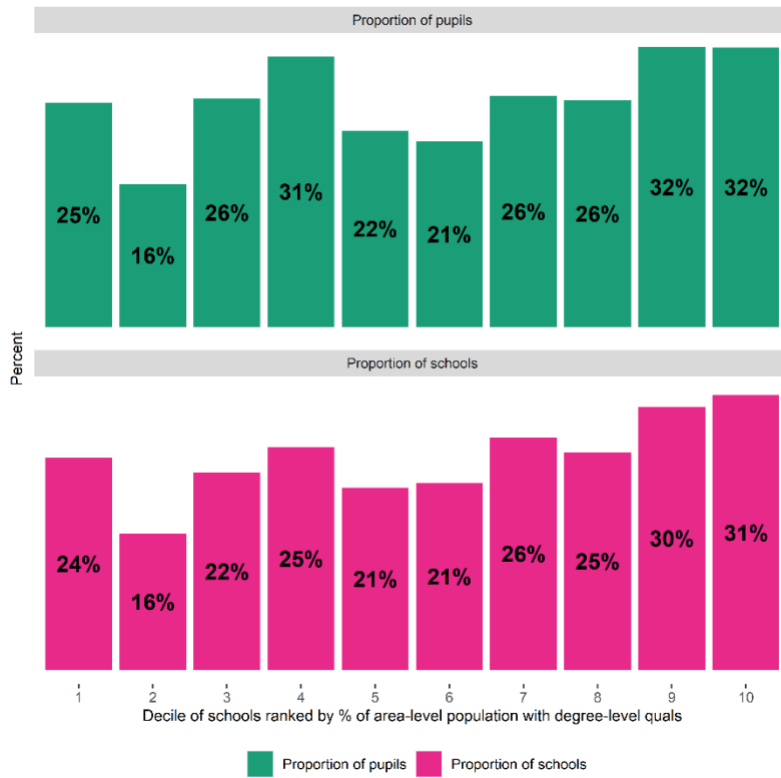


Figure 45 – Proportion of population with degree-level qualifications in LSOA around School Street and non-School Street schools

10.3. Appendix C – Ethnic Equity

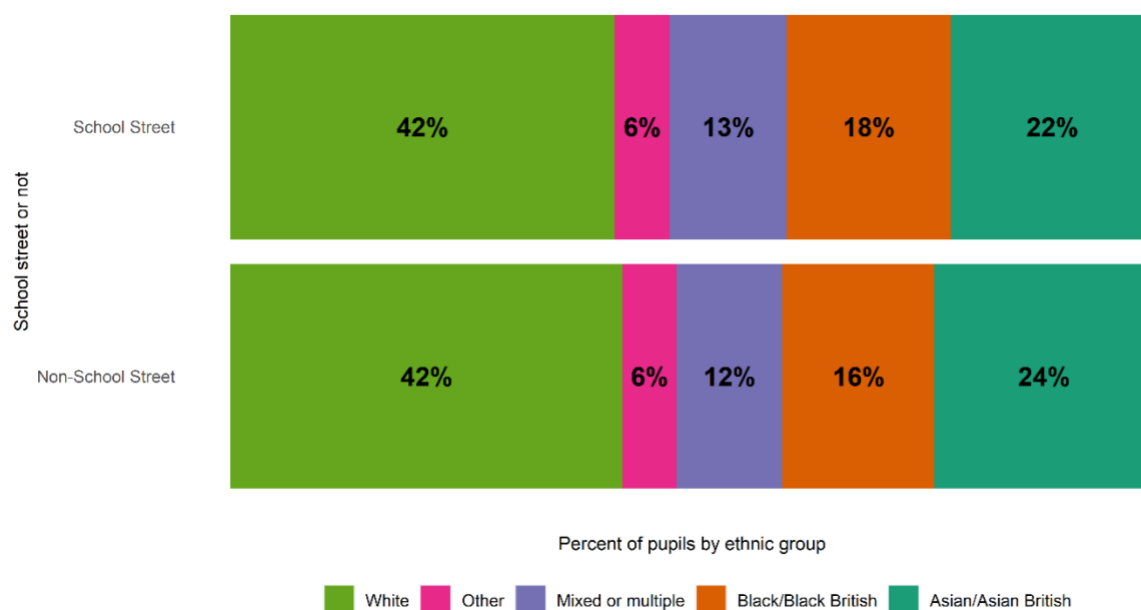


Figure 46 – Breakdown of pupils by ethnic group by school status

Table 29 – Breakdown of pupils by ethnic group by school status (inner and outer London)

Geography	School status	Count of pupils					Percent of pupils				
		White	Mixed or multiple	Asian/Asian British	Black/Black British	Other	White	Mixed or multiple	Asian/Asian British	Black/Black British	Other
Inner London	Non-School Street	46,092	18,266	32,862	32,412	10,341	32.93	13.05	23.48	23.16	7.39
	School Street	30,041	11,559	16,761	19,429	4,599	36.46	14.03	20.34	23.58	5.58
Outer London	Non-School Street	168,011	39,829	86,996	50,557	19,085	46.1	10.93	23.87	13.87	5.24
	School Street	41,602	10,221	21,095	11,243	5,778	46.26	11.36	23.45	12.5	6.42

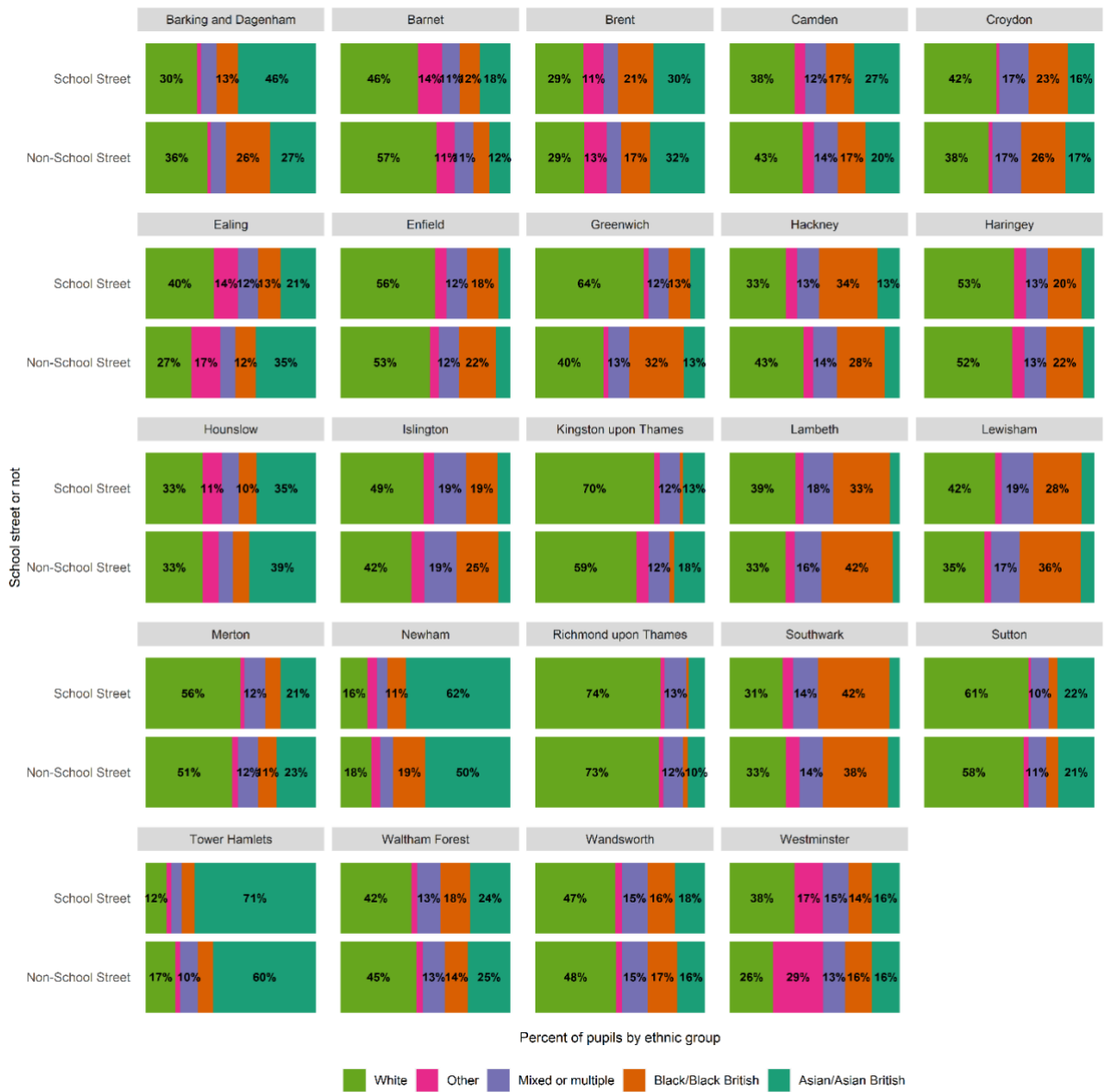


Figure 47 – Breakdown of pupils by ethnic group by school status and district borough

10.4. Appendix D – Environmental Equity

Table 30 – Road classification of roads in surrounding area of School Street and non-School Street schools

School status	Road class	Within 500m of school		Within 1000m of school		Within 75th percentile of travel to school distance	
		Road length (m)	Percent of road length	Road length (m)	Percent of road length	Road length (m)	Percent of road length
Non-School Street	A road, B road or motorway	1,106,657	11.7	4,088,185	12.2	7,646,277	12.2
	Local or minor road	6,782,323	71.9	23,702,758	70.5	43,948,468	70.0
	Restricted/Access road	1,538,174	16.3	5,808,063	17.3	11,231,580	17.9
School Street	A road, B road or motorway	366,235	11.8	1,483,370	13.3	2,059,989	12.9
	Local or minor road	2,204,525	70.9	7,694,238	69.1	11,041,012	69.2
	Restricted/Access road	538,145	17.3	1,950,727	17.5	2,856,954	17.9

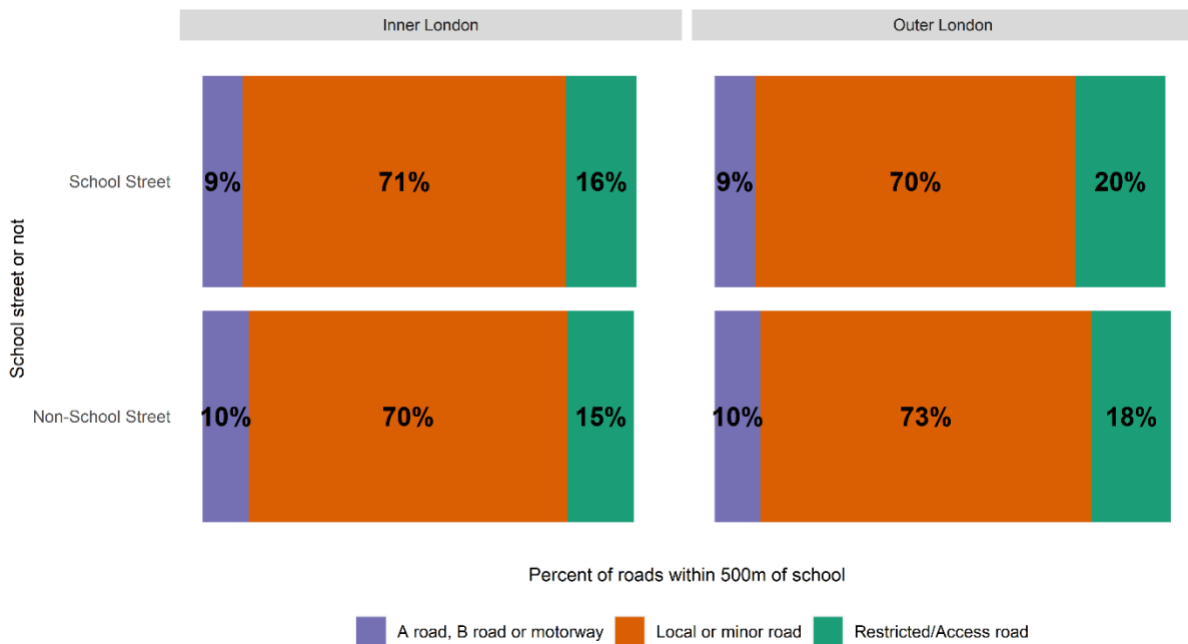


Figure 48 – Road classification of roads within 500m of School Street and non-School Street schools (inner and outer London)

Table 31 – Road classification of roads within 500m of School Street and non-School Street schools (inner and outer London)

Geography	School status	Road class	Within 500m of school	
			Road length (m)	Percent of road length
Inner London	Non-School Street	A road, B road or motorway	529,861	10.1
		Local or minor road	2,445,794	70.2
		Restricted/Access road	510,145	14.7
	School Street	A road, B road or motorway	234,342	8.8
		Local or minor road	1,251,941	71.2
		Restricted/Access road	271,763	15.5
Outer London	Non-School Street	A road, B road or motorway	576,796	10
		Local or minor road	4,336,529	73
		Restricted/Access road	1,028,029	17.5
	School Street	A road, B road or motorway	131,893	8.9
		Local or minor road	952,584	70.5
		Restricted/Access road	266,382	19.8

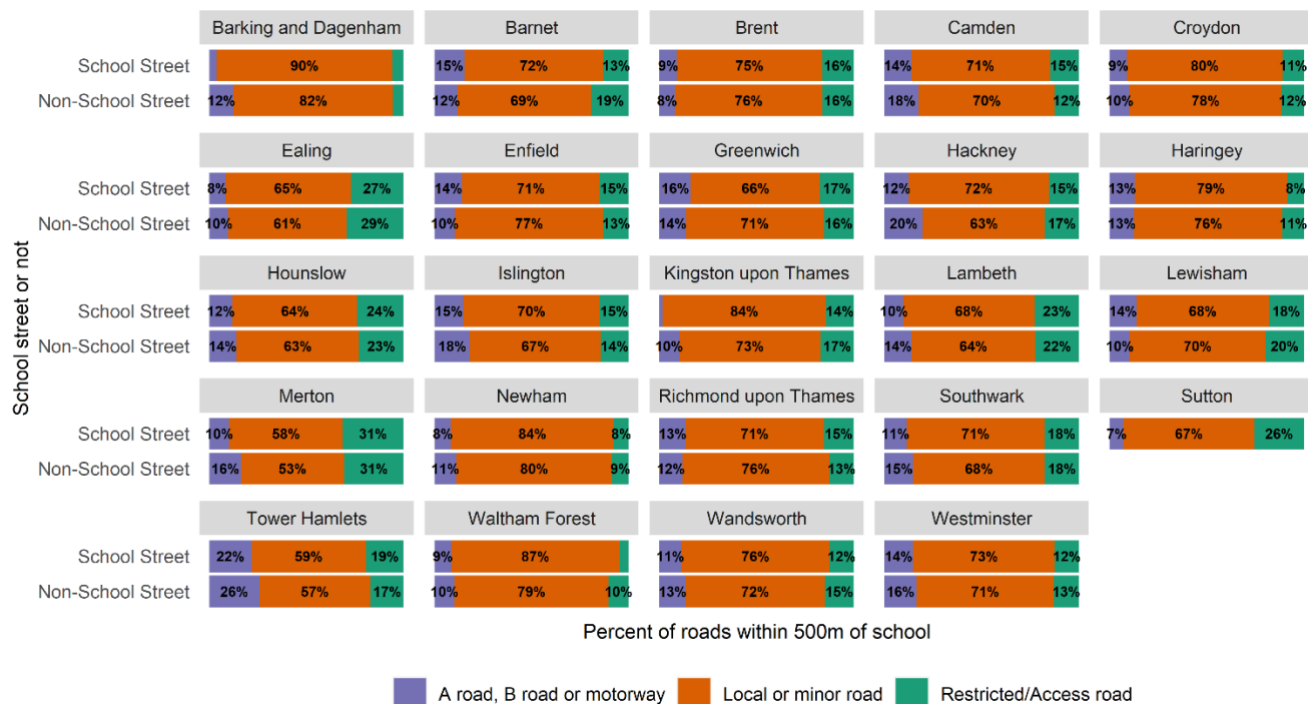


Figure 49 – Road classification of roads within 500m of School Street and non-School Street schools by district boroughs

