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Barriers and facilitators to cycling to school for children in the UK: A systematic review.

Abstract

The benefits of cycling as a means of active transport are well known and there is recent UK Government interest in promoting cycling. Few children in the UK cycle to school and little research has explored the factors that affect this. This systematic review aimed to identify the barriers and facilitators for children cycling to school in the UK.

We searched seven electronic databases and grey literature for sources, from 2010 onwards. In total 16 papers/articles were included. The capabilities approach (CA) was used as a framework for analysis to identify personal, social, and environmental barriers and facilitators. Personal barriers and facilitators centred around gender and age, but also related to concerns about safety or confidence. Social barriers and facilitators related to parental attitudes and wider social norms. Environmental barriers included distance, infrastructure, and deprivation. Using the CA revealed the complex interweaving of factors that must be addressed by interventions seeking to promote children's cycling to school. For example, parental fears about children's safety when cycling are linked to prevailing social norms and to local cycling infrastructure. Local authorities can promote cycling by developing well-connected accessible and safe cycle routes, but this alone is likely to be insufficient. Schools can enhance personal, social, and environmental conversion factors by developing and implementing active transport plans, increasing children's personal competences, reassuring parental fears, and providing secure storage and changing facilities. Further research exploring how barriers can be addressed, together with local and national policies and targeted funding which focus on facilitation of cycling to school are warranted.

Keywords: children; cycling; active transport; school; adolescents

1.0 Background

Children's cycling habits are at the nexus of two pressing policy concerns – health promotion and sustainable mobility. Cycling to school can have a positive effect on children's daily physical activity levels (Cooper et al., 2005). However, the past half century has seen a sharp decline in the number of children either walking or cycling to school (Goodman et al., 2019). Children's active transportation to

school in England, and particularly in Scotland and Wales, ranks well below many other countries in Europe (Active Healthy Kids Global Alliance, 2022) and figures from the UK National Travel Survey indicate that the number of children aged 5-15 in the UK that either walked or cycled to school has declined from 67% (63% walking, 4% cycling) in 1975/76 to 47% (44% walking, 3% cycling) in 2023 (Goodman et al., 2019, Department of Transport, 2023). While levels of cycling to school are low, there is evidence to suggest that children do want to cycle to school (Larouche et al., 2016, Glasgow Centre for Population Health, 2011) and in recent years there has been an increased focus on cycling not just for children but in the general population in government policy in the UK and beyond. In 2017, the UK government's Cycling and Walking Investment strategy pledged to provide cycle training opportunities for all children and provide better links to schools by 2040 (Department of Transport, 2017). In the wake of the Covid-19 pandemic, the UK government launched *Gear Change*, a plan to create cleaner, healthier, safer streets, to make cycling and walking more accessible and prioritise cycling and walking infrastructure in transport policy and planning (Department of Transport, 2020). The report of the House of Commons Committee of Public Accounts (2023), however identified that the government will not achieve the targets set out in *Gear Change* despite significant public funding for active travel infrastructure. Concerns with promoting safe cycling is echoed in the 2023 European Union Declaration on Cycling (European Commission, 2023), the United Nations Conference on Sustainable Transport and Sustainable Development (2021) and the United Nations Regional Information Centre for Western Europe (2024).

Research into active school transport has grown considerably in recent years and has been the focus of several systematic reviews (Jones et al., 2019, Villa-González et al., 2018, Chillón et al., 2011, Aranda-Balboa et al., 2020, Herrero et al., 2021, Lu et al., 2014). However, a lot of the studies in this area have analysed cycling in combination with walking and given that walking and cycling are two different behaviours with differing influencing factors research should focus on these separately (Lu et al., 2014, Savolainen et al., 2024). Also, evidence suggests that there are country specific factors that influence active transport choices (Haug et al., 2021). For example, a study exploring 12-year trends in active transport to school across four European countries, showed children in Norway and the Czech Republic were more likely to actively travel to and from school in comparison to two UK nations (Scotland and Wales), with distance to school, age, gender and family affluence being of varying importance in different countries (Haug et al., 2021).

To enable the development of effective interventions that will increase levels of children cycling to school it is important to understand the factors that prevent or facilitate this behaviour (Lu et al.,

2014, Savolainen et al., 2024). Previous research in this area have framed these factors as personal, social, and environmental barriers and facilitators (Lu et al., 2014, Savolainen et al., 2024, Aranda-Balboa et al., 2020) but with limited attention to how these interact. An emerging theoretical framework within active transport research is the Capabilities Approach (CA) (Sen and Nussbaum, 1993). The CA focuses on what a person can “be and do”, or *capabilities*, and the complex ways in which different personal, social, and environmental factors interweave to affect achievement of these. CA encourages a focus beyond the distribution of economic goods or resources, towards consideration of *conversion factors*, that is what conditions actually enable individuals to use resources to achieve their goals (Pereira et al., 2017).

In this review we adopt a capabilities approach to analysing existing literature because CA is at the forefront of growing theoretically informed studies that are trying to understand transport justice (Verlinghieri and Schwanen, 2020, Van Burgsteden et al., 2024) but there is need for more research using CA to analyse children’s mobility (Humberto et al., 2020). CA can recognise children as competent social actors, as well as revealing the complex state-driven and societal factors that impact upon their lives and desires for independent mobility (Larkins et al., 2023, Humberto et al., 2020) and CA has been adapted and applied in previous studies that have explored adult cycling and active transport (Mandic et al., 2015, Sherriff et al., 2020).

This systematic review aims to identify the barriers and facilitators for cycling to school for children in the UK.

2.0 Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 checklist and reporting standards (Page et al., 2021). In adherence with PRISMA guidelines and to increase visibility, transparency and reproducibility of this work, the protocol was registered on PROSPERO (registration number: CRD42021268142) (Boland et al., 2021) prior to commencing the review.

