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Understanding parents' school travel choices: a qualitative study using the Theoretical Domains Framework.

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Abstract

Traffic related air pollution is detrimental to health and creates a substantial attributable mortality burden. It is suggested that a shift from motorised transport to active forms of travel will therefore have significant health benefits. Currently 46% of school journeys for primary aged children are made by car and this figure has risen steadily. Understanding barriers to active school travel (AST) is an important first step in developing behavioural interventions to increase active travel. The purpose of this study was to explore parents' experiences of school travel and their choices regarding travel mode with a focus on identifying barriers and facilitators to AST.

Twenty parents of primary school children (4-12 years) in the West Yorkshire region took part in semi-structured interviews regarding school travel, informed by the Theoretical Domains Framework. Framework Analysis was used to identify key themes in the data and to develop a comprehensive picture of parents' experiences of school travel at both individual and structural levels.

Distance was the biggest barrier to AST. Time constraints were reported as the main barrier to parents accompanying children in AST, while concerns about safety deterred parents from allowing children to travel independently. The need to incorporate multiple jouneys, such as the work commute and/or multiple school drop-offs, placed demands on parents' time, while difficulty getting children into local schools meant further to travel for a number of parents. Findings suggest that interventions to promote AST may be particularly effective if tailored towards working parents. However, also addressing factors such as distance to school and school travel at a policy level may produce more significant shifts in behaviour.

1. Introduction

Air quality is a key determinant of health with estimates suggesting that atributable mortality in the UK is equivalent to 40,000 deaths each year (Department for Environment Food and Rural Affairs, 2015a; Royal College of Physicians, 2016). Evidence shows links between air pollution and low birthweight (Laurent et al., 2014; Pedersen et al., 2013), adverse birth outcomes (Ha et al., 2014; Olsson et al., 2013), cardiovascular illnesses (Brook et al., 2010; COMEAP, 2006; Newby et al., 2014), stroke (Shah et al., 2015), respiratory disease and infection (Brunekreef and Holgate, 2002; Kampa and Castanas, 2008), and certain cancers (Beelen et al., 2008; Chen et al., 2008). Children are particularly vulnerable, with traffic related air pollution linked to the onset of childhood asthma and reductions in lung function (Gauderman et al., 2015, 2000; Gehring et al., 2013) and cognitive development (Freire et al., 2010; Porta et al., 2015; Sunyer et al., 2015). However, inequalities exist in exposure to air pollution; with children living in deprived areas experiencing higher concentrations (Barnes and Chatterton, 2016; Mitchell and Dorling, 2003; Walker Fairburn, J., Smith, G., Gordon, M., 2003) and therefore a greater risk of the associated health consequences.

A decrease in motor vehicle use, alongside increased uptake of lower emission vehicles, could significantly reduce the number of premature deaths and overall disease burden resulting from air pollution (Maizlish et al., 2013; Woodcock et al., 2009). A shift to more sustainable, and specifically more active, modes of transport brings other health benefits, in particular increasing physical activity and reducing sedentary time. Most children and adults in the UK do not currently meet physical activity recommendations (Health and Social Care Information Centre, 2014) despite the associated health risks (World Health Organization, 2010). Studies suggest that children and adults who regularly engage in active travel have higher levels of physical activity than those who do not (Cooper et al., 2005; Faulkner et al., 2009; van Sluijs et al., 2009; Yang et al., 2012) which may be a consequence of incorporating these additional opportunities to be active into the normal day. The school commute offers one opportunity to reduce vehicle emissions and incorporate physical activity into a daily routine by walking or cycling to school. In the UK more than a third of school journeys are made by car, with half of primary aged children driven to school (Department for Transport, 2014). If we are to develop effective interventions to promote active travel then it is important to understand the factors which influence choice of travel to school.