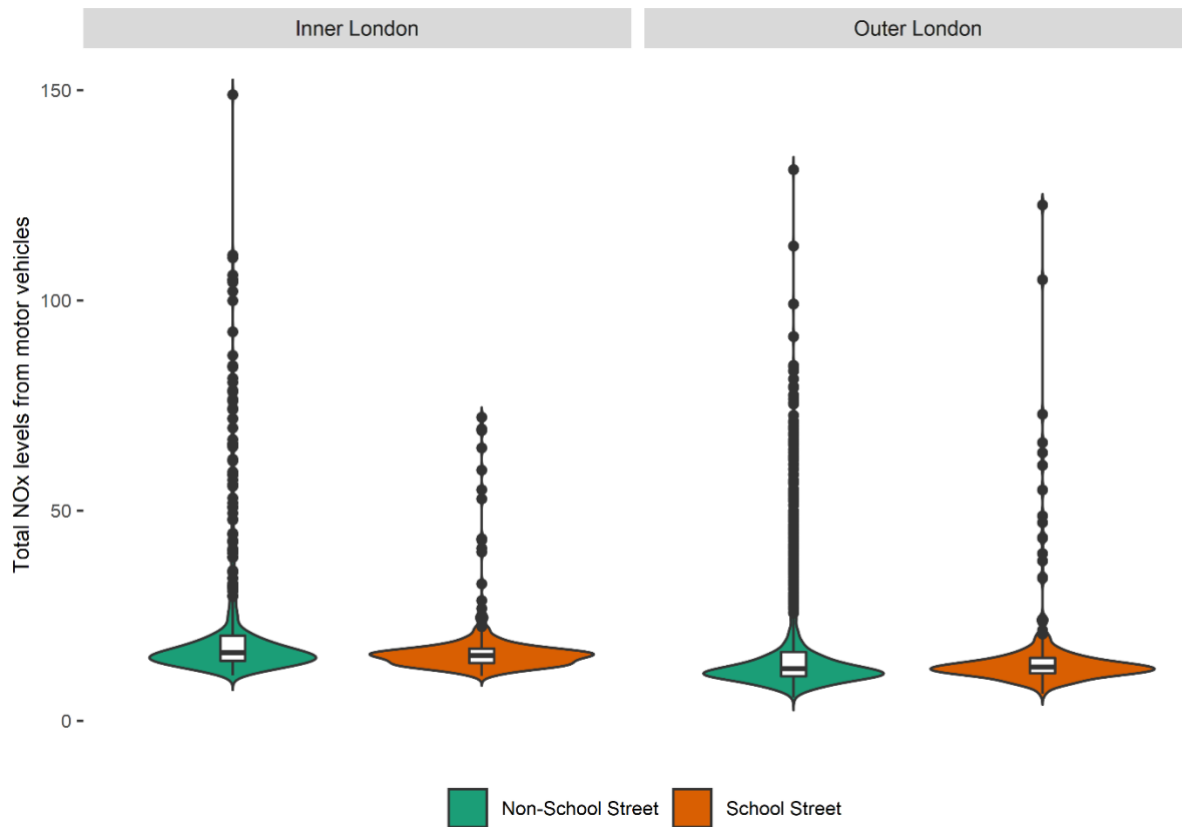


Figure 50 – Distribution of NOx levels from motor vehicles by school status

Table 32 – Distribution of NOx levels from motor vehicles by school status (inner and outer London)

Geography	School status	n	min	Q0.25	mean	median	Q0.75	max	sd
Inner London	School Street school	229	10.7	13.7	17.6	15.5	17.2	72.2	9.4
	Non-School Street school	435	10.9	14.3	23.5	16.2	20.2	148.9	19.7
Outer London	School Street school	188	6.4	11.3	16.6	12.8	15	122.7	14.5
	Non-School Street school	879	5.5	10.6	18.6	12.4	16.4	131.1	16.3

10.5. Appendix E – Model Predictions

Table 33 – Predicted probability of schools having a School Street based on their hypothetical location in different district boroughs

School	Pupils (%)			LSOA (%)		LSOA		Local env.		Model probabilities		
	FSM	Asian / Asian British	Black / Black British	Mixed or multiple	Black / Black British	IMD Score	Pop density	Road ratio	NOx level	Richmond upon Thames	Hackney	Hillingdon
Barnehurst Junior School	11	7	5	7	4	11	49	0	10	0.28	0.77	0.03
Coldfall Primary School	9	7	4	17	12	26	60	0	11	0.29	0.78	0.03
Cooper's Lane Primary School	19	11	19	18	20	28	51	0	12	0.29	0.78	0.03
Deansbrook Junior School	27	23	16	8	9	9	73	0	12	0.36	0.83	0.05
Gonville Academy	21	56	25	8	29	22	70	0	12	0.36	0.83	0.04
Martin Primary School	15	11	6	19	4	8	44	0	17	0.28	0.77	0.03
Northbury Primary School	20	51	23	8	28	32	125	0	20	0.32	0.81	0.04
Our Lady Immaculate Catholic Primary School	6	21	7	10	1	8	34	0	14	0.26	0.75	0.03
Perivale Primary School	23	47	7	8	8	13	76	0	13	0.38	0.84	0.05
St Joseph's Catholic Primary School	7	8	34	10	3	12	34	1	11	0.14	0.59	0.01

10.6. Appendix F – Additional models

Table 34 – Regression summary of models using normalised explanatory variables

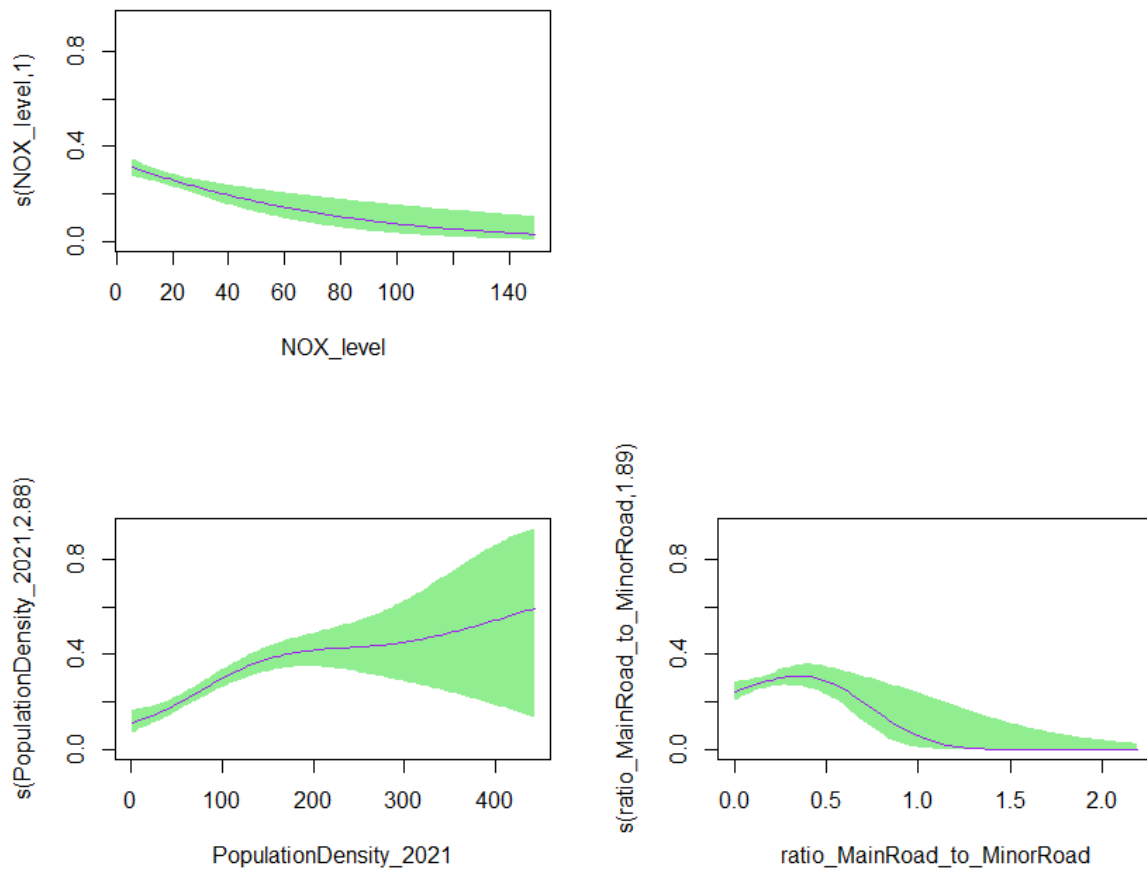
	Dependent variable:		
	School Street or not		
	School-level only	With local area variables	Multilevel model with fixed effects (L2 = Borough)
	(1)	(2)	(3)
Free school meals	0.733 (0.345)	0.415 (0.408)	0.283 (0.499)
Ethnicity: Asian/Asian British	0.245 (0.336)	-0.193 (0.351)	0.381 (0.490)
Ethnicity: Black/Black British	0.183 (0.409)	-1.251 (0.581)	-1.100 (0.679)
Ethnicity: Mixed/Multiple	1.054 (0.414)	0.773 (0.428)	0.416 (0.524)
LSOA ethnicity: Black/Black British		1.858 ^{***} (0.514)	1.519 (0.623)
Index of Multiple Deprivation score		-1.289 (0.514)	-2.085 ^{***} (0.629)
Ratio of main roads to quiet roads		-0.746 (0.689)	-2.471 [*] (0.834)
NOx level from motor vehicles		-2.388 ^{***} (0.675)	-3.018 ^{***} (0.745)
Population density		3.326 ^{***} (0.475)	2.089 ^{***} (0.628)
Intercept	-1.880 ^{***} (0.219)	-1.800 ^{***} (0.235)	-1.174 [*] (0.392)
Observations	1,728	1,728	1,728
Log Likelihood	-945.945	-904.503	-811.480
Akaike Inf. Crit.	1,901.890	1,829.006	1,644.960
Bayesian Inf. Crit.			1,704.962

Note: ^{*}p<0.05 ^{**}p<0.01 ^{***}p<0.001

Table 35 – GAM model summary

Parametric coefficients				
	Estimate	Std. Error	p-value	Significance
(Intercept)	-1.042	0.168	0.00	***
FSM	0.009	0.006	0.15	
Black / Black British (school)	-0.017	0.006	0.01	**
Asian / Asian British (school)	-0.005	0.003	0.12	
IMD score	-0.023	0.008	0.01	**
Black / Black British (LSOA)	0.033	0.009	0.00	***
Approximate significance of smooth terms				
	EDF	Chi.sq	p-value	Significance
Population density	4.003	52.494	0.00	***
Ratio of main roads to minor roads	1.891	6.689	0.03	*
NOx level	1	14.534	0.00	***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
R-sq.(adj) = 0.0609 Deviance explained = 6.45%				

Figure 51 – Partial effects plots from the GAM model



10.7. Appendix G – Sample Interview Question Script

Initial Scoping Questions

I just want to ask some really general questions right off the bat and then maybe we can get into some of the specifics of what I’m trying to find out.

1. Can you tell me about your role at the council and how that fits in to in implementing school streets?
2. Can you tell me the ‘story of school streets’ in your borough? How long has the borough been doing them. When did they start? What prompted that?
3. Is there a particular example of a school street that you could talk about? How that project came to be? What were the challenges and what have the benefits been?

Domains and Scales

I have a couple of questions here about where these school streets sit in terms of the priorities of the council and where the practical and political impetus for their implementation comes from.

1. **Have school streets been seen as responses to specific problems at specific schools or are they a wider policy or strategy within the borough?**
2. If you had to choose one in particular, what is the main problem that school streets are trying to change in the borough? Traffic management, safety, mode shift, physical activity?
3. What targets/goals do they contribute to within the borough? For example, Zero Carbon by 2030? Are these goals related to targets from Central Gov or GLA?
4. Why are school streets particularly effective in meeting these goals, say in comparison to other interventions?
5. Do you see it as policy for a school and its community, the whole neighbourhood, just the street it's on? How large are the benefits that you would expect to see?
6. **Do you see school streets as a way into wider Healthy Streets or Healthy Neighbourhoods changes in an area?**

Follow Ups

-Do you think policies for healthier streets have a role to play in other policy areas such as inequality or regeneration?

Change

This bit is really about behaviour change and the thinking of what the underlying mechanisms of school streets are etc.

1. Can you describe to me what a successful school street looks like and how it achieves this success?
2. What behaviours are you trying to encourage, which are you trying to change?
3. Do you think that schools are particularly effective places for affecting change? If so, why?
4. What is the scale that you hope a single school street would affect change on? Neighbourhood, street, individual, family, borough?
5. Is there a model of behaviour change that informs this policy? **How do you get from those changes to the built environment to the stated outcome?**
6. Who do you feel benefits most from that change? Are those the people that you intended to benefit the most? Does anyone lose out?
7. Are there particular characteristics of the area or the school that impact of

What is the importance of actually changing the BE, vs just traffic regulation.

Floating Q: Can you tell me about your monitoring? What data have you gathered; how do you judge success?

Follow Ups

- Do you feel like there is a gap between this ideal and what happens in practice?
- What degree of behaviour change is expected? Car trip reduction? Total mode shift? Just school trips?

Implementation

I just have a few questions here about the more practical stuff around how these streets get from idea to implementation. Where does the pressure in the organisation come from etc.

1. Do you work with any 3rd sector organisations on implementing school streets? What kind of support do they provide?
2. Does the work of other councils influence your borough's approach?
3. Do councillors support school streets in your borough?
4. How are schools selected for School Streets? What are the factors that are weighed?
5. What are the main barriers to implementing school streets? Political reluctance, resident discontent, School Opposition, money? etc?
6. How have school streets been implemented in your borough from a design perspective. I.e. Temporary barriers or camera operated. What was the reasoning behind that decision?

Follow Ups

- How has the pandemic affected school streets? Have they risen up the agenda?

10.8. Appendix H – Topic Guide Summary Tables

Table 36 – A concept guide of models of behaviour elaborated for review.

Theory of behaviour	Description	References
<i>Formal Theories of Behaviour (Change)</i>		
Theory of Planned Behaviour	People perform certain actions if they have a premeditated intention to do so. Behaviour is the result of reasoned thought. Explanatory theory	(Ajzen, 1985, 1991, 2011)
Health Belief Model	Dependent also on motivation, change in behaviour comes primarily from deliberation based on known information and implicit cues from interacting with the world. Change theory.	(Rosenstock, 1977)
Social Cognitive Theory	“three-way dynamic reciprocal model in which personal factors, environmental influences, and	(Bandura, 1986; Marks and Bandura, 2002)

	behaviour continually interact" (Glanz and Bishop, 2010). Explanatory theory.	
Transtheoretical Model of Change	During the process of changing behaviours people move through several different states ultimately leading to change. Moving from one state to another involves direct intention. Change theory	(Sarkin <i>et al.</i> , 2001; Prochaska, Norcross and DiClemente, 2010)
Social Ecological Model	People's behaviours are shaped by and shape the social environment they are found in. They are constrained by the availability within their social ecology of the resources and opportunities needed to take part in certain behaviours. Explanatory theory.	(McLeroy <i>et al.</i> , 1988; Sallis, Owen and Fisher, 2008)
Practice Theory	Practices are made up of Materials, Competences, Meanings. Practices "emerge, persist, shift, and disappear when <i>connections</i> between elements of these three types are made sustained or broken." (Shove, Pantzar and Watson, 2012, p. 14) Explanatory theory	(Schatzki, 2002; Shove and Pantzar, 2005; Shove, Pantzar and Watson, 2012)
Behaviour Change Wheel/COM-B	Capability, Opportunity, Motivation influence Behaviour. Any intervention should seek to rearrange the current configuration of these factors. Change theory.	(Michie, van Stralen and West, 2011; Michie, Atkins and West, 2014)
Nudge	"Putting the fruit at eye level counts as a nudge. Banning junk food does not" (Thaler and Sunstein, 2008). People can be encouraged to make different choices if the 'choice architecture' of a given situation is changed.	(Thaler and Sunstein, 2008)
<i>Ideal Type Theories of Behaviour</i>		
Attitudes-based change	Following on from the primary constructs of TPB, TTM, and HBM this posits that the main purpose of an intervention is to change attitudes.	
Breaking of habits	People do not actively contemplate their travel decisions. Here the mechanism for change is by diverting and/or disincentivising automated behaviours.	
Built environment provision/improvement	Interventions should improve space for walking and cycling and provide opportunities for alternate use of the street. It makes active modes more attractive, safer, and more fun.	
Social normative/cognitive change	The mechanism in this case lies in the social environment of the school and the different social dynamics that arise both through interactions with the institution and other parents/carers.	

Table 37 – Summary of the cross-relationships between the ideal type and formal models

		Ideal Types			
		Attitudes-based change	Breaking of habits	Built environment improvement	Social normative change
Formal Models	Theory of Planned Behaviour	X			
	Health Belief Model	X			
	Social Cognitive Theory	X			X
	Transtheoretical Model of Change	X	X		
	Social Ecological Model			X	
	Practice Theory		X	X	X
	Behaviour Change Wheel/COM-B		X	X	
	Nudge		X		X

10.9. Appendix I – Sensitivity Analysis

This section presents the results of some parts of the analysis when repeated with a more-strict (75-125% vs. 50-150%) range for acceptable deviations from the Department for Education’s school headcount-figure for any given survey response-rate. In this case any survey with a number of responses larger than 125% or smaller than 75% of the official headcount figure is excluded from the analysis.

Table 38 – Description of data for analysis using stricter threshold for acceptable response-rate deviation from stated headcount.

Total n Surveys in Dataset	17960
Total n Surveys incl. in analysis	1430
Total n Schools	431
Total n Schools w School Street	80

Total n Schools w/o School Street	351
Total n Surveys before March 2020	931
Total n Surveys after March 2020	499
Total n Surveys after School Street installed and after March 2020	91
Total n child trips recorded by all surveys in analysis	559911

Table 39 – Descriptive statistics using stricter response-rate thresholds.

		Average	% AT	% Walk	% Cycling	% Motorised	% Public Transport
All Surveys	Before March 2020	Median	69.8	49.5	3.3	19.7	6.8
	After March 2020		71.4	52.6	3.4	20.3	5.2
	Difference		1.7	3.1	0.1	0.6	-1.6
	Before March 2020	Mean	67.6	49.3	4.2	21.7	8.6
	After March 2020		69.5	52.2	4.3	22.1	6.6
	Difference		2.0	3.0	0.1	0.4	-2.0
School Street Surveys	Before School Street	Median	74.4	56.1	4.5	15.5	6.9
	After School Street		78.6	59.5	4.4	14.1	4.4
	Difference		4.2	3.3	-0.1	-1.5	-2.5
	Before School Street	Mean	73.7	54.7	5.6	17.1	8.0
	After School Street		78.3	58.6	5.0	14.7	5.9
	Difference		4.6	3.9	-0.6	-2.4	-2.1
Total	Total	Median	70.3	50.6	3.3	20.1	6.2
	Total	Mean	68.3	50.3	4.3	21.8	7.9

Table 40 – Regression output of the canonical difference in difference analysis using stricter response-rate thresholds.