2.1 Search strategy

Seven electronic databases (Ovid Medline, Ovid Embase, CINAHL Complete, PsychInfo, Social Care Online, SocIndex and Web of Science) were searched on 16 August 2023. Key words for database searches were as follows: (child* OR youth OR adolescen* OR kid OR kids OR girl* OR boy* OR teen*

OR 'young people' OR 'young person' OR student or pupil*) AND (school OR schools OR academy OR education) AND ('active transport*' OR 'active commuting' OR 'school journey' OR 'journey to school' or 'school travel planning' OR cycle OR cycling OR bicycl* OR bike OR biking) (see Supplementary Material for the search strategies used for each database). Grey literature was also included from internet searches from Google, Department of Transport, Sustrans, Cycling.uk and National Institute of Health and Clinical Excellence. To search for grey literature, phrases such as 'cycling to school' and outcomes such as 'barriers' and 'facilitators' were used in combination. Searches in Google were limited to the first 100 results. Forward and backward citations were also carried out on included studies and relevant papers.

Table 1: Inclusion and exclusion criteria based on the components of the PICO.

	Inclusion criteria	Exclusion criteria
Population	Children and young people (aged 5-16) Parents, families, school staff and travel advisors who discussed children cycling to school.	Studies focusing on adult cyclists only
Intervention	Studies involving cycling to school	Studies that relate to cycling to destinations other than school
Comparator	Studies where children cycled to school are compared to those who do not.	
Outcome	Factors in the form of barriers and/or facilitators relating to children cycling to and from school.	

2.2 Eligibility criteria

Primary studies using any quantitative or qualitative designs were included that identified facilitators or barriers for children and young people (aged 5-16) cycling to school. Studies that had an adult population were only included if the adults were part of a family unit or if the results were in relation to children and young people. We only included studies that were focused on cycling to school as a setting and excluded studies that related to cycling to destinations other than school (see Table 1). Only studies published in English language and conducted in the UK (i.e. England, Scotland, Wales, and Northern Ireland (NI)) were included. In relation to studies that focused on walking and cycling, we only included those that analysed walking and cycling separately and provided barriers and/or facilitators specifically in relation to cycling to school. We only included research published from

January 2010 in accordance with changes in UK legislation to promote active transportation and bike usage (Department of Transport, 2010, Department of Transport, 2017, Public Health England, 2014). We excluded editorials, opinion pieces, commentaries, protocols, reviews, and erratum.

2.3 Study selection

Identified papers/articles were downloaded to EndNote and duplicates removed. The remaining sources were then exported into Rayyan where further duplicates undetected by EndNote were removed prior to title and abstract screening (see Figure 1). At the start of the title and abstract screening stage, 20% of the papers were screened independently by five reviewers (PB, KT, RN, DC, CL) and any conflicts were discussed. Inter-rater reliability (IRR) was recorded at all stages. At the title and abstract screening stage, IRR was above 90%. The remaining 80% of papers/articles were allocated to three reviewers (PB, KT, RN) to be screen independently.

During the full text screening stage all identified papers were sourced. Full text screening was conducted in two phases. An initial screening phase was conducted where full texts were checked for country of study origin, only studies conducted in the UK were retained and continued to full text screening. Prior to commencing full text screening, a calibration of screening decisions was conducted, 32% of all included papers were screened by three reviewers (PB, KT, RN). Reasons for exclusion at this stage are noted in the Prisma Flow diagram (Figure 1). The remaining 68% of papers/articles were screened by at least two reviewers. Any conflicts in decisions were discussed, and agreement made by consensus, involving a third reviewer where needed. IRR for full text screening was 90%.

2.4 Data extraction

Data from all selected papers/articles were extracted using a data extraction sheet co-created and piloted by the reviewers using Microsoft Excel. Extracted data from each paper/article included study characteristics e.g., study design, setting and country, participant characteristics e.g., sample size and age, and the prevalence of children that cycled to school. Data on any reported barriers and facilitators to children cycling to school. Data extraction was conducted by five reviewers (PB, KT, RN, MA, JW) independently and once sufficient agreement (>80%) was reached in the test phase, all five reviewers independently extracted data from the remaining studies (Daudt et al., 2013). Any disagreements between the reviewers completing the data extraction were resolved through discussion.

2.5 Data analysis

Key information about the study (i.e. sample size) and population (e.g. the ages of the children involved) and the prevalence of children cycling to school were extracted from studies and data was provided in a table to describe and compare the studies. Information was then summarised narratively. A thematic analysis was then performed enabling facilitators and barriers to be extracted and categorised in relation to reported personal, social and environmental themes (Sherriff et al., 2020).

In addition, we used CA - a capabilities approach (Sen and Nussbaum, 1993) to understand the interweaving of these themes. CA is a way of focusing on what people are doing or being, and the wide-ranging factors that influence an individual's *capabilities* to be or do things that are valued (Sen, 2001). These factors that affect individual's capabilities include an individual's access to *resources* (for example a bike), and conditions that enable resources to be used effectively. These conditions, referred to as *conversion factors*, are often characterised as personal, social, and environmental. As Robeyns (2017) summarises, *personal conversion factors* are internal to people, so may include skills, attitudes and physical attributes (for example, knowing how to ride a bike and being fit enough to do so). *Social conversion factors* include social norms and attitudes and practices that, for example, perpetuate discrimination, but also public policies and economic conditions (for example, policies and investments that promote cycling). *Environmental conversion factors* relate to the physical infrastructure and environment but also factors such as climate and pollution (for example, air which is clean enough to breath to enable cycling). Digital environments and the quality of physical environments in terms of what they afford, are both also relevant aspects of environmental conversion factors (Van Burgsteden et al., 2024). Thinking about conversion factors, then, enables understanding of how, for example, issues that other articles have reported as 'personal' and that might be reported in the present review as within the personal theme, are at the same time inseparable from social and/or environmental factors.

When considering children, the personal conversion factors of other people and social factors are of particular significance, as children are economically and socially situated in dependent and interdependent relationships (Cockburn, 1998). As Sen (2001) describes, even at a most basic level of the capability to live, children's mortality rates are directly related to the conditions that their mother's experience. Sen (2001) also points to the fact that children's functionings are affected by the extent to which social responsibility towards children is embraced. In the context of the present study, this interdependence might be seen, for example, in the combined significance of a child's ownership

of a commodity (a bike) together with a parent's personal conversion factor (the confidence to cycle) supporting a child's freedom to cycle to school. Applying CA, then, allows us to understand children's cycling practice in the context of existing distributions of commodities and the personal, social, and environmental conversion factors that shape their freedom to make choices about if, when and how to cycle to school. And, it encourages us to raise questions about the intertwined role of state, civil society, friends and families and potential implications for policy making (Van Burgsteden et al., 2024).