Previous conceptual frameworks of school travel have put forward a number of individual, social and environmental factors that directly and indirectly impact upon behaviour (McMillan, 2005; Panter et al., 2008). Socio-demographic factors such as a child's gender (Davison et al., 2008; Panter et al.,

2008; Stewart, 2011), age (Bringolf-Isler et al., 2008; Davison et al., 2008; Su et al., 2013), ethnicity (Bere et al., 2008; Chillón et al., 2014; Davison et al., 2008), and socio-economic background (Davison et al., 2008; Stewart, 2011; Su et al., 2013) have all been found to influence rates of AST. Similarly parents' socio-economic status (Stewart, 2011; Su et al., 2013), employment status (Stewart, 2011) and car ownership (DiGuiseppi et al., 1998; Timperio et al., 2006; Zhu and Lee, 2009) have been found to be positively associated with car use and/or negatively associated with walking to school. A review of environmental determinants of active travel by Panter et al. (2008) suggested that safer routes, including appropriate crossings and less busy roads, and shorter routes were positively associated with walking and cycling in young people between 5 and 18 years old. Together this research suggests that developing interventions to promote active travel is complex and consideration needs to be given to both individual and environmental influences on behaviour.

A futher complexity is that school travel behaviours involve parent-child dyads. Decisions on travel mode for the school commute are impacted upon by parents and children and their responses to multiple other factors. Succesfully carrying out the chosen behaviour requires cooperation from both indicating that a shift in travel behaviour from motorised travel to AST will involve a change in behaviour by parents and children. However, while the level of influence of a child in the decision making process will undoutedly vary between families, it can be assumed that for children of primary school age it is parents who act as the ultimate decision makers. It could therefore be argued that parents' perceived barriers to AST are likely to have greater influence than children's on choice of travel mode.

A number of studies have attempted to identify what barriers parents experience to AST. Distance, and concerns about safety have consistently been found to be the most common barriers (Carlson et al., 2014; Chillón et al., 2014; Martin and Carlson, 2005; Panter et al., 2013; Yeung et al., 2008). However, the majority have been correlational studies employing quantitative measures and while this has facilitated the identification of common factors that predict AST, it fails to provide the narrative needed to help better interpret this information (Davison et al., 2008). Fewer studies have explored parents' experiences of factors, how they interact, and how they influence decision making around school travel. Few qualitative studies exploring parents' choices regarding school travel have been published. Those that have reinforce the idea that school travel behaviour is affected by multiple levels of influence but have suggested that potential barriers are perceived, experienced and responded to differently by parents (Ahlport et al., 2008; Faulkner et al., 2010; Greves et al., 2007; Zuniga, 2012).

These findings may help to account for the limited success of interventions aimed at reducing car use and increasing active travel for school (Arnott et al., 2014; Chillón et al., 2011; Davison et al., 2008; Ogilvie et al., 2007). It has been suggested that intervention designs too rarely account for context or incorporate input from the intended target populations (Arnott et al., 2014; Ogilvie et al., 2007). Which may mean they are less effective. The range of variables found to impact upon school travel is broad and it is likely that different communities experience these factors differently. In order to develop effective AST interventions, and identify target populations for these interventions, it is necessary to understand what barriers and facilitators are experienced by different groups and how those barriers and facilitators are experienced and negotiated.

Interventions also require a strong theoretical basis (Arnott et al., 2014; Chillón et al., 2011) to ensure that they correctly target mechanisms of behaviour change. An important part of this process is completing a theoretical assessment of target behaviours in order to include all relevant constructs and discount irrelevant ones (Michie et al., 2005). The Theoretical Domains Framework (TDF; Michie et al., 2005) provides an integrative framework which incorporates a number of constructs from a range of behavioural theories (Figure 1). By making theories more accessible, the resultant domains allow researchers to build up an understanding of behaviours in context and identify potential target areas for intervention. The TDF may be particularly appropriate for use in research into AST given the breadth and range of influencing factors suggested by the literature.

Figure 1 about here

Understanding of barriers and facilitators to AST is crucial for targeting and developing successful interventions. Families in deprived areas are at greatest risk from the health impacts of transport and yet little research has explored these issues in depth with these populations in the UK. Similarly little has been done ro explore cultural or ethinic differences in school travel behaviour. The aim of this study was to identify factors that impact upon parents' choices regarding school travel in a UK population, with a focus on the key barriers to and facilitators of AST. Furthermore, the study aimed to build a comprehensive picture of school travel from a multicultural sample of parents of primary school children living in urban areas across West Yorkshire - a region with some of the poorest air quality in the UK (DEFRA, 2015b) and fewer people meeting physical activity guidelines than the national average (55.5% vs 57%, Sport England, 2015). Using a qualitative approach based upon the TDF, this study looked to provide a strong theoretical basis for future intervention development.