<i>Dependent variable:</i>	
% Private Motor Vehicle	% Active Travel
Outcome	Outcome

Intercept (β_0)	21.81**	66.99**
-------------------------	---------	---------

	(0.74)	(0.97)
Treatment (β_1)	0.90 (1.05)	1.33 (1.37)
Post-treatment (β_2)	-4.83* (1.90)	5.83* (2.48)
Diff in Diff (β_3)	-3.81 (2.69)	5.98 (3.50)

Note: * $p < 0.05$; ** $p < 0.01$

References

- Abraham, C. and Michie, S. (2008) 'A Taxonomy of Behavior Change Techniques Used in Interventions', *Health Psychology*, 27(3), pp. 379–387. doi:10.1037/0278-6133.27.3.379.
- Aditjandra, P.T., Mulley, C. and Nelson, J.D. (2013) 'The influence of neighbourhood design on travel behaviour: Empirical evidence from North East England', *Transport Policy*, 26, pp. 54–65. doi:10.1016/j.tranpol.2012.05.011.
- Ahmed, A. and Ali, S. (2022) 'Lessons learned from adapting a quantitative to an emergent mixed methods research design in Pakistan during COVID-19', *International Journal of Research and Method in Education*, 46(2), pp. 144–160. doi:10.1080/1743727X.2022.2094358.
- Ahmed, A. and Sil, R. (2012) 'When multi-method research subverts methodological pluralism-Or, why we still need single-method research', *Perspectives on Politics*, 10(4), pp. 935–953. doi:10.1017/S1537592712002836.
- Air Quality Consultants (2021) *Air Quality Monitoring Study: London School Streets*. Available at: https://www.london.gov.uk/sites/default/files/school_streets_monitoring_study_march21.pdf.
- Ajuntament de Barcelona (2023) *Superilla Barcelona*. Barcelona. Available at: <http://hdl.handle.net/11703/129164>.
- Ajuntament de Barcelona (2021) *Protegim les escoles*. Available at: <https://ajuntament.barcelona.cat/ecologiaurbana/ca/que-fem-i-per-que/urbanisme-per-als-barris/protegim-escoles> (Accessed: 27 June 2022).
- Ajzen, I. (1985) 'From Intentions to Actions: A Theory of Planned Behavior', in *Action Control*. doi:10.1007/978-3-642-69746-3_2.
- Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*. doi:10.1016/0749-5978(91)90020-T.
- Ajzen, I. (2011) 'The theory of planned behaviour: Reactions and reflections', *Psychology and Health*, 26(9), pp. 1113–1127. doi:10.1080/08870446.2011.613995.
- Aldred, R. (2019) 'Built Environment Interventions to Increase Active Travel: a Critical Review and Discussion', *Current environmental health reports*, 6(4), pp. 309–315. doi:10.1007/s40572-019-00254-4.
- Aldred, R. and Croft, J. (2019) 'Evaluating active travel and health economic impacts of small streetscape schemes: An exploratory study in London', *Journal of Transport and Health*, 12, pp. 86–98. doi:10.1016/j.jth.2018.11.009.
- Aldred, R., Verlinghieri, E., Sharkey, M., Itova, I. and Goodman, A. (2021) 'Equity in new active travel infrastructure: A spatial analysis of London's new Low Traffic Neighbourhoods', *Journal of Transport Geography*, 96(June), p. 103194. doi:10.1016/j.jtrangeo.2021.103194.
- Allen, R. (2007) 'Allocating pupils to their nearest secondary school: The consequences for social and ability stratification', *Urban Studies*, 44(4), pp. 751–770. doi:10.1080/00420980601184737.
- Anable, J., Brown, L., Docherty, I. and Marsden, G. (2022) *Less is more : Changing travel in a post-pandemic society*.
- Ancaes, P.R., Boniface, S., Dhanani, A., Mindell, J.S. and Groce, N. (2016) 'Urban transport and community severance: Linking research and policy to link people and places', *Journal of Transport and Health*, 3(3), pp. 268–277. doi:10.1016/j.jth.2016.07.006.

- Andersson, E., Malmberg, B. and Östh, J. (2012) 'Travel-to-school distances in Sweden 2000-2006: Changing school geography with equality implications', *Journal of Transport Geography*, 23, pp. 35–43. doi:10.1016/j.jtrangeo.2012.03.022.
- Andres, L. (2013) 'Differential Spaces, Power Hierarchy and Collaborative Planning: A Critique of the Role of Temporary Uses in Shaping and Making Places', *Urban Studies*, 50(4), pp. 759–775. doi:10.1177/0042098012455719.
- Appleyard, D., Gerson, S. and Lintell, M. (1981) *Livable Streets*. Berkeley: University of California Press.
- Arden, M., Thorneloe, R., Jordan, C., Clarke, E., Lamb, M., Wilcockson, H., Howie, I., Reed, E., Brenner, G., Gould, B., Green, K., Temperton, C., Whittaker, E., Everson, R., Thompson, C., Iles, A. and Knowles, N. (2022) *Using Behaviour Change Techniques to encourage active travel across the Yorkshire and Humber region. A Behavioural Insights report commissioned by the Local Government Association*.
- Atkins (2010) 'An Evaluation of the "Travelling to School Initiative" Programme', (October).
- Atkins, L., Francis, J., Islam, R., O'Connor, D., Patey, A., Ivers, N., Foy, R., Duncan, E.M., Colquhoun, H., Grimshaw, J.M., Lawton, R. and Michie, S. (2017) 'A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems', *Implementation Science*, 12(1), pp. 1–18. doi:10.1186/s13012-017-0605-9.
- Bamberg, S., Rölle, D. and Weber, C. (2003) 'Does habitual car use not lead to more resistance to change of travel mode?', *Transportation*, 30(1), pp. 97–108. doi:10.1023/A:1021282523910.
- Bamberg, S. and Schmidt, P. (2010) 'Choice of Travel Mode in the Theory of Planned Behavior : The Roles of Past Behavior, Habit, and Reasoned Action', *Basic and Applied Social Psychology*, 25(3), pp. 175–187. doi:10.1207/S15324834BASP2503.
- Bandura, A. (1986) *Social Foundations of Thought and Action: A Social Cognitive Theory*. Upper Saddle River, NJ: Prentice Hall.
- Barr, S. and Prillwitz, J. (2014) 'A Smarter Choice? Exploring the Behaviour Change Agenda for Environmentally Sustainable Mobility', *Environment and Planning C: Government and Policy*, 32(1), pp. 1–19. doi:10.1068/c1201.
- Barrell, J. and Whitehouse, J. (2004) 'Home Zones - an evolving approach to community streets', *Proceedings of the Institution of Civil Engineers: Municipal Engineer*, 157(4), pp. 257–265. doi:10.1680/muen.2004.157.4.257.
- Barrett, S., Willis, J. and Washington-Ihime, M. (2020) *Reclaim the kerb: The future of parking and kerbside management*. London. Available at: <https://www.centreforlondon.org/reader/parking-kerbside-mangement/chapter-1/#travel-habits-are-changing-but-modal-shift-is-slow>.
- Bartzokas-Tsiompras, A., Tampouraki, E.M. and Photis, Y.N. (2020) 'Is walkability equally distributed among downtowners? Evaluating the pedestrian streetscapes of eight European capitals using a micro-scale audit approach', *International Journal of Transport Development and Integration*, 4(1), pp. 75–92. doi:10.2495/TDI-V4-N1-75-92.
- Belcourt-Weir, T., Cannell, C. and Pearce, M. (2022) *School Streets and Traffic Displacement Technical Report*. Birmingham.
- Ben-Joseph, E. (1995) 'Changing the Residential Street Scene: Adapting the Shared Street (Woonerf) Concept to the Suburban Environment', *Journal of the American Planning Association*, 61(4), pp. 504–515. doi:10.1080/01944369508975661.
- Bertolini, L. (2020) 'From "streets for traffic" to "streets for people": can street experiments transform urban mobility?', *Transport Reviews*, 40(6), pp. 734–753. doi:10.1080/01441647.2020.1761907.

- Biddulph, M. (2008) 'Reviewing the UK home zone initiatives', *Urban Design International*, 13(2), pp. 121–129. doi:10.1057/udi.2008.11.
- Biddulph, M. (2010) 'Evaluating the English Home Zone initiatives', *Journal of the American Planning Association*, 76(2), pp. 199–218. doi:10.1080/01944361003622688.
- Biddulph, M. (2012a) 'Radical streets? the impact of innovative street designs on liveability and activity in residential areas', *Urban Design International*, 17(3), pp. 178–205. doi:10.1057/udi.2012.13.
- Biddulph, M. (2012b) 'Street Design and Street Use: Comparing Traffic Calmed and Home Zone Streets', *Journal of Urban Design*, 17(2), pp. 213–232. doi:10.1080/13574809.2012.666206.
- Bierbaum, A.H., Karner, A. and Barajas, J.M. (2021) 'Toward Mobility Justice: Linking Transportation and Education Equity in the Context of School Choice', *Journal of the American Planning Association*, 87(2), pp. 197–210. doi:10.1080/01944363.2020.1803104.
- Biesta, G. (2010) 'Pragmatism and the philosophical foundations of mixed methods research', in Tashakkori, A. and Teddlie, C. (eds) *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, CA: SAGE Publications, pp. 95–117. doi:https://doi.org/10.4135/9781506335193.
- Bishop, P. and Williams, L. (2012) *The Temporary City*. London: Routledge.
- Black, C., Collins, A. and Snell, M. (2001) 'Encouraging walking: The case of journey-to-school trips in compact urban areas', *Urban Studies*, 38(7), pp. 1121–1141. doi:10.1080/00420980124102.
- Blake, J. (1999) 'Overcoming the "value-action gap" in environmental policy: Tensions between national policy and local experience', *Local Environment*, 4(3), pp. 257–278. doi:10.1080/13549839908725599.
- Bloyce, D. and White, C. (2018) 'When transport policy becomes health policy: A documentary analysis of active travel policy in England', *Transport Policy*, 72(September), pp. 13–23. doi:10.1016/j.tranpol.2018.09.012.
- Blue, S., Shove, E., Carmona, C. and Kelly, M.P. (2016) 'Theories of practice and public health: understanding (un)healthy practices', *Critical Public Health*, 26(1), pp. 36–50. doi:10.1080/09581596.2014.980396.
- Boarnet, M.G., Anderson, C.L., Day, K., McMillan, T. and Alfonzo, M. (2005) 'Evaluation of the California Safe Routes to School legislation: Urban form changes and children's active transportation to school', *American Journal of Preventive Medicine*, 28(2 SUPPL. 2), pp. 134–140. doi:10.1016/j.amepre.2004.10.026.
- Boarnet, M.G., Day, K., Anderson, C., McMillan, T. and Alfonzo, M. (2005) 'California's safe routes to school program: Impacts on walking, bicycling, and pedestrian safety', *Journal of the American Planning Association*, 71(3), pp. 301–317. doi:10.1080/01944360508976700.
- Bonsall, P. (2009) 'Do we know whether personal travel planning really works?', *Transport Policy*, 16(6), pp. 306–314. doi:10.1016/j.tranpol.2009.10.002.
- Børrestad, L.A.B., Andersen, L.B. and Bere, E. (2011) 'Seasonal and socio-demographic determinants of school commuting', *Preventive Medicine*, 52(2), pp. 133–135. doi:10.1016/j.ypmed.2010.12.006.
- Bragaglia, F. and Rossignolo, C. (2021) 'Temporary urbanism as a new policy strategy: a contemporary panacea or a trojan horse?', *International Planning Studies*, 26(4), pp. 370–386. doi:10.1080/13563475.2021.1882963.
- Braun, L.M., Rodriguez, D.A. and Gordon-Larsen, P. (2019) 'Social (in)equity in access to cycling infrastructure: Cross-sectional associations between bike lanes and area-level

- sociodemographic characteristics in 22 large U.S. cities', *Journal of Transport Geography*, 80(October), p. 102544. doi:10.1016/j.jtrangeo.2019.102544.
- Braun, R., Blok, V., Loeber, A. and Wunderle, U. (2020) 'COVID-19 and the onlineification of research: kick-starting a dialogue on Responsible online Research and Innovation (RoRI)', *Journal of Responsible Innovation*, pp. 680–688. doi:10.1080/23299460.2020.1789387.
 - Brenner, B.N. (2016) 'Is tactical urbanism an alternative to neoliberal urbanism?', *Critique of Urbanization: Selected Essays*, pp. 128–146. doi:10.4324/9780429270482-37.
 - Broberg, A. and Sarjala, S. (2015) 'School travel mode choice and the characteristics of the urban built environment: The case of Helsinki, Finland', *Transport Policy*, 37, pp. 1–10. doi:10.1016/j.tranpol.2014.10.011.
 - Brooks, J. and King, N. (2014) 'Doing Template Analysis: Evaluating an End-of-Life Care Service', *Doing Template Analysis: Evaluating an End-of-Life Care Service*, pp. 1–20. doi:10.4135/978144627305013512755.
 - Brooks, J., McCluskey, S., Turley, E. and King, N. (2015) 'The Utility of Template Analysis in Qualitative Psychology Research', *Qualitative Research in Psychology*, 12(2), pp. 202–222. doi:10.1080/14780887.2014.955224.
 - Bruno, M., Dekker, H.J. and Lemos, L.L. (2021) 'Mobility protests in the Netherlands of the 1970s: Activism, innovation, and transitions', *Environmental Innovation and Societal Transitions*, 40(September), pp. 521–535. doi:10.1016/j.eist.2021.10.001.
 - Buchanan, C. (1963) *Traffic in Towns*. 3rd Editio. London: Her Majesty's Stationery Office.
 - Buchanan, D.A. and Denyer, D. (2013) 'Researching tomorrow's crisis: Methodological innovations and wider implications', *International Journal of Management Reviews*, 15(2), pp. 205–224. doi:10.1111/ijmr.12002.
 - Bueddefeld, J., Murphy, M., Ostrem, J. and Halpenny, E. (2021) 'Methodological Bricolage and COVID-19: An Illustration From Innovative, Novel, and Adaptive Environmental Behavior Change Research', *Journal of Mixed Methods Research*, 15(3), pp. 437–461. doi:10.1177/15586898211019496.
 - Buliung, R.N., Larsen, K., Faulkner, G. and Ross, T. (2017) 'Children's independent mobility in the City of Toronto, Canada', *Travel Behaviour and Society*, 9, pp. 58–69. doi:10.1016/j.tbs.2017.06.001.
 - Bulkeley, H., Marvin, S., Palgan, Y.V., McCormick, K., Breitfuss-Loidl, M., Mai, L., von Wirth, T. and Frantzeskaki, N. (2019) 'Urban living laboratories: Conducting the experimental city?', *European Urban and Regional Studies*, 26(4), pp. 317–335. doi:10.1177/0969776418787222.
 - Bungum, T.J., Clark, S. and Aguilar, B. (2014) 'The Effect of an Active Transport to School Intervention at a Suburban Elementary School', *American Journal of Health Education*. Taylor & Francis, pp. 205–209. doi:10.1080/19325037.2014.916635.
 - Buttazzoni, A.N., Van Kesteren, E.S., Shah, T.I. and Gilliland, J.A. (2018) 'Active School Travel Intervention Methodologies in North America: A Systematic Review', *American Journal of Preventive Medicine*, 55(1), pp. 115–124. doi:10.1016/j.amepre.2018.04.007.
 - Butts, K. and Gardner, J. (2022) 'Difference-in-Differences', 14(September), pp. 162–173.
 - Cairns, S. (2005) 'Achieving safer school travel in the UK', 44(August), pp. 1–13.
 - Cairns, S., Hopkinson, L., Schuller, Z., Stoddart, I., Heinen, E. and Sloman, L. (2019) 'CWIS Active Travel Investment Models: Model structure and evidence base Technical appendix 5: Compendium of interventions', (September). Available at: www.transportforqualityoflife.com.
 - Callaway, B. and Sant'Anna, P.H.C. (2021) 'Difference-in-Differences with multiple time periods', *Journal of Econometrics*, 225(2), pp. 200–230. doi:10.1016/j.jeconom.2020.12.001.