2.6 Critical appraisal

Five authors independently assessed the quality of included papers/articles (JW, KT, MA, PB, RN). Inter-rater reliability was also recorded here and an IRR of 90% was achieved. The Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018, Pace et al., 2012) was used to assess study quality. Using a five-point checklist, the MMAT is specifically designed to appraise both qualitative, quantitative, and mixed methods studies (Hong et al., 2018, Pace et al., 2012).

3.0 Results

A total of 18,398 records were identified through database searches. A total of 7,702 were removed due to duplication. Following title and abstract screening 118 records were retained. After an initial screening at the full text screening phase (screening for country of study origin) resulted in the retention of 62 potentially relevant sources for the second phase of full text screening. Grey literature sources found via websites and citation searching identified 619 records and 42 articles were retrieved for full text screening. In the second phase of full text screening, inclusion decisions were made using the full inclusion/exclusion criteria and 16 sources were included in the review. Due to the mix of both peer-reviewed papers and grey literature sources, from here on, all sources will be referred to as papers/articles, unless discussing specific characteristics e.g. study design.

3.1 Characteristics of included papers/articles

The characteristics of the included papers/articles are presented in Table 2. The papers/articles were published between 2010 and 2023. Eight of the papers/articles used quantitative designs (Benson and Scriven, 2012, Department for Regional Development, 2015, Page et al., 2010, Panter et al., 2010a, Panter et al., 2010b, Roth et al., 2012, Teyhan et al., 2016), four used a qualitative design (Scottish Government, 2017, de Aguiar Greca et al., 2023, Fasan et al., 2021, Glasgow Centre for Population Health, 2013, Goodman et al., 2016) and four papers/articles used mixed methods (Atkins Limited,

2010, Christie et al., 2011, Moore et al., 2014, Shared Intelligence Limited, 2013). Eleven papers/articles were from peer-reviewed journals (Benson and Scriven, 2012, Christie et al., 2011, Moore et al., 2014, Page et al., 2010, Panter et al., 2010a, Panter et al., 2010b, de Aguiar Greca et al., 2023, Fasan et al., 2021, Roth et al., 2012, Teyhan et al., 2016, Goodman et al., 2016) and five were reports from Government funded travel to school initiatives (Atkins Limited, 2010, Scottish Government, 2017, Department for Regional Development, 2015, Glasgow Centre for Population Health, 2013, Shared Intelligence Limited, 2013). Of the 16 included paper/articles, 11 were conducted in England (Atkins Limited, 2010, Benson and Scriven, 2012, Christie et al., 2011, Moore et al., 2014, Panter et al., 2010a, Panter et al., 2010b, de Aguiar Greca et al., 2023, Fasan et al., 2021, Roth et al., 2012, Teyhan et al., 2016, Goodman et al., 2016), two in Scotland (Scottish Government, 2017, Glasgow Centre for Population Health, 2013), one in Northern Ireland (Department for Regional Development, 2015) and two across the United Kingdom (Shared Intelligence Limited, 2013, Page et al., 2010). Fourteen of the 16 articles/papers had children as participants, with ages ranging between 5-16 years (Benson and Scriven, 2012, Christie et al., 2011, Department for Regional Development, 2015, Moore et al., 2014, Page et al., 2010, Panter et al., 2010a, Panter et al., 2010b, Scottish Government, 2017, Shared Intelligence Limited, 2013, Glasgow Centre for Population Health, 2013, de Aguiar Greca et al., 2023, Roth et al., 2012, Teyhan et al., 2016, Goodman et al., 2016). The two articles/papers which did not have any child participants included school staff, school travel advisors, cycle instructors and other stakeholders (Atkins Limited, 2010, Fasan et al., 2021). Four articles/papers were located within a primary school (Page et al., 2010, Panter et al., 2010a, Panter et al., 2010b, Goodman et al., 2016), although two of these papers/articles used data from the same cross-sectional study but reported different outcomes (Panter et al., 2010a, Panter et al., 2010b). Five articles/papers reported on research located within a secondary school (Benson and Scriven, 2012, Department for Regional Development, 2015, Moore et al., 2014, Fasan et al., 2021, Teyhan et al., 2016), another seven were conducted in both primary and secondary schools (Christie et al., 2011, de Aguiar Greca et al., 2023, Glasgow Centre for Population Health, 2013, Roth et al., 2012, Scottish Government, 2017, Atkins Limited, 2010, Shared Intelligence Limited, 2013). Eleven of the 16 papers/articles reported the prevalence rates of cycling to school ranging from 2% to 45%.

Of the 16 included papers/articles, the outcome of the MMAT (Hong et al., 2018), 12 were rated as high quality (five stars), three rated as good quality (four stars) and one paper/article rated satisfactory (three stars) (see Table 2).

Table 2: Characteristics of included papers/articles (N=16)

Author, year	County	Aims and Objectives	Study design, methods	Participants	Age	Setting	Number of participants that cycled (%)	MMAT score
Atkins Limited, 2010	England	An evaluation of the Travelling to School Initiative	Mixed methods, school census survey, workshops and case studies	School staff, School Travel Advisors, stakeholders from 576 schools	No children involved	Primary and Secondary	N/A	***
Benson and Scriven, 2012	England	Identify the psychological, social, and environmental barriers that influence an adolescent's decision to cycle to school	Quantitative. Using two cross-sectional surveys	Children and parents. 62 out of 120 (52%) completed both surveys	11-14	Secondary	25.8% (n=16) reported to cycle to school occasionally.	****
Christie et al, 2011	England	Explore levels of cycling and opportunities and barriers to increase children's safer cycling in disadvantaged areas	Mixed methods, cross-sectional survey and focus groups	Children and parents, 4286 children completed the survey. 67 parents participated in focus groups.	9-14	Primary and Secondary	2%	*****
de Aguiar Greca et al, 2023	England	Explore barriers to children cycling as a means of active transport	Qualitative study, semi-structured interviews	18 children and 18 parents	8-12	Primary and Secondary	5.6% (n=1)	*****