2. Method

2.1 Design

Semi structured interviews were conducted with parents of primary school aged childen to explore their opinions on and experiences of the school commute and using active travel for school journeys.

2.2 Participants

Parents of children aged 4-12 years living in the West Yorkshire region of the UK and attending participating urban primary schools were recruited between May and July 2015. The sampling strategy was to recruit mothers and/or fathers of primary school children who were of varying ages, were attending schools across the area, and who travelled to school using different modes of transport. Sampling also aimed to be representative of the ethnic diversity of the region and so a combination of purposive sampling and convenience sampling were used (Ritchie and Lewis, 2003). Purposive sampling was supported by a sampling matrix. The three ethnic categories used were white British, Asian/Asian British, and other. The three child age groups used were 4-6 years, 7-9 years and 10-12 years, and the school travel categories were car driven, public transport and active travel.

2.3 Recruitment

Eight primary schools in West Yorkshire situated near busy roads or in areas with congestion issues were approached by local authority teams to participate; six schools agreed. Schools either distributed letters and study information sheets directly to parents and collected any response sheets (3 schools) or provided an opportunity for the researcher to present the study at a parents' forum where parents could be invited to participate (3 schools).

All parents received a letter, study information sheet and response form and were asked to return the form to the school, or to the researcher directly if they wished to participate. Response forms included demographic questions and a question about regular school travel mode ("How does your child normally get to school?"). Parents were then contacted to arrange a convenient time and venue for the interview and given the opportunity to ask questions about the study. Immediately before the interviews, parents were asked to sign a consent form to confirm that they were happy to take part.

2.4 Theoretical Framework and Topic Guide

A semi-structured topic guide was developed using the TDF and previous literature (McMillan, 2005; Panter et al., 2008) comprising questions that explored influential factors for transport choices and school travel behaviours. It included general questions about the school journey as well as ones relating more specifically to active travel, shaped by the TDF domains (Figure 2). Factors which have previously been found to impact on school travel mode were incorporated into questions where appropriate and used to develop prompts which researchers could use to elicit more in depth responses from participants. The guide was developed by the research team which included behaviour change researchers. The final guide was reviewed by the team and piloted with two parents prior to data collection to ensure relevance and clarity of the questions.

Figure 2 about here

2.5 Procedure

Face to face interviews were conducted using the topic guide and lasted an average of 29 minutes (range 17-65 minutes). At the end of the interview all particpants received a £10 high street voucher as compensation for their time. Interviews were recorded using a digital recorder and were transcribed verbatim.

2.6 Ethical approval

This study was approved by the University of Leeds School of Psychology Ethics Committee (ref no: 15-0093; date approved: 07-Apr-2015).

3. Analysis

Transcripts were analysed using Framework analysis (Ritchie and Spencer, 1994) guided by the TDF. The analysis was conducted by two experienced researchers (SA and RM) and involved a five stage process (Pope et al., 2000).

3.1 Familiarisation

Transcripts were read and re-read by both researchers so that contextual and reflective notes could be made independently. This also allowed the researchers to comment on the initial fit of the data to the framework.

3.2 Coding and indexing

Some initial open coding then took place on ten of the transcripts, conducted by both researchers individually. The text was labelled according to emerging themes in an effort to capture those that were unexpected and those that fitted the existing framework. Disagreements regarding initial themes were resolved through discussion until joint consensus was reached. This involved combining and/or renaming existing themes. Coding was then completed on the remaining transcripts. The new codes were grouped and incorporated into the domains of the framework as subheadings and given an index number. Transcripts were then read line by line and where appropriate index numbers were applied. Indexing was completed by both researchers independently on ten of the 20 transcripts followed by a discussion to reach consensus. Any further adaptations to the framework were then made before it was applied to the remaining transcripts. Indexing was completed by SA.

3.3 Charting

Following indexing, a spreadsheet was used to develop a matrix of the domains and subdomains. Data were charted onto the matrix by extracting quotes directly into the relevant categories. This allowed researchers to retain the context and language of the interviews. This matrix was then condensed to show all quotes by category.