- Camden Borough Council (2018) 'Healthy School Streets: Opening Streets to Children (Feedback on first pilot school – St Joseph's, Macklin Street, Holborn)'. Available at: www.camden.gov.uk/documents/20142/0/Healthy+School+Streets+Initial+Report+Final.pdf.
- Campbell, K. (2018) *Making Massive Small Change*. White River Junction: Chelsea Green Publishing.
- Campbell-Lendrum, D. and Corvalán, C. (2007) 'Climate change and developing-country cities: Implications for environmental health and equity', *Journal of Urban Health*, 84(SUPPL. 1), pp. 109–117. doi:10.1007/s11524-007-9170-x.
- Carmichael, J., Williams, T., Ko, J., Raveshia, C., Schmid, C., Walmsley, N., West, K. and Westerman, C. (2020) *Tactical Urbanism: Making it Happen*. New South Wales.
- Carter, E.D. (2015) 'Making the Blue Zones: Neoliberalism and nudges in public health promotion', *Social Science and Medicine*, 133, pp. 374–382. doi:10.1016/j.socscimed.2015.01.019.
- Carver, A., Timperio, A. and Crawford, D. (2013) 'Parental chauffeurs: What drives their transport choice?', *Journal of Transport Geography*, 26, pp. 72–77. doi:10.1016/j.jtrangeo.2012.08.017.
- de Certeau, M. (1984) *The Practice of Everyday Life*. Berkeley: University of California Press.
- Cervero, R. and Kockelman, K. (1997) 'Travel demand and the 3Ds: Density, diversity, and design', *Transportation Research Part D: Transport and Environment*, 2(3), pp. 199–219. doi:10.1016/S1361-9209(97)00009-6.
- Chatterjee, K., Sherwin, H. and Jain, J. (2013) 'Triggers for changes in cycling: The role of life events and modifications to the external environment', *Journal of Transport Geography*, 30, pp. 183–193. doi:10.1016/j.jtrangeo.2013.02.007.
- Chillon, P., Evenson, K., A., V. and D.S., W. (2011) 'A systematic review of interventions for promoting active transportation to school', *International Journal of Behavioral Nutrition and Physical Activity*, 8. Available at: <http://www.ijbnpa.org/content/8/1/10%5Cnhttp://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed10&NEWS=N&AN=2011130231>.
- Christiansen, L.B., Toftager, M., Ersbøll, A.K. and Troelsen, J. (2014) 'Effects of a danish multicomponent physical activity intervention on active school transport', *Journal of Transport and Health*, 1(3), pp. 174–181. doi:10.1016/j.jth.2014.05.002.
- Di Ciommo, F. and Shiftan, Y. (2017) 'Transport equity analysis', *Transport Reviews*, 37(2), pp. 139–151. doi:10.1080/01441647.2017.1278647.
- Clarke, R. (2022) *School Streets: Putting Children and the Planet First*. Available at: <https://www.childhealthinitiative.org/media/792262/school-streets-globally.pdf>.
- Clayden, A., McKoy, K. and Wild, A. (2006) 'Improving residential liveability in the UK: Home Zones and alternative approaches', *Journal of Urban Design*, 11(1), pp. 55–71. doi:10.1080/13574800500490307.
- van de Coevering, P., Maat, K. and van Wee, B. (2021) 'Causes and effects between attitudes, the built environment and car kilometres: A longitudinal analysis', *Journal of Transport Geography*, 91(January), p. 102982. doi:10.1016/j.jtrangeo.2021.102982.
- Cohen, J.M., Boniface, S. and Watkins, S. (2014) 'Health implications of transport planning, development and operations', *Journal of Transport and Health*, 1(1), pp. 63–72. doi:10.1016/j.jth.2013.12.004.
- Cohn, S. (2014) 'From health behaviours to health practices: An introduction', *Sociology of Health and Illness*, 36(2), pp. 157–162. doi:10.1111/1467-9566.12140.

- Cooper, A.R., Page, A.S., Foster, L.J. and Qahwaji, D. (2003) 'Commuting to school: Are children who walk more physically active?', *American Journal of Preventive Medicine*, 25(4), pp. 273–276. doi:10.1016/S0749-3797(03)00205-8.
- Couvrette, A. (2021) 'The most consequential experiments carried out during the COVID-19 pandemic will be social', *LSE Impact of Social Sciences Blog*, June. Available at: <https://blogs.lse.ac.uk/impactofsocialsciences/2021/06/04/the-most-consequential-experiments-carried-out-during-the-covid-19-pandemic-will-be-social/>.
- Cowman, K. (2017) 'Play streets: Women, children and the problem of urban traffic, 1930-1970', *Social History*, 42(2), pp. 233–256. doi:10.1080/03071022.2017.1290366.
- Craig, P., Dieoee, P., Macintyre, S., Michie, S., Nazareth, I. and Petticrew, M. (2019) 'Developing and evaluating complex interventions', *Medical Research Council*, pp. 1–39. Available at: <https://mrc.ukri.org/documents/pdf/complex-interventions-guidance/>.
- Crawford, R. (1980) 'HEALTHISM AND THE MEDICALIZATION OF EVERYDAY LIFE', *International Journal of Health Services*, 10(3), pp. 365–388.
- Creswell, J. and Plano Clark, V. (2018) *Designing and Conducting Mixed Methods Research*. Third, *Designing and conducting mixed methods research*. Third. Thousand Oaks, CA: Sage Publications.
- Curtis, C., Babb, C. and Olaru, D. (2015) 'Built environment and children's travel to school', *Transport Policy*, 42, pp. 21–33. doi:10.1016/j.tranpol.2015.04.003.
- Dahlgren, G. and Whitehead, M. (1991) *Policies and strategies to promote social equity in health*.
- Dahlgren, G. and Whitehead, M. (2021) 'The Dahlgren-Whitehead model of health determinants: 30 years on and still chasing rainbows', *Public Health*, 199, pp. 20–24. doi:10.1016/j.puhe.2021.08.009.
- Dajnak, D., Evangelopoulos, D., Kitwiroon, N., Beevers, S. and Walton, H. (2021) *London Health Burden of Current Air Pollution and Future Health Benefits of Mayoral Air Quality Policies*, Imperial College London Projects. Available at: <http://erg.ic.ac.uk/research/home/projects/tfl-hia-maqp.html>.
- Davis, A. (2020) *School Street Closures and Traffic Displacement: A Literature Review and semi-structured interviews*. Edin.
- Davis, A. and Jones, L.J. (1996) 'Children in the urban environment: An issue for the new public health agenda', *Health and Place*, 2(2), pp. 107–113. doi:10.1016/1353-8292(96)00003-2.
- Davis, R., Campbell, R., Hildon, Z., Hobbs, L. and Michie, S. (2015) 'Theories of behaviour and behaviour change across the social and behavioural sciences: a scoping review', *Health Psychology Review*, 9(3), pp. 323–344. doi:10.1080/17437199.2014.941722.
- Denzin, N.K. (2010) 'Moments, mixed methods, and paradigm dialogs', *Qualitative Inquiry*, 16(6), pp. 419–427. doi:10.1177/1077800410364608.
- Denzin, N.K. and Lincoln, Y.S. (2000) *Handbook of Qualitative Research*. 2nd edn. Thousand Oaks, CA: SAGE.
- Department for Business Energy and Industrial Strategy (2023) *2021 UK Greenhouse Gas Emissions, Final Figures*. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/295968/20140327_2013_UK_Greenhouse_Gas_Emissions_Provisional_Figures.pdf.
- Department for Education (2014) 'Home to school travel and transport guidance: Statutory guidance for local authorities', (July), pp. 1–37.
- Department for Transport (2005) *Home Zones: Challenging the future of our streets*.
- Department for Transport (2006) *Walking and cycling: 'Links to Schools''*.

- Department for Transport (2007) *Manual for Streets*, Thomas Telford Publishing. London.
- Department for Transport (2014) *National Travel Survey 2014: Travel to school Fact Sheet*. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/476635/travel-to-school.pdf.
- Department for Transport (2020a) *Gear Change: A bold vision for cycling and walking*.
- Department for Transport (2020b) *Statutory Guidance: Traffic management act 2004: network management in response to COVID-19 (May)*.
- Department for Transport (2022) *Road Traffic Estimates: Great Britain 2021*. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1107056/road-traffic-estimates-in-great-britain-2021.pdf.
- Deutsch, K. and Goulias, K. (2012) 'Understanding place through use of mixed-method approach', *Transportation Research Record*, (2323), pp. 1–9. doi:10.3141/2323-01.
- Douglas, G. (2018) *The Help Yourself City*. Oxford: Oxford University Press.
- Dovey, K. (2014) 'Review: The Temporary City', *Journal of Urban Design*, 19(2), pp. 261–263. doi:10.1080/13574809.2013.853246.
- Dudley, G., Banister, D. and Schwanen, T. (2022) 'Low Traffic Neighbourhoods and the Paradox of UK Government Control of the Active Travel Agenda', *Political Quarterly*, 93(4), pp. 585–593. doi:10.1111/1467-923X.13198.
- Edwards, P., Green, J., Roberts, I., Grundy, C. and Lachowycz, K. (2006) 'Deprivation and Road Safety in London: A report to the London Road Safety Unit', pp. 1–127. Available at:
<https://content.tfl.gov.uk/deprivation-and-road-safety.pdf>.
- Egan, R. and Hackett, J. (2022) 'The Social Practice and Regulation of Cycling as "A Boy's Thing" in Irish Secondary Schools', *Active Travel Studies*, 2(2), pp. 1–20. doi:<https://doi.org/10.16997/ats.1121>.
- Elliott, L.D., Lieberman, M., Rovniak, L.S., Bose, M., Holmes, L.M. and Bopp, M. (2022) 'What are States Doing to Encourage Safe Routes to School Programming in Disadvantaged Communities? Findings From a U.S. Mixed-Methods Survey', *Transportation Research Record: Journal of the Transportation Research Board*, 2677(5), p. 036119812211403. doi:10.1177/03611981221140363.
- Eubank-Ahrens, B. (1985) 'The impact of "Woonerven" on children's behavior', *Children's Environments Quarterly*, 1(4), pp. 39–45.
- Evans, J., Karvonen, A. and Raven, R. (2016) *The Experimental City*. Edited by J. Evans, A. Karvonen, and R. Raven. Abingdon: Routledge.
- Evenson, K., Neelon, B., Ball, S., Vaughn, A. and Ward, D. (2008) 'Validity and Reliability of a School Travel Survey', *Journal of Physical Activity Health*, 5(Suppl 1), pp. S1-15.
- Ewing, R. and Cervero, R. (2010) 'Travel and the built environment', *Journal of the American Planning Association*, 76(3), pp. 265–294. doi:10.1080/01944361003766766.
- Ewing, R., Schroeder, W. and Greene, W. (2004) 'School location and student travel: Analysis of factors affecting mode choice', *Transportation Research Record*, (1895), pp. 55–63. doi:10.3141/1895-08.
- Fairfax, K. (2022) 'The unplanned experiment : strategic learnings from COVID-19 temporary footway widening schemes and the delivery of the London Healthy Streets Approach .', (August).
- Fast, I. (2020) 'Unequal traveling: How school district and family characteristics shape the duration of students' commute to school', *Travel Behaviour and Society*, 20(March), pp. 165–173. doi:10.1016/j.tbs.2020.03.008.

- Faulkner, G.E.J., Richichi, V., Buliung, R.N., Fusco, C. and Moola, F. (2010) 'What's quickest and easiest Parental decision making about school trip mode', *International Journal of Behavioral Nutrition and Physical Activity*, 7, pp. 1–11. doi:10.1186/1479-5868-7-62.
- Fecht, D., Fischer, P., Fortunato, L., Hoek, G., De Hoogh, K., Marra, M., Kruize, H., Vienneau, D., Beelen, R. and Hansell, A. (2015) 'Associations between air pollution and socioeconomic characteristics, ethnicity and age profile of neighbourhoods in England and the Netherlands', *Environmental Pollution*, 198, pp. 201–210. doi:10.1016/j.envpol.2014.12.014.
- Ferenchak, N.N. and Marshall, W.E. (2019) 'Equity Analysis of Proactively- vs. Reactively- Identified Traffic Safety Issues', *Transportation Research Record*, 2673(7), pp. 596–606. doi:10.1177/0361198119841296.
- Ferguson, A. (2019) 'Playing out: a grassroots street play revolution', *Cities & Health*, 3(1–2), pp. 20–28. doi:10.1080/23748834.2018.1550850.
- Ferrari, E. and Green, M.A. (2013) 'Travel to school and housing markets: A case study of Sheffield, England', *Environment and Planning A*, 45(11), pp. 2771–2788. doi:10.1068/a45423.
- Ferreri, M. (2021) *The Permanence of Temporary Urbanism: Normalising Precarity in Austerity London*. Amsterdam: Amsterdam University Press. doi:10.1177/00943061221142074i.
- Fetters, M.D. and Molina-Azorin, J.F. (2021) 'Special Issue on COVID-19 and Novel Mixed Methods Methodological Approaches During Catastrophic Social Changes', *Journal of Mixed Methods Research*, 15(3), pp. 295–303. doi:10.1177/15586898211029100.
- Finn, D. (2014) 'DIY urbanism: implications for cities', *Journal of Urbanism*, 7(4), pp. 381–398. doi:10.1080/17549175.2014.891149.
- Firth, C.L., Baquero, B., Berney, R., Hoerster, K.D., Mooney, S.J. and Winters, M. (2021) 'Not quite a block party: COVID-19 street reallocation programs in Seattle, WA and Vancouver, BC', *SSM - Population Health*, 14, p. 100769. doi:10.1016/j.ssmph.2021.100769.
- Fischer, J. and Winters, M. (2021) 'COVID-19 street reallocation in mid-sized Canadian cities: socio-spatial equity patterns', *Canadian Journal of Public Health*, 112(3), pp. 376–390. doi:10.17269/s41997-020-00467-3.
- Flanagan, E., Lachapelle, U. and El-Geneidy, A. (2016) 'Riding tandem: Does cycling infrastructure investment mirror gentrification and privilege in Portland, OR and Chicago, IL?', *Research in Transportation Economics*, 60, pp. 14–24. doi:10.1016/j.retrec.2016.07.027.
- Foster, A. (2023) *Illegal levels of air toxins found in many boroughs*, BBC. Available at: <https://www.bbc.co.uk/news/articles/c4nw2r72l5ro> (Accessed: 2 August 2023).
- Fouquet, R. (2011) 'Long run trends in energy-related external costs', *Ecological Economics*, 70(12), pp. 2380–2389. doi:10.1016/j.ecolecon.2011.07.020.
- Frank, L.D., Sallis, J.F., Saelens, B.E., Leary, L., Cain, L., Conway, T.L. and Hess, P.M. (2010) 'The development of a walkability index: Application to the neighborhood quality of life study', *British Journal of Sports Medicine*, 44(13), pp. 924–933. doi:10.1136/bjism.2009.058701.
- Freund, P. (1993) *The ecology of the automobile*. Montreal and New York: Black Rose Books.
- Fuller, G., Friedman, S. and Mudway, I. (2023) *Impacts of air pollution across the life course – evidence highlight note*. London.
- Gaffron, P. and Niemeier, D. (2015) 'School locations and traffic Emissions — Environmental (In)justice findings using a new screening method', *International Journal of Environmental Research and Public Health*, 12(2), pp. 2009–2025. doi:10.3390/ijerph120202009.
- Gardner, J. (2022) 'Two-stage differences in differences', (April). Available at: <http://arxiv.org/abs/2207.05943>.

- Ghanem, S., Ahmad, A.F. and Aboualy, S. (2021) 'COVID-19 Bringing Cairenes Back to their Streets', *Journal of Urban Management*, 10(4), pp. 393–408. doi:10.1016/j.jum.2021.06.001.
- Gigerenzer, G. (2015) 'On the Supposed Evidence for Libertarian Paternalism', *Review of Philosophy and Psychology*, 6(3), pp. 361–383. doi:10.1007/s13164-015-0248-1.
- Giles-Corti, B., Wood, G., Pikora, T., Learnihan, V., Bulsara, M., Van Niel, K., Timperio, A., McCormack, G. and Villanueva, K. (2011) 'School site and the potential to walk to school: The impact of street connectivity and traffic exposure in school neighborhoods', *Health and Place*, 17(2), pp. 545–550. doi:10.1016/j.healthplace.2010.12.011.
- Gill, T. (2006) 'Home Zones in the UK: History, Policy and Impact on Children and Youth', *Children, Youth and Environments*, 16(1), pp. 90–103.
- Gill, T. (2021) *Urban Playground: How Child-Friendly Planning and Design Can Save Cities*. Milton: RIBA Publishing. doi:0.4324/9781003108658.
- GLA (2016) 'The London Plan: The Spatial Development Strategy For London Consolidated With Alterations Since 2011', *Greater London Authority*, (March), p. 430. Available at: <https://www.london.gov.uk/what-we-do/planning/london-plan>.
- Glanz, K. and Bishop, D.B. (2010) 'The Role of Behavioral Science Theory in Development and Implementation of Public Health Interventions', *Annual Review of Public Health*, 31(1), pp. 399–418. doi:10.1146/annurev.publhealth.012809.103604.
- Glazener, A., Sanchez, K., Ramani, T., Zietsman, J., Nieuwenhuijsen, M.J., Mindell, J.S., Fox, M. and Khreis, H. (2021) 'Fourteen pathways between urban transportation and health: A conceptual model and literature review', *Journal of Transport and Health*, 21(February), p. 101070. doi:10.1016/j.jth.2021.101070.
- Gobo, G. (2023) 'Mixed Methods and Their Pragmatic Approach: Is There a Risk of Being Entangled in a Positivist Epistemology and Methodology? Limits, Pitfalls and Consequences of a Bricolage Methodology', *Forum: Qualitative Social Research, Sozialforschung*, 24(1). doi:10.17169/fqs-24.1.4005.
- Gomez, L.F., Sarmiento, R., Ordoñez, M.F., Pardo, C.F., de Sá, T.H., Mallarino, C.H., Miranda, J.J., Mosquera, J., Parra, D.C., Reis, R. and Quistberg, D.A. (2015) 'Urban environment interventions linked to the promotion of physical activity: A mixed methods study applied to the urban context of Latin America', *Social Science and Medicine*, 131, pp. 18–30. doi:10.1016/j.socscimed.2015.02.042.
- Goodman, A., Furlong, J., Laverty, A.A., Thomas, A. and Aldred, R. (2021) 'The Impact of 2020 Low Traffic Neighbourhoods in London on Road Traffic Injuries', *Findings*, (July), pp. 1–8. doi:10.32866/001c.23568.
- Goodman, A., Laverty, A.A., Furlong, J. and Aldred, R. (2023) 'The Impact of 2020 Low Traffic Neighbourhoods on Levels of Car/Van Driving among Residents: Findings from Lambeth, London, UK', *Findings*, (March 2018), pp. 1–10. doi:10.32866/001c.75470.
- Goodman, A., Laverty, A.A., Thomas, A. and Aldred, R. (2021) 'The Impact of 2020 Low Traffic Neighbourhoods on Fire Service Emergency Response Times, in London, UK', *Findings*, May. doi:10.32866/001c.23568.
- Goodman, A., Wilkinson, P., Stafford, M. and Tonne, C. (2011) 'Characterising socio-economic inequalities in exposure to air pollution: A comparison of socio-economic markers and scales of measurement', *Health and Place*, 17(3), pp. 767–774. doi:10.1016/j.healthplace.2011.02.002.
- Goodman-Bacon, A. (2021) 'Difference-in-differences with variation in treatment timing', *Journal of Econometrics*, 225(2), pp. 254–277. doi:10.1016/j.jeconom.2021.03.014.
- Gorard, S. (2013) *Research Design: Creating Robust Approaches for the Social Sciences*. London: SAGE Publications. doi:<https://dx.doi.org/10.4135/9781526431486>.