Department of Regional Development, 2015	NI	To provide statistics on the methods of travel of post primary school pupils to/from school and their attitudes to walking and cycling to/from school	Quantitative, data from the 'Travelling to School' module of the Young Persons' Behaviour and Attitudes Survey	3164 children	11-16	Secondary	2% (n=63)	*****
Fasan et al, 2021	England	To understand the factors influencing cycling among secondary school adolescents, perspectives of local transport stakeholders promoting cycling amongst school adolescents	Qualitative, semi-structured interviews focusing on the barriers and facilitators to increasing cycling for school and non-school travel	14 local transport stakeholders	No children involved	Secondary	N/A	*****
Glasgow Centre for Population Health, 2013	Scotland	Identify what encourages active transport to schools where rates are higher than expected	Qualitative interviews and focus groups	School staff, children, and parents from 18 schools	10-15	Primary and Secondary	NR	*****
Goodman et al, 2016	England	Data from the Millennium Cohort Study to examine whether Bikeability cycling training was associated with	Quantitative, using data from the Millennium Cohort Study	3336 children	10-11	Primary	2.8% (N=93)	*****

		increased frequency in cycling, cycling independently or cycling to school						
Moore et al, 2014	England	To identify the environments in which adolescents participate in physical activity, the factors relating to physical activity and environmental context, and how they influence behaviour	Mixed methods, focus groups and GPS/accelerometer data	28 children	11-14	Secondary	NR	****
Page et al, 2010	All the UK	Investigate the environmental and personal determinants of physical activity, eating behaviours and obesity in young people as they transition from primary to secondary school	Quantitative. Longitudinal study, using data from the Personal and Environmental Associations with Children's Health (PEACH) project	1300 children	10-11	Primary	3% (N=40)	*****
Panter et al, 2010a	England	Examine whether attitudes, social support and environmental perceptions are	Quantitative, data from the Sport, Physical activity and Eating behaviour: Environmental	2012 children	9-10	Primary	9% (n=186)	*****

		associated with active transport behaviour in school children and whether these associations are moderated by the distance to school	Determinants in Young People (SPEEDY) cross-sectional study					
Panter et al, 2010b	England	To assess whether objectively measured characteristics of the neighbourhood, route and school environments are associated with active commuting to school among children. Also explore whether distance acts as a moderator in this association	Quantitative, using data from the Sport, Physical activity and Eating behaviour: Environmental Determinants in Young People (SPEEDY) cross-sectional study	2012 children	9-10	Primary	9% (n=186)	****
Roth et al, 2012	England	Explore whether children who walk or cycle to school are more active overall and less likely to be obese, and whether active transport to school is as important as	Quantitative, cross-sectional study using data from the Health Survey for England	4468 children	5-15	Primary and Secondary	3% (n=148)	*****

		formal sports and exercise in achieving PA recommendations						
Shared Intelligence Limited, 2013	All of UK	An evaluation of the Bike Club initiative	Mixed methods using an online survey, stakeholder interviews, place studies, and a young person's questionnaire	Bike club leaders, stakeholders, children and parents. 42 out of 44 children responded to the young person's questionnaire	NR	Primary and Secondary	45% (n=19)	*****
Scottish Government, 2017	Scotland	A report commissioned by the Scottish Government to provide the latest evidence on school transport choices and which approaches have been effective in influencing these, to minimise the number of journeys to school by car while also increasing active transport	Qualitative. Fieldwork phase involving interviews with school staff, mini-focus groups with children, child led interviews with parents at home, and local authority and other stakeholder discussions	178 Children, 11 staff 106 parents Local authority and other stakeholders 24	10-15	Primary and Secondary	NR	*****

Teyhan et al, 2016	England	To examine if National Cycle Proficiency Scheme training is associated with cycling, cycling safety behaviours, or accidents in adolescence	Quantitative. Using data from the Avon Longitudinal Study of Parents and Children, a birth cohort study	5415 children	14-16	Secondary	Less than 2% of girls and just over 10% of boys	*****
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Table 3: Barriers and facilitators in relation to personal, social, and environmental conversion factors across the selected papers/articles.

Personal barriers	Social barriers	Environmental barriers
Gender: girls were less likely to cycle to school than boys (Benson and Scriven, 2012, Page et al., 2010, Panter et al., 2010a, Scottish Government, 2017, Roth et al., 2012, Teyhan et al., 2016)	Parents reluctant to let their child cycle to school (Atkins Limited, 2010, Christie et al., 2011, Panter et al., 2010a, Scottish Government, 2017, de Aguiar Greca et al., 2023)	Long distance to school (Moore et al., 2014, Panter et al., 2010a)
Age: cycling to school decreased with age. (Benson and Scriven, 2012, Scottish Government, 2017)	The pressure to comply with social norms (Scottish Government, 2017, de Aguiar Greca et al., 2023, Fasan et al., 2021)	Infrastructure i.e., lack of connectivity and cycle paths, funding for infrastructure (Atkins Limited, 2010, Department for Regional Development, 2015, Scottish Government, 2017, de Aguiar Greca et al., 2023, Fasan et al., 2021)
Access to a bike and accessories (Scottish Government, 2017, Shared Intelligence Limited, 2013)	Motorists' attitudes (Department for Regional Development, 2015)	Living in a deprived area (Panter et al., 2010b, Christie et al., 2011, Roth et al., 2012)
A preference for other forms of active transport (Scottish Government, 2017, Shared Intelligence Limited, 2013, Glasgow Centre for Population Health, 2013)	Short term initiatives (Scottish Government, 2017)	
Too much equipment to take to school (Department for Regional Development, 2015, Scottish Government, 2017)	Lack of funding (Atkins Limited, 2010)	
Child lacking the confidence to cycle to school (Shared Intelligence Limited, 2013)	School discouraged children to cycle or did not promote cycling (Scottish Government, 2017, Glasgow Centre for Population Health, 2013)	
Not wanting to arrive to school tired, hot and sweaty (Scottish Government, 2017)		
Concerns around crime and personal safety (Department for Regional Development, 2015)		
Personal facilitators	Social facilitators	Environmental facilitators