3.4 Interpretation

Following generation of the final matrix, discussion was had around the main concepts emerging from the data. Researchers attempted to identify and map interactions between the domains and describe these relationships. This also allowed the key behavioural determinants to be highlighted and grouped as barriers or facilitators to the target behaviours.

4. Results

20 interviews were undertaken; eight were conducted in schools, ten took place at participants' homes, and two took place at participants' places of work at their request. Participants were 18 mothers, and two fathers. Of these, ten were of White British, seven were Pakistani, one was Indian, and two were of mixed ethnicity. All interviews were conducted in English with most taking place one to one (n=15). However, two group interviews were conducted at the request of the participants; one group of three and a pair. The majority of parents had more than one child (n=16) and most had three or more (n=9). Half of parents had just one child of primary school age (n=10)

and only one parent had more than two children in this age group. Eight parents normally drove their children to school, ten children walked and two caught buses. No children regularly cycled to school, but this appeared to be representative of selected schools. Levels of relative deprivation were established using participant postcodes and the Index of Multiple Deprivation (IMD; Department for Communities and Local Government, 2015). Half lived in areas ranked as the 'most deprived' in England (IMD=1, n=10), seven lived in areas categorised as 'more deprived' (IMD=2-4), one lived in an area of 'average' deprivation (IMD=5), one in an area ranked as 'less deprived' (IMD=6) and one lived in an area considered to be one of the 'least deprived' in the country (IMD=10).

Guided by the TDF informed topic guide parents were encouraged to discuss a range of issues related to walking and cycling to school. Emergent themes shaped by the populated domains of the framework are discussed below along with barriers and facilitators to AST which were identified from parental reports. Sample quotes for each of the themes and related domains are presented in Table 1. Table 2 provides a summary of the key barriers and facilitators to AST.

4.1 Complexity of school travel choices

School travel behaviour was rarely constant and most children, at least ocassionally, varied their mode of travel (Table 1.1.ai). Parents described two distinct issues relating to AST. First the importance of having a parent or other trusted adult accompanying children in active travel (escorted AST) and second, children's capability to be independently mobile to engage in unescorted AST. Decisions relating to these issues preceded those of travel mode. A range of different and overlapping barriers and facilitators emerged (Table 2). Walking appeared to be the most salient AST option, with many parents seemingly never having considered cycling as a possible alternative despite more than half of children owning bikes. Only two of the twenty parents had children who had at some point cycled to school.

Overall many of the same issues were expressed by parents with regards to school travel, yet it was evident that parents' responses to these issues could vary and this was reflected in parents' school travel choices. Furthermore, there were a number of cases where parents with primary aged children who engaged in AST had other children at secondary school who were driven highlighting the complexity of school travel behaviour within families.

4.2 Knowledge, beliefs and motivation around AST

Irrespective of usual travel mode, parents were aware of some of the potential benefits of active travel (Table 1.2.bi) and many made reference to the contribution it could make to children's physical activity levels. However, parents were much less likely to comment on possible benefits to air quality with few demonstrating any awareness of local air quality issues (Table 1.2.bii). Overall attitudes to AST were positive (Table 1.2.ciii) with the general consensus being that walking would be parents' choice for their children, provided that other factors permitted.

Parents were confident they knew the fastest and safest routes for AST and in some cases the two were distinct from each other. The types of routes considered safest depended on whether parents were focused on accompanied AST, or their child travelling independently (Table 1.1aiii). Parents were more likely to consider the busy, main road routes as safe for unescorted AST because they felt this kept their child visible. This was related to parents' fears about their childs' safety when travelling unaccompanied to school (Table 1.2e), particularly regarding possible threat posed by strangers (Table 1.2.ciii). Parents who accompanied children in walking to school tended to avoid busy roads where possible in order to evade traffic and careless drivers which they considered the greater risks (Table 1.2.bii). These assessments of risk appeared to be based on parents' beliefs about the potential consequences of a travel behaviour and the recall of salient events locally such as road traffic accidents.

4.3 Actual and perceived capability to engage in AST

Of those parents whose children did consistently walk or take the bus to school, most reported that they were not able to drive or did not have access to a car. Lacking driving skills or the means to drive children to school therefore emerged as the most significant determinant of consistent active travel or use of public transport.