- Greater London Authority (2011) *Childhood Obesity in London, GLA Intelligence Unit*.
- Greater London Authority (2022) *Good Growth Fund Evaluation - Annex 8 - Case Studies, Greater London Authority*. London. Available at: https://www.london.gov.uk/sites/default/files/ggf_appendix_8_case_studies_240522.pdf.
- Greenhalgh, T. and Engebretsen, E. (2022) 'The science-policy relationship in times of crisis: An urgent call for a pragmatist turn', *Social Science and Medicine*, 306(May), p. 115140. doi:10.1016/j.socscimed.2022.115140.
- Guliani, A., Mitra, R., Buliung, R.N., Larsen, K. and Faulkner, G.E.J. (2015) 'Gender-based differences in school travel mode choice behaviour: Examining the relationship between the neighbourhood environment and perceived traffic safety', *Journal of Transport and Health*, 2(4), pp. 502–511. doi:10.1016/j.jth.2015.08.008.
- Gutierrez, C.M., Slagle, D., Figueras, K., Anon, A., Huggins, A.C. and Hotz, G. (2014) 'Crossing guard presence: Impact on active transportation and injury prevention', *Journal of Transport and Health*, 1(2), pp. 116–123. doi:10.1016/j.jth.2014.01.005.
- Hackney Council (2022) *Rebuilding a Greener Hackney Survey of Residents*. Available at: <https://news.hackney.gov.uk/download/1144595/rebuildingagreenerhackney-finalpollingreport.pdf>.
- Halcomb, E.J. (2019) 'Mixed methods research: The issues beyond combining methods', *Journal of Advanced Nursing*, 75(3), pp. 499–501. doi:10.1111/jan.13877.
- Hall, R. (2013) 'Mixed methods: In search of a paradigm', *Conducting Research in a Changing and Challenging World*, (January 2013), pp. 69–78.
- Halpern, D. (2015) *Inside the Nudge Unit*. London: WH Allen.
- Hampton, S. (2018) 'Policy implementation as practice? Using social practice theory to examine multi-level governance efforts to decarbonise transport in the United Kingdom', *Energy Research and Social Science*, 38(February), pp. 41–52. doi:10.1016/j.erss.2018.01.020.
- Handy, S. (1996) 'Methodologies for exploring the link between urban form and travel behavior', *Transportation Research Part D: Transport and Environment*, 1(2), pp. 151–165. doi:10.1016/S1361-9209(96)00010-7.
- Handy, S. (2018) 'Enough with the "D's" Already — Let's Get Back to "A"', *Transfers*, (Spring), pp. 1–3. Available at: <https://transfersmagazine.org/>.
- Handy, S., Cao, X. and Mokhtarian, P. (2008) 'Neighborhood Design and Children's Outdoor Play: Evidence from Northern California.', *Children, Youth and Environments*, 18(2). doi:10.1353/cye.2008.0003.
- Harris, R. and Jarvis, C. (2011) *Statistics for Geography and Environmental Science*. London: Routledge. doi:<https://doi.org/10.4324/9781315847610>.
- Hart, J. and Parkhurst, G. (2011) 'Driven to excess: Impacts of motor vehicles on the quality of life of residents of three streets in Bristol', *World Transport Policy & Practice*, 17(2), pp. 12–30.
- Harvey, D. (1990) *The Condition of Postmodernity*. Oxford: Blackwell.
- Haughton, G., Allmendinger, P. and Oosterlynck, S. (2013) 'Spaces of neoliberal experimentation: Soft spaces, postpolitics, and neoliberal governmentality', *Environment and Planning A*, 45(1), pp. 217–234. doi:10.1068/a45121.
- He, S.Y. (2013) 'Will you escort your child to school? The effect of spatial and temporal constraints of parental employment', *Applied Geography*, 42, pp. 116–123. doi:10.1016/j.apgeog.2013.05.003.
- Healey, P. (2009) 'The pragmatic tradition in planning thought', *Journal of Planning Education and Research*, 28(3), pp. 277–292. doi:10.1177/0739456X08325175.

- Hekman, S.J. (1983) *Weber, the ideal type, and contemporary social theory*. Notre Dame, Ind. : [New York: University of Notre Dame Press.
- Helbich, M., Emmichoven, M.J.Z. van, Dijst, M.J., Kwan, M.P., Pierik, F.H. and Vries, S.I. de (2016) 'Natural and built environmental exposures on children's active school travel: A Dutch global positioning system-based cross-sectional study', *Health and Place*, 39, pp. 101–109. doi:10.1016/j.healthplace.2016.03.003.
- Henderson, J. (2006) 'Secessionist automobility: Racism, anti-urbanism, and the politics of automobility in Atlanta, Georgia', *International Journal of Urban and Regional Research*, 30(2), pp. 293–307. doi:10.1111/j.1468-2427.2006.00662.x.
- Henne, H.M., Tandon, P.S., Frank, L.D. and Saelens, B.E. (2014) 'Parental factors in children's active transport to school', *Public Health*, 128(7), pp. 643–646. doi:10.1016/j.puhe.2014.05.004.
- Herman, K. and Rodgers, M. (2020) 'From tactical urbanism action to institutionalised urban planning and educational tool: The evolution of park(ing) day', *Land*, 9(7). doi:10.3390/land9070217.
- Herrador-Colmenero, M., Escabias, M., Ortega, F.B., McDonald, N.C. and Chillón, P. (2019) 'Mode of commuting TO and FROM school: A similar or different pattern?', *Sustainability (Switzerland)*, 11(4), pp. 1–9. doi:10.3390/su11041026.
- Hertfordshire Behaviour Change Unit (2020) *Covid-19 Social Distancing Regulations*.
- Hesketh, K.R., Brage, S., Inskip, H.M., Crozier, S.R., Godfrey, K.M., Harvey, N.C., Cooper, C. and Van Sluijs, E.M.F. (2022) 'Activity Behaviors in British 6-Year-Olds: Cross-Sectional Associations and Longitudinal Change During the School Transition', *Journal of Physical Activity and Health*, 19(8), pp. 558–565. doi:10.1123/jpah.2021-0718.
- Hillman, M., Adams, J. and Whitelegg, J. (1990) *One False Move, Policy Studies Institute*. doi:10.5040/9781838710569.0062.
- Hirsch, J.A., Green, G.F., Peterson, M., Rodriguez, D.A. and Gordon-Larsen, P. (2017) 'Neighborhood sociodemographics and change in built infrastructure', *Journal of Urbanism*, 10(2), pp. 181–197. doi:10.1080/17549175.2016.1212914.
- Hobbs, G. and Vignoles, A. (2010) 'Is children's free school meal "eligibility" a good proxy for family income?', *British Educational Research Journal*, 36(4), pp. 673–690. doi:10.1080/01411920903083111.
- Hoch, C. (2017) 'Neo-Pragmatist Planning Theory', in Gunder, M., Madanipour, A., and Watson, V. (eds) *The Routledge Handbook of Planning Theory*. New York: Routledge, pp. 118–129. doi:10.1080/00137916208928634.
- Hoelscher, D.M., Ganzar, L.A., Salvo, D., Kohl, H.W., Pérez, A., Brown, H.S., Bentley, S.S., Dooley, E.E., Emamian, A. and Durand, C.P. (2022) 'Effects of Large-Scale Municipal Safe Routes to School Infrastructure on Student Active Travel and Physical Activity: Design, Methods, and Baseline Data of the Safe Travel Environment Evaluation in Texas Schools (STREETS) Natural Experiment', *International Journal of Environmental Research and Public Health*, 19(3), pp. 1–17. doi:10.3390/ijerph19031810.
- Hollands, G.J., Shemilt, I., Marteau, T.M., Jebb, S.A., Kelly, M.P., Nakamura, R., Suhrcke, M. and Ogilvie, D. (2013) 'Altering micro-environments to change population health behaviour: Towards an evidence base for choice architecture interventions', *BMC Public Health*, 13(1). doi:10.1186/1471-2458-13-1218.
- Holloway, S. and Valentine, G. (2000) *Children's Geographies*. New York: Routledge.
- Homes England (2022) *Streets for a Healthy Life*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1089852/Streets-for-a-Healthy-Life.pdf.

- Honey-Rosés, J., Anguelovski, I., Chireh, V.K., Daher, C., Konijnendijk van den Bosch, C., Litt, J.S., Mawani, V., McCall, M.K., Orellana, A., Oscilowicz, E., Sánchez, U., Senbel, M., Tan, X., Villagomez, E., Zapata, O. and Nieuwenhuijsen, M.J. (2021) 'The impact of COVID-19 on public space: an early review of the emerging questions—design, perceptions and inequities', *Cities and Health*, 5(sup1), pp. S263–S279. doi:10.1080/23748834.2020.1780074.
- Hopkinson, L., Goodman, A., Sloman, L., Aldred, R. and Thomas, A. (2021) *School Streets: Reducing children's exposure to toxic air pollution and road danger*. London. Available at: <https://static1.squarespace.com/static/5d30896202a18c0001b49180/t/5ff86080e72bb40340c83efa/1610113159846/School+Streets+-+Possible.pdf>.
- Hou, J. (2020) 'Guerrilla urbanism: urban design and the practices of resistance', *Urban Design International*, 25(2), pp. 117–125. doi:10.1057/s41289-020-00118-6.
- Houde, M., Apparicio, P. and Séguin, A.M. (2018) 'A ride for whom: Has cycling network expansion reduced inequities in accessibility in Montreal, Canada?', *Journal of Transport Geography*, 68(February), pp. 9–21. doi:10.1016/j.jtrangeo.2018.02.005.
- Howe, K.R. (2004) 'A critique of experimentalism', *Qualitative Inquiry*, 10(1), pp. 42–61. doi:10.1177/1077800403259491.
- Hwang, J., Joh, K. and Woo, A. (2017) 'Social inequalities in child pedestrian traffic injuries: Differences in neighborhood built environments near schools in Austin, TX, USA', *Journal of Transport and Health*, 6(May), pp. 40–49. doi:10.1016/j.jth.2017.05.003.
- Ikeda, E., Hinckson, E., Witten, K. and Smith, M. (2018) 'Associations of children's active school travel with perceptions of the physical environment and characteristics of the social environment: A systematic review', *Health and Place*, 54(October 2017), pp. 118–131. doi:10.1016/j.healthplace.2018.09.009.
- Ikeda, E., Mavoia, S., Cavadino, A., Carroll, P., Hinckson, E., Witten, K. and Smith, M. (2020) 'Keeping kids safe for active travel to school: A mixed method examination of school policies and practices and children's school travel behaviour', *Travel Behaviour and Society*, 21(September 2019), pp. 57–68. doi:10.1016/j.tbs.2020.05.008.
- Ilie, S., Sutherland, A. and Vignoles, A. (2017) 'Revisiting free school meal eligibility as a proxy for pupil socio-economic deprivation', *British Educational Research Journal*, 43(2), pp. 253–274. doi:10.1002/berj.3260.
- *In Spain News* (2021) 'Schools in Catalonia and Madrid protest over traffic', 28 February. Available at: <https://inspain.news/schools-in-catalonia-and-madrid-protest-over-traffic/>.
- Iveson, K. (2013) 'Cities within the City: Do-It-Yourself Urbanism and the Right to the City', *International Journal of Urban and Regional Research*, 37(3), pp. 941–956. doi:10.1111/1468-2427.12053.
- Jacobs, J. (1961) *The death and life of great American cities*. 50th anniv. New York: Modern Library.
- Jacobs, K. and Manzi, T. (2013) 'New Localism, Old Retrenchment: The "Big Society", Housing Policy and the Politics of Welfare Reform', *Housing, Theory and Society*, 30(1), pp. 29–45. doi:10.1080/14036096.2012.683293.
- Jain, J., Line, T. and Lyons, G. (2011) 'A troublesome transport challenge? Working round the school run', *Journal of Transport Geography*, 19. doi:10.1016/j.jtrangeo.2011.04.007.
- Jephcote, C. and Chen, H. (2012) 'Environmental injustices of children's exposure to air pollution from road-transport within the model British multicultural city of Leicester: 2000–09', *Science of the Total Environment*, 414, pp. 140–151. doi:10.1016/j.scitotenv.2011.11.040.
- Jones, P.M., Dix, M.C., Clarke, M.I. and Heggie, I.G. (1983) *Understanding travel behaviour*. Brookfield: Gower.

- Jones, R., Pykett, J. and Whitehead, M. (2011) 'Governing temptation: Changing behaviour in an age of libertarian paternalism', *Progress in Human Geography*, 35(4), pp. 483–501. doi:10.1177/0309132510385741.
- Jones, R., Pykett, J. and Whitehead, M. (2013) 'Replanning the street: changing behaviours by spatial design', *Changing Behaviours*, pp. 81–110. doi:10.4337/9780857936882.00010.
- Jones, S. and Somper, C. (2014) 'The role of green infrastructure in climate change adaptation in London', *Geographical Journal*, 180(2), pp. 191–196. doi:10.1111/geoj.12059.
- Jones, S.J., Lyons, R.A., John, A. and Palmer, S.R. (2005) 'Traffic calming policy can reduce inequalities in child pedestrian injuries: Database study', *Injury Prevention*, 11(3), pp. 152–156. doi:10.1136/ip.2004.007252.
- Jung, J., Koli, M.K., Mavros, C., Smith, J. and Stepanian, K. (2021) 'Research in Crisis: COVID-19 and Methodological Adaptation', in Hill, A.D., Lê, J.K., McKenny, A.F., O'Kane, P., Paroutis, S., and Smith, A.D. (eds) *Research in Times of Crisis*. Emerald Publishing Limited (Research Methodology in Strategy and Management), pp. 151–177. doi:10.1108/S1479-838720210000013011.
- Karlsson, C. (2018) *Healthy Streets for All ? A Multi-Method Assessment of Pedestrians ' Experiences of Uxbridge Road in Ealing Broadway [MSc Thesis]*. University of Westminster.
- Kärmeniemi, M., Lankila, T., Ikäheimo, T., Koivumaa-Honkanen, H. and Korpelainen, R. (2018) 'The Built Environment as a Determinant of Physical Activity: A Systematic Review of Longitudinal Studies and Natural Experiments', *Annals of Behavioral Medicine*, 52(3), pp. 239–251. doi:10.1093/abm/kax043.
- Karndacharuk, A., Wilson, D.J. and Dunn, R. (2014) 'A Review of the Evolution of Shared (Street) Space Concepts in Urban Environments', *Transport Reviews*, 34(2), pp. 190–220. doi:10.1080/01441647.2014.893038.
- Karner, A., London, J., Rowangould, D. and Manaugh, K. (2020) 'From Transportation Equity to Transportation Justice: Within, Through, and Beyond the State', *Journal of Planning Literature*, 35(4), pp. 440–459. doi:10.1177/0885412220927691.
- Karvonen, A. and van Heur, B. (2014) 'Urban laboratories: Experiments in reworking cities', *International Journal of Urban and Regional Research*, 38(2), pp. 379–392. doi:10.1111/1468-2427.12075.
- Kaushik, V. and Walsh, C.A. (2019) 'Pragmatism as a research paradigm and its implications for Social Work research', *Social Sciences*, 8(255), pp. 1–17. doi:10.3390/socsci8090255.h.
- Keen, S., Lomeli-Rodriguez, M. and Joffe, H. (2022) 'From Challenge to Opportunity: Virtual Qualitative Research During COVID-19 and Beyond', *International Journal of Qualitative Methods*, 21, pp. 1–11. doi:10.1177/16094069221105075.
- Kent, J.L. (2022) 'The use of practice theory in transport research', *Transport Reviews*, 42(2). doi:10.1080/01441647.2021.1961918.
- Kenyon, A. and Pearce, J. (2019) 'The socio-spatial distribution of walkable environments in urban Scotland: A case study from Glasgow and Edinburgh', *SSM - Population Health*, 9(January), p. 100461. doi:10.1016/j.ssmph.2019.100461.
- Kim, J. (2022) 'COVID-19's impact on local planning and urban design practice: focusing on tactical urbanism and the public realm with respect to low income communities', *Journal of Urbanism*, 00(00), pp. 1–7. doi:10.1080/17549175.2022.2146155.
- Kincheloe, J.L. (2001) 'Describing the Bricolage: Conceptualizing a New Rigor in Qualitative Research', *Qualitative Inquiry*, 7(6), pp. 679–692. doi:10.1177/107780040100700601.
- King, N. (2012) 'Doing Template Analysis', in Symon, G. and Cassell, C. (eds) *Qualitative Organizational Research: Core Methods and Current Challenges*. Sage Publications. doi:10.4135/9781526435620.