Cycling is seen as an enjoyable activity that is good for health (Department for Regional Development, 2015, de Aguiar Greca et al., 2023)	Positive social support from family and friends (Fasan et al., 2021, Panter et al., 2010a, Glasgow Centre for Population Health, 2013)	Storage at school and changing facilities (Atkins Limited, 2010, Scottish Government, 2017, Department for Regional Development, 2015, de Aguiar Greca et al., 2023)
Child can travel independently (Department for Regional Development, 2015, Atkins Limited, 2010)	School having a travel plan (Panter et al., 2010b)	Cycling is seen as being good for the environment (Department for Regional Development, 2015)
Saves money (Department for Regional Development, 2015)		Living closer to school (Department for Regional Development, 2015)
Allows child to arrive on time to school (Department for Regional Development, 2015)		Having better weather (Department for Regional Development, 2015)

3.2 Categorization of barriers and facilitators

There were a variety of barriers and facilitators to children cycling to school as identified by children, parents, school staff and other stakeholders. These barriers and facilitators have been categorised using the conceptions of personal, social, environmental factors that is present in many of the articles we have analysed (see Table 3). In each of these themes, examples of the issues are explored with reference to the capabilities approach (Sen and Nussbaum, 1993) and understanding of the complex interweaving of conversion factors (Robeyns, 2017, Sen, 2001).

3.3 Personal issues

The literature suggests that personal facilitators and barriers related to gender, age, confidence, and practical issues. Gender was the most frequently identified influence, with papers/articles reporting that boys were more likely to cycle to school than girls in both primary and secondary school (Page et al., 2010, Panter et al., 2010a, Scottish Government, 2017, Benson and Scriven, 2012, Roth et al., 2012, Teyhan et al., 2016). One article reported that fewer girls cycling to school may be due to not wanting to cycle alone or wanting to cycle with a friend (Moore et al., 2014) One article reported a general decrease in adolescent girls' physical activity (Fasan et al., 2021). Two papers/articles found that age

influenced cycling to school. Both were cross sectional studies and found that the frequency of children reporting cycling to school reduced as age increased (Benson and Scriven, 2012, Scottish Government, 2017). The pressure to fit in was also identified as a factor in this drop-off in cycling to school between primary and secondary year groups as cycling was not seen as a “cool” activity (Scottish Government, 2017) .

In one paper/article, there was a perception from parents that children lacked the skills to cycle to school (Christie et al., 2011) and a report evaluating a cycle initiative noted a lack of confidence as a key barrier to children cycling to school (Shared Intelligence Limited, 2013). There were often practical reasons for why children did not cycle to school as well as a reported lack of cycling skills and cycle training, not having access to a bike or equipment such as a bike lock was highlighted in two papers/articles (Shared Intelligence Limited, 2013, Scottish Government, 2017). No ownership or access to a bike was particularly relevant for children living in deprived areas (Shared Intelligence Limited, 2013). For secondary school children, other practical barriers included having too much equipment to take to school (e.g. school bag, PE kit, musical instruments etc), other competing activities and increased amount of homework, not wanting to arrive to school tired, hot and sweaty, and concerns about personal safety/crime (Scottish Government, 2017, Department for Regional Development, 2015).

A national survey of secondary school children in Northern Ireland (Department for Regional Development, 2015) identified the personal benefits of cycling to school. Some children cycled to school because they enjoyed it or it made them feel healthier, it gave them freedom to choose their own route, save money, allowed them to do things on the way to and after school, and helped them to arrive on time to school. In the same paper/article, the ability to travel independently without an adult was identified as an advantage to cycling to school and a second paper/article, evaluating the Bike Club programme reported the initiative allowed children with special education needs who were often reliant on taxis to travel independently to school (Shared Intelligence Limited, 2013).

Conversely, some children indicated no desire to cycle (Department for Regional Development, 2015) or had a preference for other methods of active transport such as walking (Shared Intelligence Limited, 2013) and the increased popularity of scooting which was seen as being just as fast as cycling but as safe and as off-road as walking (Scottish Government, 2017).

Analysed from a CA perspective, these reported personal issues can be understood as related to *resources* and personal, social, and environmental *conversion factors*. Individuals may or may not have relevant personal conversion factors, such as the personal attributes of skills, confidence, and physical health to ride a bike. Personal issues related to gender or age that makes it feel or seem appropriate to be cycling are however related to social conversion factors – for example, social values that challenge age-based notions of how ‘safe’ or ‘cool’ it is to cycle, or interventions that encourage cycle buddying for girls. Personal concerns about arriving at school hot and sweaty, and concerns about safety might in turn relate to resources (for example, a lightweight bicycle with good gearing) and personal, social and environmental conversion factors including fitness and self-image, social attitudes about what children should look like when arriving at school and cycling infrastructure. Even the issue of owning or having access to a bike, bike lock or a bike on which it is possible to carry school equipment, which might be seen simply as a personal *resource* issue, could also be related to the presence or absence of a social conversion factor – for example, a community intervention that lends bicycles to children.

3.4 Social issues

Social issues reported in the literature related to social norms, peer pressure, social hierarchies, and perceptions of power. Parents, peers, motorists, and schools had an influence on children’s decision to cycle to school. Parental attitudes to children cycling to school was discussed in seven of the included papers/articles (Atkins Limited, 2010, Panter et al., 2010a, Christie et al., 2011, Scottish Government, 2017, Glasgow Centre for Population Health, 2013, Fasan et al., 2021, de Aguiar Greca

et al., 2023). Parents showed a reluctance to allow their child to cycle to school with concerns centring around road safety (Atkins Limited, 2010, Scottish Government, 2017) a perceived lack of cycle paths (Panter et al., 2010a), encountering strangers (Atkins Limited, 2010), belief about the capability of their child cycling to school, and a fear of their child's bike being stolen (Christie et al., 2011). Changing the parents' routine and the convenience of driving their child to school was also a factor (Atkins Limited, 2010, Panter et al., 2010a). There was also a disconnect between who made the decision to cycle to school i.e., the parent or the child. In one article (Benson and Scriven, 2012) 40% of children believed they made the decision, whereas only 23% of parents claimed their child decided; if parents made the decision it resulted in children not cycling to school, whereas half of those children whose parents left the decision to them cycled to school. To overcome some of these attitudes it was suggested that parents should be made more aware of the benefits of cycling and explore ways for greater engagement with the development of school travel plans (Atkins Limited, 2010). Glasgow Centre for Population Health (2013) reported that parents felt it was safe for their children to travel independently to school as it was seen as *"a fun, healthy and green thing to do"* (p.5). Fasan and colleagues (2021) suggested that encouraging incentives to cycle amongst secondary school pupils, coupled with parental education and family cycling events could tackle the perceived resistance to allowing children to cycle to school.

The effect of social support from friends and parents was discussed in eight papers/articles (Benson and Scriven, 2012, Moore et al., 2014, Department for Regional Development, 2015, Panter et al., 2010a, Shared Intelligence Limited, 2013, de Aguiar Greca et al., 2023, Glasgow Centre for Population Health, 2013, Fasan et al., 2021). Parents recognise the benefits of cycling to their child in terms of physical activity, fun and cognition (de Aguiar Greca et al., 2023). The probability of a child cycling to school decreased when they did not have a friend who cycled to school (Benson and Scriven, 2012) and those that had encouragement from friends and parents were four times more likely to cycle to school than use motorised transport (Panter et al., 2010a). Similarly, wanting to talk with friends and

listen to music on route was identified as a barrier as children felt unable to do these when cycling (Scottish Government, 2017). Motorists' attitudes were mentioned in one article about secondary school children who felt unsafe travelling to school with their main concern being that more care is needed when overtaking cyclists (Department for Regional Development, 2015).

Nine of the included papers/articles highlighted the role that schools play in influencing children to cycle to school with regards to planning, initiatives and encouraging children to cycle (Panter et al., 2010b, Scottish Government, 2017, Atkins Limited, 2010, Shared Intelligence Limited, 2013, Teyhan et al., 2016, Goodman et al., 2016, Fasan et al., 2021, de Aguiar Greca et al., 2023, Glasgow Centre for Population Health, 2013). One cross-sectional study (Panter et al., 2010b) revealed that having a travel plan in place was positively associated with cycling to school with 84% of schools having an active transport policy. One paper cited a lack of funding as a barrier to implementing a travel plan (Atkins Limited, 2010). This paper also reported that schools feared being sued if cycles are stolen or if a child has an accident (Atkins Limited, 2010). Another paper showed some schools discouraged children cycling to school due to concerns around safety or did not promote active transport (Scottish Government, 2017).

Four papers/articles focused specifically on the impact of cycle training initiatives at schools (Atkins Limited, 2010, Shared Intelligence Limited, 2013, Teyhan et al., 2016, Goodman et al., 2016). One paper/article found that cycle training was positively associated with cycling to school in children aged 14-16 (Teyhan et al., 2016). However, another paper/article exploring the effectiveness of Bikeability, England's national cycling training scheme found there was no evidence that Bikeability increased cycling to school. (Goodman et al., 2016). Shared Intelligence Limited (2013) were able to demonstrate that cycling initiatives can improve children's confidence as well as develop other skills such as leadership, teamwork, and independence. Moreover, short-term school initiatives were seen as not being conducive to long-term adoption of cycling to school (Scottish Government, 2017).

Analysed from a CA perspective, these social issues relate to multiple conversion factors. The attitudes of friends and family were fundamental, and these supportive attitudes can be defined as the personal conversion factors of other individuals – for example, parents’ fears about safety and bicycle theft versus knowledge of the health benefits and their promotion of children’s autonomous decision-making. But these personal conversion factors in turn can be seen as related to social and environmental conversion factors – for example, school schemes that encourage parental awareness of the benefits of cycling and safe cycling routes. The possibility of cycling with friends, or enjoying friendships while cycling, can also be seen as related to both social and environmental conversion factors – for example, the presence of school-based encouragement for cycling, awareness raising to encourage tolerance from motorists and bike paths on which it is possible to talk whilst cycling. The social interventions which attempted to strength the personal skills of children, in the form of cycle training, were of mixed success, especially if the intervention was short term. This indicates a further social conversion factor – the presence or absence of sustained funding and the political will or economic context which enables this.

3.5 Environmental issues

Reported environmental issues primarily related to distance from home to school, geographical location and having the infrastructure to support cycling with regards to road safety, access to cycle paths and safe storage at school.

The distance that children travel to school identified as a barrier/facilitator in four papers/articles (Department for Regional Development, 2015, Panter et al., 2010a, Moore et al., 2014). One article reported that children who had a longer route to school were less likely to cycle to school (Panter et al., 2010a). Living closer to school was the main factor that would encourage children to cycle to school (42%) as identified from national survey data in Northern Ireland (Department for Regional

Development, 2015). The same survey data also identified that having 'better weather' would encourage them to cycle to school in a fifth of those surveyed (20%).

The area that the child lived in was also a factor in whether they cycled to school. Three articles/papers reported that those children that lived in more disadvantaged areas were less likely to cycle to school (Panter et al., 2010b, Christie et al., 2011, Roth et al., 2012). Lack of other forms of transport, and the location of schools at the heart of the community facilitated cycling and other forms of active travel (Glasgow Centre for Population Health 2013).

Infrastructure was a key factor in five the articles/papers that influenced whether children cycled to school. The perception that roads are unsafe due to the amount of traffic was a concern shared by both parents (Benson and Scriven, 2012), children (Department for Regional Development, 2015) and school staff (Atkins Limited, 2010). Having less traffic and safer cycling routes to school with cycle lanes that were well marked and clear of obstructions e.g. parked cars, were all identified by secondary school children in Northern Ireland as factor that that would encourage them to cycle to school (Department for Regional Development, 2015). Similarly, safer local roads and cycle paths were seen as the most important factors that would encourage cycling to school in an evaluation of a Travel to School initiative (Atkins Limited, 2010).