- Kitamura, R., Mokhtarian, P.L. and Laidet, L. (1997) 'A micro-analysis of land use and travel in five neighborhoods in the San Francisco Bay Area', *Transportation*, 24, pp. 125–158. Available at: <https://www.researchgate.net/publication/263523300>.
- Lam, T.M., Wang, Z., Vaartjes, I., Karssenber, D., Ettema, D., Helbich, M., Timmermans, E.J., Frank, L.D., den Braver, N.R., Wagtenonk, A.J., Beulens, J.W.J. and Lakerveld, J. (2022) 'Development of an objectively measured walkability index for the Netherlands', *International Journal of Behavioral Nutrition and Physical Activity*, 19(1), pp. 1–16. doi:10.1186/s12966-022-01270-8.
- Lambert, A., Vlaar, J., Herrington, S. and Brussoni, M. (2019) 'What is the relationship between the neighbourhood built environment and time spent in outdoor play? A systematic review', *International Journal of Environmental Research and Public Health*, 16(20). doi:10.3390/ijerph16203840.
- Larouche, R., Mammen, G., Rowe, D.A. and Faulkner, G. (2018) 'Effectiveness of active school transport interventions: A systematic review and update', *BMC Public Health*, 18(1), pp. 1–18. doi:10.1186/s12889-017-5005-1.
- Larsen, K., Buliung, R.N. and Faulkner, G. (2016) 'School travel route measurement and built environment effects in models of children's school travel behavior', *Journal of Transport and Land Use*, 9(2), pp. 5–23. doi:10.5198/jtlu.2015.782.
- Lavery, A.A., Hone, T., Goodman, A., Kelly, Y. and Millett, C. (2021) 'Associations of active travel with adiposity among children and socioeconomic differentials: a longitudinal study', *BMJ Open*, 11(1), pp. 1–9. doi:10.1136/bmjopen-2019-036041.
- Laville, S. (2020) 'Air pollution a cause in girl's death, coroner rules in landmark case', *The Guardian*, 16 December. Available at: <https://www.theguardian.com/environment/2020/dec/16/girls-death-contributed-to-by-air-pollution-coroner-rules-in-landmark-case>.
- Le, H.T.K., Buehler, R. and Hankey, S. (2018) 'Correlates of the built environment and active travel: Evidence from 20 US metropolitan areas', *Environmental Health Perspectives*, 126(7), pp. 1–13. doi:10.1289/EHP3389.
- Lee, J. and Lubienski, C. (2017) 'The Impact of School Closures on Equity of Access in Chicago', *Education and Urban Society*, 49(1), pp. 53–80. doi:10.1177/0013124516630601.
- Lee, R.J., Sener, I.N. and Jones, S.N. (2017) 'Understanding the role of equity in active transportation planning in the United States', *Transport Reviews*, 37(2), pp. 211–226. doi:10.1080/01441647.2016.1239660.
- Leggett, W. (2014) 'The politics of behaviour change: nudge, neoliberalism and the state', *Policy and Politics*, 42(1), pp. 3–19.
- Legislation, U. (2010) *Road Traffic Regulation Act 1984*.
- Lerner, J., Margolis, Mac., Muello, P. and Daher, A. (2014) *Urban Acupuncture*. Washington, D.C: Island Press.
- LGA (2021) *Stakeholder engagement in an emergency: Lessons from low-traffic neighbourhoods*. Available at: <https://local.gov.uk/publications/stakeholder-engagement-emergency-lessons-low-traffic-neighbourhoods> (Accessed: 9 August 2021).
- London Borough of Hackney (no date) *School Streets timed traffic restrictions: Toolkit for professionals*. London. Available at: <https://drive.google.com/file/d/1IhbBqQso9E66olxHshd6jn9ukeK8hHdy/view>.
- London Councils (2018) 'Demystifying Air Pollution in London full report', *London Councils*, p. 40. Available at: [https://www.londoncouncils.gov.uk/sites/default/files/Policy themes/Environment/Demystifying air pollution in London FINAL FULL REPORT_IM_0.pdf](https://www.londoncouncils.gov.uk/sites/default/files/Policy%20themes/Environment/Demystifying%20air%20pollution%20in%20London%20FINAL%20FULL%20REPORT_IM_0.pdf).

- Lopes, F., Cordovil, R. and Neto, C. (2014) 'Children's independent mobility in Portugal: Effects of urbanization degree and motorized modes of travel', *Journal of Transport Geography*, 41, pp. 210–219. doi:10.1016/j.jtrangeo.2014.10.002.
- Lowndes, V. and Pratchett, L. (2012) 'Local Governance under the Coalition Government: Austerity, Localism and the "Big Society"', *Local Government Studies*, 38(1), pp. 21–40. doi:10.1080/03003930.2011.642949.
- Lu, W., McKyer, E.L.J., Lee, C., Goodson, P., Ory, M.G. and Wang, S. (2014a) 'Perceived barriers to children's active commuting to school: A systematic review of empirical, methodological and theoretical evidence', *International Journal of Behavioral Nutrition and Physical Activity*, 11(1). doi:10.1186/s12966-014-0140-x.
- Lu, W., McKyer, E.L.J., Lee, C., Goodson, P., Ory, M.G. and Wang, S. (2014b) 'Perceived barriers to children's active commuting to school: A systematic review of empirical, methodological and theoretical evidence', *International Journal of Behavioral Nutrition and Physical Activity*, 11(1). doi:10.1186/s12966-014-0140-x.
- Lucas, K. and Jones, P. (2012) 'Social impacts and equity issues in transport: An introduction', *Journal of Transport Geography*, 21, pp. 1–3. doi:10.1016/j.jtrangeo.2012.01.032.
- Lucas, K., Martens, K., Ciommo, F. Di and Dupont-Kieffer, A. (2019) *Measuring Transport Equity*. San Diego: Elsevier. Available at: <https://www.elsevier.com/books/measuring-transport-equity/lucas/978-0-12-814818-1>.
- Lunetto, M., Castro, O., Gericke, C. and Hale, J. (2023) 'Barriers and enablers to local active travel during COVID-19: A case study of Streetspace interventions in two London boroughs', *Wellcome Open Research*, 8(May), p. 177. doi:10.12688/wellcomeopenres.19164.1.
- Lydon, M. and Garcia, A. (2015) *Tactical Urbanism: Short-term Action for Long-term Change*. Washington: Island Press.
- Madill, A., Jordan, A. and Shirley, C. (2000) 'Objectivity and reliability in qualitative analysis: Realist, contextualist and radical constructionist epistemologies', *British Journal of Psychology*, 91(1), pp. 1–20. doi:10.1348/000712600161646.
- Mammen, G., Stone, M.R., Faulkner, G., Ramanathan, S., Buliung, R., O'Brien, C. and Kennedy, J. (2014) 'Active school travel: An evaluation of the Canadian school travel planning intervention', *Preventive Medicine*, 60, pp. 55–59. doi:10.1016/j.ypmed.2013.12.008.
- Mandic, S., Sandretto, S., García Bengoechea, E., Hopkins, D., Moore, A., Rodda, J. and Wilson, G. (2017) 'Enrolling in the Closest School or Not? Implications of school choice decisions for active transport to school', *Journal of Transport and Health*, 6(May), pp. 347–357. doi:10.1016/j.jth.2017.05.006.
- Maria, L., Fabris, F., Camerin, F., Semperebon, G. and Balzarotti, R.M. (2020) 'New Healthy Settlements Responding to Pandemic Outbreaks: Approaches from (and for) the Global City', *The Plan Journal*, 5(2), pp. 1–22. doi:10.15274/tpj.2020.05.02.4.
- Marks, D.F. and Bandura, A. (2002) 'The Health Psychology Reader: Social Foundations of Thought and Action', p. 388. Available at: <https://books.google.com/books?hl=en&lr=&id=EY0MsG8ZHUC&pgis=1>.
- Marsden, G., Anable, J., Chatterton, T., Docherty, I., Faulconbridge, J., Murray, L., Roby, H. and Shires, J. (2020) 'Studying disruptive events: Innovations in behaviour, opportunities for lower carbon transport policy?', *Transport Policy*, 94(April), pp. 89–101. doi:10.1016/j.tranpol.2020.04.008.
- Marsden, G., Mullen, C., Bache, I., Bartle, I. and Flinders, M. (2014) 'Carbon reduction and travel behaviour: Discourses, disputes and contradictions in governance', *Transport Policy*, 35, pp. 71–78. doi:10.1016/j.tranpol.2014.05.012.

- Marsden, G. and Rye, T. (2010) 'The governance of transport and climate change', *Journal of Transport Geography*, 18(6), pp. 669–678. doi:10.1016/j.jtrangeo.2009.09.014.
- Martens, K. (2012) 'Justice in transport as justice in accessibility: Applying Walzer's "Spheres of Justice" to the transport sector', *Transportation*, 39(6), pp. 1035–1053. doi:10.1007/s11116-012-9388-7.
- Martens, K. and Bastiaanssen, J. (2019) 'An index to measure accessibility poverty risk', in Lucas, K., Martens, K., Ciommo, F. Di, and Dupont-Kieffer, A. (eds) *Measuring Transport Equity*. San Diego: Elsevier, pp. 39–55. doi:10.1016/B978-0-12-814818-1.00003-2.
- Marzi, I. and Reimers, A.K. (2018) 'Children's independent mobility: Current knowledge, future directions, and public health implications', *International Journal of Environmental Research and Public Health*, 15(11). doi:10.3390/ijerph15112441.
- Maxwell, J.A. (2011) 'Paradigms or Toolkits', *Mid-Western Educational Researcher*, 24(2), pp. 7–10.
- Mayor of London (2018a) 'Mayor's Transport Strategy for London (2018)', (March). Available at: www.london.gov.uk.
- Mayor of London (2018b) *The Mayor's School Air Quality Audit Programme*.
- Mayor of London (2019) 'Making London Child-Friendly', pp. 1–144. Available at: https://www.london.gov.uk/sites/default/files/ggbd_making_london_child-friendly.pdf.
- Mayor of London (2022) *Mayor hails success of Schools Streets programme*. Available at: <https://www.london.gov.uk/press-releases/mayoral/mayor-hails-success-of-schools-streets-programme> (Accessed: 8 July 2022).
- Mazziotta, M. and Pareto, A. (2013) 'Methods for constructing composite indicators: One for all or all for one', *Italian Journal of Economic Demography and Statistics*, 67(2), pp. 67–80. Available at: http://www.istat.it/en/files/2013/12/Rivista2013_Mazziotta_Pareto.pdf http://www.sieds.it/listing/RePEc/journal/2013LXVII_N2_10_Mazziotta_Pareto.pdf.
- McCormack, G.A. and Shiell, A. (2011) 'In search of causality: a systematic review of the relationship between the built environment and physical activity among adults', *International Journal of Behavioral Nutrition and Physical Activity*, 125(8), pp. 557–560. doi:10.1016/j.ics.2007.02.011.
- McEachan, R.R.C., Dickerson, J., Bridges, S., Bryant, M., Cartwright, C., Islam, S., Lockyer, B., Rahman, A., Sheard, L., West, J., Lawlor, D.A., Sheldon, T.A., Wright, J. and Pickett, K.E. (2020) 'The Born in Bradford COVID-19 Research Study: Protocol for an adaptive mixed methods research study to gather actionable intelligence on the impact of COVID-19 on health inequalities amongst families living in Bradford', *Wellcome Open Research*, 5, pp. 1–19. doi:10.12688/wellcomeopenres.16129.1.
- McKee, R., Mutrie, N., Crawford, F. and Green, B. (2007) 'Promoting walking to school: Results of a quasi-experimental trial', *Journal of Epidemiology and Community Health*, 61, pp. 818–823. doi:10.1136/jech.2006.048181.
- McLeroy, K.R., Bibeau, D., Steckler, A. and Glanz, K. (1988) 'An Ecological Perspective on Health Promotion Programs', *Health Education & Behavior*, 15(4), pp. 351–377. doi:10.1177/109019818801500401.
- McMillan, T.E. (2005) 'Urban form and a child's trip to school: The current literature and a framework for future research', *Journal of Planning Literature*, 19(4), pp. 440–456. doi:10.1177/0885412204274173.
- McMillan, T.E. (2007) 'The relative influence of urban form on a child's travel mode to school', *Transportation Research Part A: Policy and Practice*, 41, pp. 69–79. doi:10.1016/j.tra.2006.05.011.

- Meixner, C. and Spitzner, D.J. (2022) 'Leveraging the Power of Online Qualitative Inquiry in Mixed Methods Research: Novel Prospects and Challenges Amidst COVID-19', *Journal of Mixed Methods Research*, 17(2), pp. 171–186. doi:10.1177/15586898221084504.
- Michail, N., Ozbil, A., Parnell, R. and Wilkie, S. (2021) 'Children's experiences of their journey to school: Integrating behaviour change frameworks to inform the role of the built environment in active school travel promotion', *International Journal of Environmental Research and Public Health*, 18(9). doi:10.3390/ijerph18094992.
- Michie, S., Atkins, L. and West, R. (2014) *The Behaviour Change Wheel: A Guide to Designing Interventions*. London: Silverback.
- Michie, S., Johnston, M., Francis, J., Hardeman, W. and Eccles, M. (2008) 'From Theory to Intervention: Mapping Theoretically Derived Behavioural Determinants to Behaviour Change Techniques', *Applied Psychology*, 57(4), pp. 660–680. doi:10.1111/j.1464-0597.2008.00341.x.
- Michie, S., van Stralen, M.M. and West, R. (2011) 'The behaviour change wheel: A new method for characterising and designing behaviour change interventions', *Implementation Science*, 42(6). doi:10.1001/archderm.1985.01660070119033.
- Michie, S., West, R., Finnerty, A.N., Norris, E., Wright, A.J., Marques, M.M., Johnston, M., Kelly, M.P., Thomas, J. and Hastings, J. (2020) 'Representation of behaviour change interventions and their evaluation: Development of the Upper Level of the Behaviour Change Intervention Ontology [version 1; peer review: 1 approved, 1 approved with reservations]', *Wellcome Open Research*, 5, pp. 1–27. doi:10.12688/WELLCOMEOPENRES.15902.1.
- Mills, Z., Wright, K. and D'Lima, D. (2023) 'Applying the Behaviour Change Wheel to UK Local Authority Policy Documents: A Content Analysis in the Context of Financial Behaviour', *Behavioral Sciences*, 13(12). doi:10.3390/bs13120991.
- Mindell, J.S. and Karlsen, S. (2012) 'Community severance and health: What do we actually know?', *Journal of Urban Health*, 89(2), pp. 232–246. doi:10.1007/s11524-011-9637-7.
- Ministry of Housing Communities and Local Government (2005) 'Land Use Statistics'. Available at: <https://data.london.gov.uk/dataset/land-use-ward>.
- Ministry of Housing Communities and Local Government (2020) 'COVID-19 Secure: Safer Public Places - Urban Centres and Green Spaces', p. 56. Available at: <https://www.gov.uk/guidance/safer-public-places-urban-centres-and-green-spaces-covid-19/download-this-guidance>.
- Mitchell, G. and Dorling, D. (2003) 'An environmental justice analysis of British air quality', *Environment and Planning A*, 35(5), pp. 909–929. doi:10.1068/a35240.
- Mitra, R. (2013) 'Independent Mobility and Mode Choice for School Transportation: A Review and Framework for Future Research', *Transport Reviews*, 33(1), pp. 21–43. doi:10.1080/01441647.2012.743490.
- Mitra, R. and Buliung, R.N. (2014) 'The influence of neighborhood environment and household travel interactions on school travel behavior: An exploration using geographically-weighted models', *Journal of Transport Geography*, 36, pp. 69–78. doi:10.1016/j.jtrangeo.2014.03.002.
- Mitra, R. and Faulkner, G. (2012) 'There's no such thing as bad weather, just the wrong clothing: Climate, weather and active school transportation in Toronto, Canada', *Canadian Journal of Public Health*, 103(SUPPL. 3), pp. 35–41. doi:10.1007/bf03403833.
- Mitra, R., Moore, S.A., Gillespie, M., Faulkner, G., Vanderloo, L.M., Chulak-Bozzer, T., Rhodes, R.E., Brussoni, M. and Tremblay, M.S. (2020) 'Healthy movement behaviours in children and youth during the COVID-19 pandemic: Exploring the role of the neighbourhood environment', *Health and Place*, 65(June), p. 102418. doi:10.1016/j.healthplace.2020.102418.