In three of the included papers/articles (Atkins Limited, 2010, Scottish Government, 2017, Department for Regional Development, 2015) it was also identified that the school could improve infrastructure with the provision of safe and secure cycle storage which would encourage children to cycle to school. Having secure cycling facilities would give more confidence to children to cycle to school if they can safely lock up their bikes. The provision of cycle storage along with changing facilities was seen as important factors that would encourage more children to cycle to school as well as having safer local roads and cycle paths (Atkins Limited, 2010) which connected cycle routes directly to schools (Fasan et al., 2021).

Analysed from a CA perspective, the place where a child lives might be seen as a personal attribute, but the relative location of a school within a community, its relationship to other travel routes and options and availability of bike lockers and changing facilities are clear environmental conversion factors. Some of these factors also relate back to the personal conversion factors – including concerns about arriving at school dishevelled and about bike theft which may be less of a factor on shorter cycling routes, and which could be addressed by provision of appropriate changing and safe storage facilities. There are also apparent social conversion factors which seem to be at the root of much of these infrastructure issues – for example, social attitudes about the relative importance of enabling children’s safe cycling, which might in turn affect social support for public investment in cycling infrastructure over longer distances.

4.0 Discussion

The aim of this systematic review was to identify the barriers and facilitators for cycling to school for children in the UK. To our knowledge this is the first systematic review focusing on children cycling to school as a means of active transport in the UK. This review found 16 papers/articles which identified various barriers and facilitators to children cycling to school. Using the capabilities approach (Sen and Nussbaum, 1993) has enabled us to identify the complex interweaving of personal, social and environmental conversion factors that operate within the personal, social and environmental barriers and facilitators to children’s cycle commuting that have been reported in the UK literature. The CA concepts of resources and conversion factors (Robeyns, 2017) were key to unpicking this complexity, as they prompted us to reflect on the wider causes of the diverse issues that were reported. Understanding these underlying and causal conditions is vital if children’s wish to cycle to school more is to be responded to effectively.

We identified gender as a key personal characteristic that acts as a barrier to cycling, meaning that girls are less likely to cycle to school than boys. This finding is not uncommon and concurs with other

research on active travel to school, including in international contexts (Schönbach et al., 2020, Higgins and Ahern, 2021, Lam et al., 2023). A 2021 study by Higgins and Ahern attributed the differences between boys and girls cycling behaviours to the difference in school uniforms, traffic concerns, the physical effects of cycling, the effects on appearance and the influence of friends. Adult cycling, initiatives that have specifically considered gender have seen increases in women cycling (British Cycling, 2022) and these could be adapted and developed for girls and young women. In addition, it has been suggested that women's cycling needs should be considered when it comes to the development of towns and cities (Grudgings et al., 2018). But our CA analysis of gender-related barriers also highlights the social nature of this issue. This has significant implications for interventions because addressing gender as a personal issue might mean encouraging girls to feel more confident, whereas addressing gender as a social conversion factor might mean a whole school approach to celebrating women's strength in cycling and challenging any remarks that attempt to perpetuate gendered discrimination.

Reported social issues predominantly related to parental perceptions, social norms, and the influence of friends on whether the child cycles to school. To address these, it is important to engage with personal, social, and environmental conversion factors. Previous research has identified the important role that parents' perceptions play in allowing children to cycle to school (Forsberg et al., 2023, Aranda-Balboa et al., 2020, Lorenc et al., 2008, Savolainen et al., 2024) and it is important to acknowledge how these perceptions affect children's decision to cycle to school but also addressing these through education interventions and environmental/infrastructure changes (Aranda-Balboa et al., 2020). Engaging with all these conversion factors at the same time might mean working with parents to understand their fear in detail, addressing some of these through education, but also learning from their fears to design infrastructure that avoids potential dangers.

Corresponding with previous research (Emond and Handy, 2012, Lam et al., 2023, Fraser and Lock, 2011, Aranda-Balboa et al., 2020), distance from home to school was also an important environmental

and personal factor. This interaction of factors needs to be considered when schools develop their Active Travel/Transport Plans (ATPs) and when cycling infrastructure is being planned by Local Authorities. ATPs are currently developed by each individual school and tend to focus on the physical environment and identification of routes, but a joined-up neighbourhood and locality approach to their development would see better coordinated safe cycle routes that could be utilised by children of all ages and their families, engendering a culture of cycling from an earlier age. An example of this is the School Streets initiatives (Clarke, 2022) which closes off streets to car traffic during School opening and closing times. This reduces traffic and address the real concerns that parents and children have about road safety. In the UK, Department for Transport strategies including Low Traffic Neighbourhoods (LTN), and other local and regional programmes are optimising public interest and motivation to reduce car journeys (Department of Transport, 2021, Department of Transport, 2020). School related car journeys contribute to the volume of traffic in local neighbourhoods and both local and national government policies should engage with and develop behaviour change strategies targeted at parents/carers to discourage car journeys to school and correspondingly increase cycling and other active travel options. Our research found that schools which have implemented and are supportive of active travel through addressing social and environmental conversion factors as well as education, enjoy more success in increasing cycling to school. This may require capital investment to provide secure storage and changing facilities, as well as resources to provide rewards and incentives for cycling and investing in behaviour change strategies. School based cycling initiatives which are short-term and only address personal conversion factors (cycling skills) (Goodman et al., 2016) do not increase cycling to school and a sustained effort that changes the travel cultures and opportunities in and around schools is required.

None of the included papers/articles directly discussed children's *ability* to cycle although this is a key personal conversion factor. Lack of confidence was reported as a barrier to cycling to school (Shared Intelligence Limited, 2013) which could reflect children's concerns about their ability as well as the

safety of the physical environment within which they would have to cycle. A recent scoping review by Savolainen and colleagues (2024) exploring the psychosocial factors that influence children's active travel to school reported that a child's confidence in their ability was positively associated with active transport to school and, a parent's confidence in their child's ability also shared a positive relationship with active transport. National programmes such as Bikeability which focus on training children and developing their cycle skills, have seen a significant increase in Department for Transport funded provision within schools (Department of Transport, 2020). The lack of evidence that cycle skills training encourages cycling to school in itself (Goodman et al., 2016), and the complexity of interweaving of personal, social and environmental conversion factors revealed by our review, suggests that it is the interaction of the three conversion factors that must be carefully considered if cycle commuting to school is to become an option that more children enjoy.