- Mitra, R., Papaioannou, E. and Habib, K. (2015) 'Past and Present of Active School Transportation: An Exploration of the Built Environment Effects in Toronto, Canada from 1986 to 2006', *Journal of Transport and Land Use*, 2, pp. 1–17. doi:<https://doi.org/10.5198/jtlu.2015.537>.
- Moorcroft, S., Williamson, T., Nunn, J. and Pearce, H. (2021) 'Air Pollution and Inequalities in London: 2019 Update', (October). Available at: https://www.london.gov.uk/sites/default/files/air_pollution_and_inequalities_in_london_2019_update_0.pdf.
- Morgan, D.L. (2007) 'Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods', *Journal of Mixed Methods Research*, 1(1), pp. 48–76. doi:10.1177/2345678906292462.
- Morgan, D.L. (2014) 'Pragmatism as a Paradigm for Social Research', *Qualitative Inquiry*, 20(8), pp. 1045–1053. doi:10.1177/1077800413513733.
- Möser, G. and Bamberg, S. (2008) 'The effectiveness of soft transport policy measures: A critical assessment and meta-analysis of empirical evidence', *Journal of Environmental Psychology*, 28(1), pp. 10–26. doi:10.1016/j.jenvp.2007.09.001.
- Mould, O. (2014) 'Tactical urbanism: The new vernacular of the creative city', *Geography Compass*, 8(8), pp. 529–539. doi:10.1111/gec3.12146.
- Mums for Lungs (2023) *School Streets camera costs research*. Available at: <https://www.mumsforlungs.org/news/school-streets-camera-costs-research> (Accessed: 9 July 2023).
- MVA (2004) *A comparative study of European child pedestrian exposure and accidents: Further analyses*. London.
- NACTO (2020) 'Streets for Pandemic Response & Recovery', p. 29. Available at: <https://nacto.org/streets-for-pandemic-response-recovery/>.
- Næss, P. (2014) 'Tempest in a teapot: The exaggerated problem of transport-related residential self-selection as a source of error in empirical studies', *Journal of Transport and Land Use*, 7(3), pp. 57–79. doi:10.5198/jtlu.v7i3.491.
- Næss, P. (2015) 'Built Environment, Causality and Travel', *Transport Reviews*, 35(3), pp. 275–291. doi:10.1080/01441647.2015.1017751.
- Nahmias-Biran, B.H., Martens, K. and Shiftan, Y. (2017) 'Integrating equity in transportation project assessment: a philosophical exploration and its practical implications', *Transport Reviews*, 37(2), pp. 192–210. doi:10.1080/01441647.2017.1276604.
- Nantulya, V.M. and Reich, M.R. (2003) 'Equity dimensions of road traffic injuries in low- and middle-income countries', *Injury Control and Safety Promotion*, 10(1–2), pp. 13–20. doi:10.1076/icsp.10.1.13.14116.
- Ndhlovu, E. (2020) 'Qualitative data collection under the "new normal" in Zimbabwe', in Kara, H. and Khoo, S. (eds) *Researching in the Age of COVID-19 Vol 1*. Bristol: Bristol University Press, Policy Press. Available at: <https://www.jstor.org/stable/j.ctt1t89cfr.10>.
- Nello-Deakin, S. (2022) 'Exploring traffic evaporation: Findings from tactical urbanism interventions in Barcelona', *Case Studies on Transport Policy*, 10(4), pp. 2430–2442. doi:10.1016/j.cstp.2022.11.003.
- Newson, C., Cairns, S. and Davis, A. (2010) *Making school travel plans work Experience from English case studies*.
- NHS (2021) *Physical activity guidelines for children and young people*.
- Nieuwenhuijsen, M.J. (2016) 'Urban and transport planning, environmental exposures and health-new concepts, methods and tools to improve health in cities', *Environmental Health: A Global Access Science Source*, 15(Suppl 1). doi:10.1186/s12940-016-0108-1.

- Nind, M., Coverdale, A. and Meckin, R. (2020) *Changing Social Research Practices in the Context of Covid-19: Rapid Evidence Review*. doi:10.5258/NCRM/NCRM.00004458.
- Noy, C. (2008) 'Sampling knowledge: The hermeneutics of snowball sampling in qualitative research', *International Journal of Social Research Methodology*, 11(4), pp. 327–344. doi:10.1080/13645570701401305.
- O'Brien, P., Pike, A. and Tomaney, J. (2019) 'Governing the "ungovernable"? Financialisation and the governance of transport infrastructure in the London "global city-region"', *Progress in Planning*, 132(February 2018), p. 100422. doi:10.1016/j.progress.2018.02.001.
- Ogden, J. (2016) 'Celebrating variability and a call to limit systematisation: the example of the Behaviour Change Technique Taxonomy and the Behaviour Change Wheel', *Health Psychology Review*, 10(3), pp. 245–250. doi:10.1080/17437199.2016.1190291.
- Osborne, S., Uche, O., Mitsakou, C., Exley, K. and Dimitroulopoulou, S. (2021) 'Air quality around schools: Part I - A comprehensive literature review across high-income countries', *Environmental Research*, 196(October 2020), p. 110817. doi:10.1016/j.envres.2021.110817.
- Ozbil, A., Yesiltepe, D., Argin, G. and Rybarczyk, G. (2021) 'Children's active school travel: Examining the combined perceived and objective built-environment factors from space syntax', *International Journal of Environmental Research and Public Health*, 18(1), pp. 1–22. doi:10.3390/ijerph18010286.
- Page, A.S., Cooper, A.R., Griew, P. and Jago, R. (2010) 'Independent mobility, perceptions of the built environment and children's participation in play, active travel and structured exercise and sport: the PEACH Project', *International Journal of Behavioral Nutrition and Physical Activity*, 7(17), pp. 1–10.
- Palominos, N. and Smith, D. (2019) 'Quantifying and mapping streetspace: a geocomputational method for the citywide analysis of pedestrian and vehicular streetspace', *UCL Centre for Advanced Spatial Analysis - Working Papers Series*, 44(212), pp. 0–22. Available at: <http://www.springerlink.com/index/j3863x4mm7gu8645.pdf>.
- Pang, B., Kubacki, K. and Rundle-Thiele, S. (2017) 'Promoting active travel to school: A systematic review (2010-2016)', *BMC Public Health*, 17(1). doi:10.1186/s12889-017-4648-2.
- Panter, J., Corder, K., Griffin, S.J., Jones, A.P. and van Sluijs, E.M.F. (2013) 'Individual, socio-cultural and environmental predictors of uptake and maintenance of active commuting in children: Longitudinal results from the SPEEDY study', *International Journal of Behavioral Nutrition and Physical Activity*, 10. doi:10.1186/1479-5868-10-83.
- Panter, J., Guell, C., Humphreys, D. and Ogilvie, D. (2019) 'Can changing the physical environment promote walking and cycling? A systematic review of what works and how', *Health and Place*, 58(July), p. 102161. doi:10.1016/j.healthplace.2019.102161.
- Panter, J.R., Jones, A.P., Van Sluijs, E.M.F. and Griffin, S.J. (2010) 'Neighborhood, Route, and School Environments and Children's Active Commuting', *American Journal of Preventive Medicine*, 38(3), pp. 268–278. doi:10.1016/j.amepre.2009.10.040.
- Parra, D.C., Gomez, L.F., Pinzon, J.D., Brownson, R.C. and Millett, C. (2018) 'Equity in cycle lane networks: examination of the distribution of the cycle lane network by socioeconomic index in Bogotá, Colombia', *Cities and Health*, 2(1), pp. 60–68. doi:10.1080/23748834.2018.1507068.
- Pate, R.R., Freedson, P.S., Sallis, J.F., Taylor, W.C., Sirard, J., Trost, S.G. and Dowda, M. (2002) 'Compliance with physical activity guidelines: Prevalence in a population of children and youth', *Annals of Epidemiology*, 12(5), pp. 303–308. doi:10.1016/S1047-2797(01)00263-0.
- Peck, J. and Theodore, N. (2015) *Fast Policy: Experimental Statecraft at the Thresholds of Neoliberalism*. Minnesota: University of Minnesota Press. doi:10.5749/j.ctt155jmqz.

- Pereira, R.H.M., Schwanen, T. and Banister, D. (2017) 'Distributive justice and equity in transportation', *Transport Reviews*, 37(2), pp. 170–191. doi:10.1080/01441647.2016.1257660.
- Piatkowski, D.P., Marshall, W.E. and Krizek, K.J. (2019) 'Carrots versus Sticks: Assessing Intervention Effectiveness and Implementation Challenges for Active Transport', *Journal of Planning Education and Research*, 39(1), pp. 50–64. doi:10.1177/0739456X17715306.
- Pistoll, C. and Goodman, A. (2014) 'The link between socioeconomic position, access to cycling infrastructure and cycling participation rates: An ecological study in Melbourne, Australia', *Journal of Transport and Health*, 1(4), pp. 251–259. doi:10.1016/j.jth.2014.09.011.
- Plowden, B. (2020) 'Creating healthy streets for sustainable cities—delivering public health benefits through redesigning London's streets', *Cities and Health*, 4(2), pp. 156–161. doi:10.1080/23748834.2019.1685852.
- Pont, K., Ziviani, J., Wadley, D. and Abbott, R. (2011) 'The Model of Children's Active Travel (M-CAT): A conceptual framework for examining factors influencing children's active travel', *Australian Occupational Therapy Journal*, 58(3), pp. 138–144. doi:10.1111/j.1440-1630.2010.00865.x.
- Pooley, C.G., Horton, D., Scheldeman, G., Tight, M., Jones, T., Chisholm, A., Harwatt, H. and Jopson, A. (2011) 'Household decision-making for everyday travel: A case study of walking and cycling in Lancaster (UK)', *Journal of Transport Geography*, 19(6), pp. 1601–1607. doi:10.1016/j.jtrangeo.2011.03.010.
- Potoglou, D. and Arslangulova, B. (2017) 'Factors influencing active travel to primary and secondary schools in Wales', *Transportation Planning and Technology*, 40(1), pp. 80–99. doi:10.1080/03081060.2016.1238573.
- Pradifta, F.S., Puspitasari, G., Indratno, I. and Fadhilah, F. (2021) 'The Application of Tactical Urbanism in Public Space on COVID-19 Transmission Prevention', *IOP Conference Series: Earth and Environmental Science*, 830(1). doi:10.1088/1755-1315/830/1/012087.
- Prestwich, A., Whittington, C., Dombrowski, S.U., Rogers, L. and Michie, S. (2014) 'Supplemental Material for Does Theory Influence the Effectiveness of Health Behavior Interventions? Meta-Analysis', *Health Psychology*, 33(5), pp. 465–474. doi:10.1037/a0032853.supp.
- Prochaska, J.O., Norcross, J.C. and DiClemente, C.C. (2010) *Changing for Good: A Revolutionary Six-Stage Program for Overcoming Bad Habits and Moving Your Life Positively Forward*. HarperCollins. Available at: https://books.google.co.uk/books?id=nrs%5C_Qyu3OgYC.
- Public Health England (2018) *Healthy High Streets: Good place-making in an urban setting*.
- Rahman, S.A., Tuckerman, L., Vorley, T. and Gherhes, C. (2021) 'Resilient Research in the Field: Insights and Lessons From Adapting Qualitative Research Projects During the COVID-19 Pandemic', *International Journal of Qualitative Methods*, 20, pp. 1–16. doi:10.1177/16094069211016106.
- Rau, H. and Scheiner, J. (2020) 'Sustainable mobility: Interdisciplinary approaches', *Sustainability (Switzerland)*, 12(23), pp. 1–6. doi:10.3390/su12239995.
- Riggs, W. (2017) 'Painting the fence: Social norms as economic incentives to non-automotive travel behavior', *Travel Behaviour and Society*, 7, pp. 26–33. doi:10.1016/j.tbs.2016.11.004.
- van Ristell, J., Quddus, M., Enoch, M., Wang, C. and Hardy, P. (2013) 'Quantifying the transport-related impacts of parental school choice in England', *Transportation*, 40(1), pp. 69–90. doi:10.1007/s11116-012-9410-0.
- Rojas-Rueda, D. and Morales-Zamora, E. (2021) 'Built Environment, Transport, and COVID-19: a Review', *Current Environmental Health Reports*, 8. doi:10.1007/s40572-021-00307-7.

- Rosenstock, I.M. (1977) 'The Health Belief Model and Preventive Health Behavior', *Health Education & Behavior*. doi:10.1177/109019817400200405.
- Ross, A., Wood, L. and Searle, M. (2020) 'The indirect influence of child play on the association between parent perceptions of the neighborhood environment and sense of community', *Health and Place*, 65(December 2018), p. 102422. doi:10.1016/j.healthplace.2020.102422.
- Rothman, L., Buliung, R., To, T., Macarthur, C., Macpherson, A. and Howard, A. (2015a) 'Associations between parents perception of traffic danger, the built environment and walking to school', *Journal of Transport and Health*, 2(3), pp. 327–335. doi:10.1016/j.jth.2015.05.004.
- Rothman, L., Buliung, R., To, T., Macarthur, C., Macpherson, A. and Howard, A. (2015b) 'Associations between parents perception of traffic danger, the built environment and walking to school', *Journal of Transport and Health*, 2(3), pp. 327–335. doi:10.1016/j.jth.2015.05.004.
- Rothman, L., Cloutier, M.-S., Manaugh, K., Howard, A., Macpherson, A. and Macarthur, C. (2018) 'Pedestrian Risk and Social Equity: The Spatial Distribution of Roadway Environment Features in Toronto, Canada', in *Transportation Research Board 97th Annual Meeting*. Injury Prevention, pp. 49–50. Available at: <https://trid.trb.org/view/1496681>.
- Rothman, L., Hagel, B., Howard, A., Cloutier, M.S., Macpherson, A., Aguirre, A.N., McCormack, G.R., Fuselli, P., Buliung, R., HubkaRao, T., Ling, R., Zanotto, M., Rancourt, M. and Winters, M. (2021) 'Active school transportation and the built environment across Canadian cities: Findings from the child active transportation safety and the environment (CHASE) study', *Preventive Medicine*, 146, p. 106470. doi:10.1016/j.ypmed.2021.106470.
- Rothman, L., Macpherson, A.K., Ross, T. and Buliung, R.N. (2018) 'The decline in active school transportation (AST): A systematic review of the factors related to AST and changes in school transport over time in North America', *Preventive Medicine*, 111(July 2017), pp. 314–322. doi:10.1016/j.ypmed.2017.11.018.
- Rowland, D., DiGuseppi, C., Gross, M., Afolabi, E. and Roberts, I. (2003) 'Randomised controlled trial of site specific advice on school travel patterns', *Archives of Disease in Childhood*, 88(1), pp. 8–11. doi:10.1136/adc.88.1.8.
- Russell, W. (2020) 'Children's Right to the Good City', *Urban Design*, (156), pp. 16–18.
- Russell, W. and Stenning, A. (2020) 'Beyond active travel: children, play and community on streets during and after the coronavirus lockdown', *Cities & Health*, 00(00), pp. 1–4. doi:10.1080/23748834.2020.1795386.
- Sack, C.S. and Kaufman, J.D. (2016) 'Air pollution levels and children's lung health: How low do we need to go?', *American Journal of Respiratory and Critical Care Medicine*, 193(8), pp. 819–820. doi:10.1164/rccm.201512-2436ED.
- Sadik-Khan, J. and Solomonow, S. (2016) *Streetfight: handbook for an urban revolution*. New York: Viking.
- Saelens, B.E. and Handy, S.L. (2008) 'Built environment correlates of walking: A review', *Medicine and Science in Sports and Exercise*, 40(7 SUPPL.1). doi:10.1249/MSS.0b013e31817c67a4.
- Saelens, B.E., Sallis, J.F. and Frank, L.D. (2003) 'Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures', *Annals of Behavioral Medicine*, 25(2), pp. 80–91. doi:10.1207/S15324796ABM2502_03.
- Sallis, J.F., Owen, N. and Fisher, E.B. (2008) 'Ecological models of health behavior', in *Health behavior and health education: Theory, research, and practice*. 4th edn. San Francisco, Calif.: Jossey-Bass.

- Sarkin, J.A., Johnson, S.S., Prochaska, J.O. and Prochaska, J.M. (2001) 'Applying the transtheoretical model to regular moderate exercise in an overweight population: Validation of a stages of change measure', *Preventive Medicine*, 33(5), pp. 462–469. doi:10.1006/pmed.2001.0916.
- Sauter, D. and Huettenmoser, M. (2008) 'Liveable streets and social inclusion', *Urban Design International*, 13(2), pp. 67–79. doi:10.1057/udi.2008.15.
- Savage, B., Knight, T., Bacon, J., Millington, A., Bullock, H. and Buckland, J. (2011) *Behavioural Insights Toolkit, Social Research*.
- Schatzki, T.R. (2002) *The Site of the Social: A Philosophical Account of the Constitution of Social Life and Change, Site of the Social*. University Park: Pennsylvania State University Press.
- Schepers, P., Heinen, E., Methorst, R. and Wegman, F. (2013) 'Road safety and bicycle usage impacts of unbundling vehicular and cycle traffic in Dutch urban networks', *European Journal of Transport and Infrastructure Research*, 13(3), pp. 221–238. doi:10.18757/ejtir.2013.13.3.3000.
- Schlossberg, M., Greene, J., Phillips, P.P., Johnson, B. and Parker, B. (2006) 'School trips: Effects of urban form and distance on travel mode', *Journal of the American Planning Association*, 72(3), pp. 337–346. doi:10.1080/01944360608976755.
- Scott, M.R. and Marshall, D.T. (2019) 'Public Transit and School Choice in Philadelphia: Exploring Spatial Equity and Social Exclusion', *Journal of School Choice*, 13(2), pp. 177–197. doi:10.1080/15582159.2018.1547579.
- Scott, N.A. (2013) 'Like a fish needs a bicycle: Henri Lefebvre and the liberation of transportation', *Space and Culture*, 16(3), pp. 397–410. doi:10.1177/1206331213487062.
- Shaw, B., Bicket, M., Elliott, B., Fagan-Watson, B., Mocca, E. and Hillman, M. (2015) *Children's Independent Mobility: an international comparison and recommendations for action, Policy Studies Institute*. Available at: http://www.psi.org.uk/docs/7350_PSI_Report_CIM_final.pdf.
- Sheller, M. and Urry, J. (2000) 'The car and the city', *Bulletin of Science, Technology and Society*, 20(5), pp. 348–359. doi:10.1177/027046760002000502.
- Shove, E. (2010) 'Beyond the ABC: Climate Change Policy and Theories of Social Change', *Environment and Planning A: Economy and Space*, 42(6), pp. 1273–1285. doi:10.1068/a42282.
- Shove, E. and Pantzar, M. (2005) 'Consumers, producers and practices: Understanding the invention and reinvention of Nordic walking', *Journal of Consumer Culture*, 5(1), pp. 43–64. doi:10.1177/1469540505049846.
- Shove, E., Pantzar, M. and Watson, M. (2012) *The Dynamics of Social Practice*. London: Sage Publications.
- Silva, P. (2016) 'Tactical urbanism: Towards an evolutionary cities' approach?', *Environment and Planning B: Planning and Design*, 43(6), pp. 1040–1051. doi:10.1177/0265813516657340.
- Singleton, Royce. and Straits, B.C. (2005) *Approaches to social research*. 4th ed. New York ; Oxford University Press.
- Sirard, J.R. and Slater, M.E. (2008) 'Walking and Bicycling to School: A Review', *American Journal of Lifestyle Medicine*, 2(5), pp. 372–396. doi:10.1177/1559827608320127.
- Smeds, E. (2019) 'Automobile peripheries: travel to school in suburban London through the lens of social practice', in Hickman, R., Mella Lira, B., Givoni, M., and Geurs, K. (eds) *A Companion to Transport, Space and Equity*. Edward Elgar, pp. 76–89.
- Smeds, E. (2021) *Urban Mobility Transitions : Governing through Experimentation in Bristol and New York City*. University College London.

- Smeds, E. and Papa, E. (2023) 'The value of street experiments for mobility and public life : Citizens' perspectives from three European cities', *Journal of Urban Mobility*, 4(April), p. 100055. doi:10.1016/j.urbmob.2023.100055.
- Smith, M., Hosking, J., Woodward, A., Witten, K., MacMillan, A., Field, A., Baas, P. and Mackie, H. (2017) 'Systematic literature review of built environment effects on physical activity and active transport - an update and new findings on health equity', *International Journal of Behavioral Nutrition and Physical Activity*, 14(1), pp. 1–27. doi:10.1186/s12966-017-0613-9.
- Song, M.-K., Lin, F.-C., Ward, S. and Fine, J. (2013) 'Composite Variable: When and How', *Nursing Research*, 62(1). doi:10.1097/NNR.0b013e3182741948.
- Southerton, D. (2013) 'Habits, routines and temporalities of consumption: From individual behaviours to the reproduction of everyday practices', *Time & Society*, 22(3), pp. 335–355. doi:10.1177/0961463X12464228.
- Spotswood, F., Chatterton, T., Tapp, A. and Williams, D. (2015) 'Analysing cycling as a social practice: An empirical grounding for behaviour change', *Transportation Research Part F: Traffic Psychology and Behaviour*, 29, pp. 22–33. doi:10.1016/j.trf.2014.12.001.
- Standing, G. (2011) 'Behavioural conditionality: Why the nudges must be stopped - An opinion piece', *Journal of Poverty and Social Justice*, 19(1), pp. 27–38. doi:10.1332/175982711X559136.
- Stappers, N.E.H., Van Kann, D.H.H., Ettema, D., De Vries, N.K. and Kremers, S.P.J. (2018) 'The effect of infrastructural changes in the built environment on physical activity, active transportation and sedentary behavior – A systematic review', *Health and Place*, 53. doi:10.1016/j.healthplace.2018.08.002.
- Steinbach, R., Edwards, P., Green, J. and Grundy, C. (2007) 'Road Safety of London's Black and Asian Minority Ethnic Groups: A report to the London Road Safety Unit.' Available at: <http://www.tfl.gov.uk/cdn/static/cms/documents/road-safety-of-londons-black-asian-minority-ethnic-groups.pdf>.
- Stevens, Q. and Dovey, K. (2022) *Temporary and tactical urbanism: (re)assembling urban space*. 1st edn. London: Routledge.
- Stiles, B. (1993) 'Quality control in Research', *Clinical Psychology Review*, 13(July), pp. 593–618. Available at: https://www.researchgate.net/profile/William_Stiles/publication/223627990_Quality-Control_in_Qualitative_Research/links/5b3018cd0f7e9b0df5c6de62/Quality-Control-in-Qualitative-Research.pdf.
- Stockton, J.C., Duke-Williams, O., Stamatakis, E., Mindell, J.S., Brunner, E.J. and Shelton, N.J. (2016) 'Development of a novel walkability index for London, United Kingdom: Cross-sectional application to the Whitehall II Study', *BMC Public Health*, 16(1), pp. 1–12. doi:10.1186/s12889-016-3012-2.
- Sustrans and Playing Out (2019) *School Play Streets*. London.
- Talen, E. (2001) 'School, community, and spatial equity: An empirical investigation of access to elementary schools in West Virginia', *Annals of the Association of American Geographers*, 91(3), pp. 465–486. doi:10.1111/0004-5608.00254.
- Tao, T. and Næss, P. (2022) 'Exploring nonlinear built environment effects on driving with a mixed-methods approach', *Transportation Research Part D: Transport and Environment*, 111(September), p. 103443. doi:10.1016/j.trd.2022.103443.
- Tashakkori, A. and Teddlie, C. (1998) *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: SAGE Publications.

- Thaler, R.H. and Sunstein, C.R. (2008) *Nudge: Improving decisions about health, wealth, and happiness*, *Nudge: Improving Decisions about Health, Wealth, and Happiness*. doi:10.1016/s1477-3880(15)30073-6.
- The Institute of Highway Incorporated Engineers (2002) *Home Zone Design Guidelines*.
- The London Assembly (2011) *School travel planning programmes, Mayors Question Time*. Available at: <https://www.london.gov.uk/who-we-are/what-london-assembly-does/questions-mayor/find-an-answer/school-travel-planning-programmes> (Accessed: 17 July 2023).
- Theodore, N., Peck, J. and Brenner, N. (2011) 'Neoliberal urbanism: cities and the rule of markets', in Bridge, G. and Watson, S. (eds) *The new Blackwell companion to the city*. Malden: Blackwell, pp. 15–25.
- Thomas, A. (2022) 'Making School Streets Healthier: Learning from temporary and emergency closures', (March). Available at: <https://crossriverpartnership.org/wp-content/uploads/2022/03/Making-School-Streets-Healthier-UoW-CRP.pdf>.
- Thomas, A. and Aldred, R. (2023) *Changes in motor traffic inside London's LTNs and on boundary roads*. Available at: https://docs.google.com/document/d/13Nsm_GFdH6CpIpPpOZ7hbhLZScgqCAP7ZGI0xi4qDqA/edit#heading=h.jfl8y2txt0c.
- Thomas, A., Furlong, J. and Aldred, R. (2022) 'Equity in temporary street closures : The case of London's Covid-19 "School Streets" schemes', *Transportation Research Part D*, 110(September). doi:10.1016/j.trd.2022.103402.
- Tonkiss, F. (2013) 'Austerity urbanism and the makeshift city', *City*, 17(3), pp. 312–324. doi:10.1080/13604813.2013.795332.
- Town and Country Planning Association (2021) *School Superzones, TCPA*. Available at: <http://www.instituteoftheequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review>.
- Transport for London (2012) 'How many cars are there in London and who owns them?', *Roads Task Force*, pp. 1–15. Available at: <http://www.tfl.gov.uk/cdn/static/cms/documents/technical-note-12-how-many-cars-are-there-in-london.pdf>.
- Transport for London (2017a) 'Better street delivered 2. Learning from completed schemes'. Available at: <https://content.tfl.gov.uk/better-streets-delivered-2.pdf>.
- Transport for London (2017b) 'Guide to the Healthy Streets Indicators', p. 28. Available at: <https://content.tfl.gov.uk/guide-to-the-healthy-streets-indicators.pdf>.
- Transport for London (2017c) 'Healthy Streets for London', pp. 1–17. Available at: <http://content.tfl.gov.uk/healthy-streets-for-london.pdf>.
- Transport for London (2017d) *Small change, big impact*. doi:10.31046/tl.v12i1.536.
- Transport for London (2018a) *TfL research shows that walking or cycling to school could take 254,000 cars off London's roads each day*. Available at: <https://tfl.gov.uk/info-for/media/press-releases/2018/august/tfl-research-shows-that-walking-or-cycling-to-school-could-take-254-000-cars-off-london-s-roads-each-day> (Accessed: 29 April 2022).
- Transport for London (2018b) 'Walking action plan: Transport for London: Making London the world's most walkable city'. Available at: <http://content.tfl.gov.uk/mts-walking-action-plan.pdf?intcmp=54543>.
- Transport for London (2020a) *Appendix 8 : School Streets Guidance*. London. Available at: <https://content.tfl.gov.uk/appx-eight-lsp-school-streets-guidance.pdf>.

- Transport for London (2020b) 'London Streetspace Plan - Interim Guidance to Boroughs', (May), pp. 1–33. Available at: <https://content.tfl.gov.uk/lsp-interim-borough-guidance-main-doc.pdf>.
- Transport for London (2020c) *Streetspace for London: Social Distancing on High Streets*. London.
- Transport for London (2020d) *Travel in London 13*. London. Available at: <http://content.tfl.gov.uk/travel-in-london-report-12.pdf>.
- Transport for London (2021) *School Streets: Intervention Sites v. Control Sites Full Report*. Available at: <https://content.tfl.gov.uk/school-streets-evaluation-report-website.pdf>.
- Transport for London (2022) *Getting to know School Streets: An in-depth analysis of five School Streets in London*. London.
- Tremper, A.H. and Green, D.C. (2018) *The impact of a green screen on concentrations of nitrogen dioxide at Bowes Primary School*. London. Available at: https://www.londonair.org.uk/london/reports/Green_Screen_Enfield_Report_final.pdf.
- United Nations (1989) *The United Nations Convention on the Rights of the Child*. doi:10.4324/9780429505485-3.
- Vale, D.S., Saraiva, M. and Pereira, M. (2016) 'Active accessibility: A review of operational measures of walking and cycling accessibility', *Journal of Transport and Land Use*, 9(1), pp. 209–235. doi:10.5198/jtlu.2015.593.
- Vallance, S., Dupuis, A., Thorns, D. and Edwards, S. (2017) 'Temporary use and the ontopolitics of "public" space', *Cities*, 70(June), pp. 83–90. doi:10.1016/j.cities.2017.06.023.
- Vallance, S. and Edwards, S. (2021) 'Charting New Ground: Between Tactical Urbanism and Strategic Spatial Planning', *Planning Theory and Practice*, 22(5), pp. 707–724. doi:10.1080/14649357.2021.1966081.
- Verlinghieri, E. and Schwanen, T. (2020) 'Transport and mobility justice: Evolving discussions', *Journal of Transport Geography*, 87(June). doi:10.1016/j.jtrangeo.2020.102798.
- Verplanken, B., Aarts, H., Van Knippenberg, A. and Moonen, A. (1998) 'Habit versus planned behaviour: A field experiment', *British Journal of Social Psychology*, 37(1), pp. 111–128. doi:10.1111/j.2044-8309.1998.tb01160.x.
- Verplanken, B., Walker, I., Davis, A. and Jurasek, M. (2008) 'Context change and travel mode choice: Combining the habit discontinuity and self-activation hypotheses', *Journal of Environmental Psychology*, 28(2), pp. 121–127. doi:10.1016/j.jenvp.2007.10.005.
- Villanueva, K., Badland, H., Kvalsvig, A., O'Connor, M., Christian, H., Woolcock, G., Giles-Corti, B. and Goldfeld, S. (2016) 'Can the Neighborhood Built Environment Make a Difference in Children's Development? Building the Research Agenda to Create Evidence for Place-Based Children's Policy', *Academic Pediatrics*, 16(1), pp. 10–19. doi:10.1016/j.acap.2015.09.006.
- Ville de Paris (2023) *180 « Rues aux Écoles » dans Paris*. Available at: <https://www.paris.fr/pages/57-nouvelles-rues-aux-ecoles-dans-paris-8197#une-pietonnisation-avec-ou-sans-dispositif-de-fermeture> (Accessed: 27 June 2023).
- Vindrola-Padros, C., Chisnall, G., Cooper, S., Dowrick, A., Djellouli, N., Symmons, S.M., Martin, S., Singleton, G., Vanderslott, S., Vera, N. and Johnson, G.A. (2020) 'Carrying Out Rapid Qualitative Research During a Pandemic: Emerging Lessons From COVID-19', *Qualitative Health Research*, 30(14), pp. 2192–2204. doi:10.1177/1049732320951526.
- Waerden, P. Van Der, Timmermans, H. and Borgers, A. (2003) 'The influence of key events and critical incidents on transport mode choice switching behaviour: a descriptive analysis', in *Moving through nets: The physical and social dimensions of travel. Proceedings of the 10th International Conference on Travel Behaviour Research*.
- Ward, C. (1978) *The Child in the City*. London: The Architectural Press.

- Waygood, E.O.D. and Susilo, Y.O. (2015) 'Walking to school in Scotland: Do perceptions of neighbourhood quality matter?', *IATSS Research*, 38(2), pp. 125–129. doi:10.1016/j.iatssr.2014.12.002.
- Webb, D. (2018) 'Tactical Urbanism: Delineating a Critical Praxis', *Planning Theory and Practice*, 19(1), pp. 58–73. doi:10.1080/14649357.2017.1406130.
- van Wee, B. and Boarnet, M. (2014) 'Reaction to the paper Tempest in a teapot: The exaggerated problem of transport-related residential self-selection as a source of error in empirical studies', *Journal of Transport and Land Use*, 7(3), pp. 57–79. doi:10.5198/jtlu.v7i3.491.
- Whitelegg, J. (1997) *Critical Mass*. London: Pluto Press.
- Whitzman, C., Worthington, M. and Mizrahi, D. (2010) 'The journey and the destination matter: Child-Friendly Cities and children's right to the City', *Built Environment*, 36(4), pp. 474–486. doi:10.2148/benv.36.4.474.
- Wilkie, S., Townshend, T., Thompson, E. and Ling, J. (2018) 'Restructuring the built environment to change adult health behaviors: a scoping review integrated with behavior change frameworks', *Cities and Health*, 2(2), pp. 198–211. doi:10.1080/23748834.2019.1574954.
- Williams, D. (2015) *Social Practice Theory and Sustainable Transport : An Analysis of English Local Transport Planning as a System of Provision*.
- Wilson, E.J., Marshall, J., Wilson, R. and Krizek, K.J. (2010) 'By foot, bus or car: Children's school travel and school choice policy', *Environment and Planning A*, 42(9), pp. 2168–2185. doi:10.1068/a435.
- de Wit, B., Loman, K., Faithfull, K. and Hinckson, E.A. (2012) 'Reliability and Validity of the Hands-Up Survey in Assessing Commuting to School in New Zealand Elementary School Children', *Health Promotion Practice*, 13(3), pp. 349–354. doi:10.1177/1524839911432932.
- Wohl, S. (2018) 'Tactical urbanism as a means of testing relational processes in space: A complex systems perspective', *Planning Theory*, 17(4), pp. 472–493. doi:10.1177/1473095217722809.
- World Health Organisation (1986) *Ottawa Charter for Health Promotion*, WHO. doi:10.1038/scientificamerican0604-48.
- Xiao, C., Sluijs, E. van, Ogilvie, D., Patterson, R. and Panter, J. (2022) 'Shifting towards healthier transport: carrots or sticks? Systematic review and meta-analysis of population-level interventions', *The Lancet Planetary Health*, 6(11), pp. e858–e869. doi:10.1016/s2542-5196(22)00220-0.
- Yomoda, K. and Kurita, S. (2021) 'Influence of social distancing during the COVID-19 pandemic on physical activity in children: A scoping review of the literature', *Journal of Exercise Science and Fitness*, 19(3), pp. 195–203. doi:10.1016/j.jesf.2021.04.002.
- Yu, C.Y. and Zhu, X. (2015) 'Impacts of Residential Self-Selection and Built Environments on Children's Walking-to-School Behaviors', *Environment and Behavior*, 47(3), pp. 268–287. doi:10.1177/0013916513500959.
- Zandieh, R., Flacke, J., Martinez, J., Jones, P. and Van Maarseveen, M. (2017) 'Do inequalities in neighborhood walkability drive disparities in older adults' outdoor walking?', *International Journal of Environmental Research and Public Health*, 14(7). doi:10.3390/ijerph14070740.

[dataset] Active Travel Academy. (2022) LTN Areas: March 2020 – November 2022. <https://blog.westminster.ac.uk/ata/projects/london-ltn-dataset/>

[dataset] OS MasterMap Highways Network [GML3 geospatial data], Scale 1:2500, Tiles: GB,
Updated: 1 November 2021, Ordnance Survey (GB), Using: EDINA Digimap Ordnance Survey
Service, <https://digimap.edina.ac.uk>, Downloaded: 2022-04-11 19:09:09.569