Older children's cycling to school decreased (Panter et al., 2008), especially in the transition from primary to secondary school and was associated with social norms and expectations, including peer pressure (a social conversion factor), and the availability of alternative travel options including walking and public transport (an environmental conversion factor). Older children have more opportunities for independent travel to school and have wider options for the mode of transport they choose for their school journeys. But analysis of the potential conversion factors indicated by our review suggests that this is not just a personal issue. It may therefore be important for interventions to address multiple dimensions. This might include personal rewards (highlighting health benefits or giving 'points for pedalling'), infrastructure concerns (provision of changing facilities and safe storage for bikes with good gears), social attitudes (promoting a 'cool to cycle to school' image) and social relationships concerns (promoting a 'cool to cycle with your buddies to school' approach). As older children preferred to cycle with friends and peers, the identification of safer routes to enable safe social interactions when cycling in groups would facilitate this.

Cycle ownership and storage was reported as a barrier to cycling to school and was more likely to affect children living in poorer and densely populated neighbourhoods and thus more likely to impact on children from Black, Asian, and Minority Ethnic communities (Fasan et al., 2021). There is a gap in the research in terms of different cultural attitudes towards children cycling to school. As parental cycling with their child to school increase rates of active travel and provides an opportunity to teach children how to deal with and avoid road hazards (Carver et al., 2014, Ghekiere et al., 2016, Fyhri et al., 2011), the question of supporting parental ownership or access to bicycles is also worthy of further research. There has been a recent increase in initiatives which have developed social/community storage and low-cost bike hire schemes which could be of benefit. Whilst the provision of infrastructure is often the go-to solution to cycling problems it is clear from the barriers identified in this review that understanding the combined impact of environmental, social, and personal conversion factors together with the distribution of the personal resources (bikes, helmets, and locks), is very important for changing the impetus to cycle to school.

A further insight from our review is the relevance of the use of CA to analyse the literature on barriers and facilitators to children cycling to school in the UK. As has been found in adult literature on cycling (Sherriff et al., 2020) our approach has enabled us to consider how reported issues interrelate and has revealed a potential barrier to effective implementation of the UK government initiative *Gear Change* (Department of Transport, 2020) and other cycling promotion initiatives. For example, as Jahanshahi et al. (2023) have noted in New Zealand, a wholistic notion of justice, such as the Capabilities Approach is needed because people of different backgrounds perceive cycling infrastructure differently. Questions of equity may not even be considered when planning for cycling (Cunha et al., 2023). So, to promote transport justice for children, and with respect to the intersections of age and other social characteristics, we suggest there has been too great a focus on the personal (skill and confidence) and environmental (cycling infrastructure) dimensions without adequate attention to the complex role of the social, including norms about who should be cycling, and social support for sustained investment

in multidimensional educational and codesign solutions. To understand how personal, social, and environmental factors interact in any local setting we suggest future research using CA would benefit from the active involvement of children, parents, schools and authorities and a focus on justice.

4.1 Strengths and limitations

There are strengths to this review which should be noted. To the best of our knowledge, this is the first review to focus on the barriers and facilitators to children cycling to school in the UK. We used an extensive search strategy to locate studies in six databases and relevant sources of grey literature. Moreover, barriers and facilitators were categorized according to the capabilities approach framework (Sen and Nussbaum, 1993). Every process in the selection and data extraction were conducted by two or more reviewers, ensuring quality of the results. The inclusion of a quality assessment was also another strength, with the majority of included papers/articles rated as either high quality or good, adding confidence in our findings. Our research is timely given the widening policy agenda which determines that cycling is a form of low cost and “green” travel in the UK (Department of Transport, 2022) this is also pertinent given wider economic factors including increasing fuel prices, inflation and the costs of living (Office for National Statistics, 2022). This review has limitations. Only a limited number of the included papers/articles specifically reported barriers to cycling to school. In addition, only eleven papers/articles came from peer reviewed journals and ten of these were quantitative in design, therefore more qualitative research focusing on the barriers and facilitators to children cycling to school is warranted.

4.2 Conclusion

Issues of justice and sustainable cities and communities are global concerns. This review identified barriers and facilitators regarding children cycling to school in a systematic review of UK literature, but we drew on international literature to discuss how a CA can illuminate the interactions between the personal, social, and environmental conversion factors. The CA adopted revealed the complexity

in understanding and addressing barriers to children cycling to school. Engaging with this complexity is essential in any research and practice which seeks to address concerns around justice holistically. Future research focussed on understanding cultural and gendered attitudes to cycling could contribute to further unpicking this complexity, as attitudes appear to be fostered at a young age. Future research and practice could also benefit from using the CA as a framework for codesigning and co-evaluating holistic solutions in the UK and beyond, with the active involvement of children, young people, parents, schools, and local and national authorities, to ensure that individual and community factors are adequately addressed and to enable greater access to cycling to school.

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Competing Interest

All authors declare that they have no conflict of interest.

Author Contributions

Paul Boland: Conceptualization, Investigation, Methodology, Data Curation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Project administration. **Rebecca Nowland:** Conceptualization, Methodology, Investigation, Data Curation, Supervision, Formal Analysis, Writing – Original Draft, Writing – Review & Editing. **Kennedy Tellis:** Investigation, Data Curation, Formal Analysis, Writing – Original Draft. **Mags Adams:** Methodology, Writing – Original Draft, Formal Analysis. **Joanne Westwood:** Funding acquisition, Writing – Original Draft, Writing – Review & Editing,

Formal Analysis **Deborah Crook**: Conceptualization, Data Curation, Writing – Original Draft **Cath Larkins**: Conceptualization, Data Curation, Writing – Review & Editing. **Julie Ridley**: Conceptualization

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