Irrespective of travel mode, parents spoke at length about children's road safety skills with some also making reference to children's general abilities to keep themselves safe (Table 1.3.f.i). These skills seemed to be central to parents' perceptions of how capable their children were of walking to and from school. Concerns that children lacked these skills prevented parents from permitting unescorted AST (Table 2) and the majority of parents believed that children would not be ready for independent travel until secondary school. Conversely, these concerns did not prevent parents from allowing children to walk when accompanied by an adult. This was demonstrated by the number of parents who reported concerns but whose children currently walked to school.

Some parents also felt that their children lacked the necessary cycling skills (Table 1.3.f.ii) or stamina (Table 1.3.g.ii) to cycle to school and again this was associated with concerns about safety. Other parents reported that their children had completed cycle training through school. However, none of these children were currently cycling to school and, in most cases, had never made the journey by bike. This would suggest that while developing children's cycling skills may improve parents' attitudes towards cycling to school, there are additional reasons why children don't do so.

Many parents felt that their choice of school travel mode was dictated by circumstances, demonstrating a lack of perceived behavioural control (Table 1.3.g.ii); this was particularly apparent amongst parents who currently drove children to school. The perceived necessity of driving was often at odds with parents' aspiration for children to walk to school but given a number of environmental barriers parents saw no practical alternatives. Parents whose children walked unaccompanied described their methods for ensuring that children were able to travel safely (Table 1.3.f.iii). Helping children to develop their skills around road safety and personal safety and allowing them to walk themselves to and from school was considered by these parents to be an important part of building their independence (Table 1.2.d.ii and Table 1.3.f.ii) and emerged as a facilitator of unescorted AST (Table 2).

4.4 Parents' roles and their social support

Parents felt responsible for getting children to and from school safely (Table 1.4.h.i), but for some that responsibility was shared with a co-parent, grandparent, older child or child-minder (Table 1.4.i.i). For a number of working parents, this additional social support appeared to be vital to facilitate AST. For parents whose children walked to school without an adult, their role seemed to evolve from one of chaperone to one of monitor (Table 1.4.h.ii). Parents described a brief stage of following their children from a distance to ensure they reached school safely, or routinely calling children via mobile telephones during the journey to track their progress.

For most, the norm at their child's school was for children to walk, with others reporting an even mix of walking and driving (Table 1.4.i.ii). Most parents were not aware of any children currently cycling to school. Generally, parents did not appear to feel influenced by other parents'travel choices, differentiating between their circumstances and the perceived circumstances of others. Nor did parents report feeling any social pressure from friends or family to opt for one travel mode over another.

A number of parents reported strategies schools had used to promote AST, including school and parent led walking buses and cycle training. Walking buses were reported to be short lived and not sustained by the schools. Children enjoyed cycling training, but this did not appear to result in an increase in cycling to school amongst those children who participated. A number of schools had tried to tackle some of the issues resulting from the number of children driven to school. This had involved posting teachers outside of the school at drop-off and pick-up times or communicating with parents via letters and newsletters in an attempt to reduce dangerous parking around the school site. Again parents reported limited success suggesting the school did not have sufficient power to enforce parking rules.

4.5 Environmental and policy influences

By far the most commonly reported reasons for low levels of AST related to issues of parents' environmental contexts.

4.5.1 Distance and time

Distance of home from school emerged as the most significant environmental factor (Table 1.5.j.i). In general parents whose children walked to school reported living close by with a walk of only a few minutes (range of 2-20 minutes). For those who lived further away, children were likely to be driven unless parents did not drive or have access to a car. Where a walk would take over 20 minutes these parents tended to opt for taking the bus which was related to parents' perceptions of children's capacity to walk that distance. For a small number of parents the issue of distance between home and school was the result of children not being allocated places at their school of choice but at another school significantly futher away.

Another factor, often exacerbated by distance, was time constraints. Many parents reported having to incorporate more than one trip into their school journey. In many cases this included their work commute (Table 1.5.j.ii), getting other children to and from different schools, and/or getting children to after school activities. Having to make multiple trips seemed to be highly related to taking the car, particularly where parents had to travel on to work. Parents reported that the car was most convenient as it saved time, and for some was seen as the only option allowing them to arrive at work on time due to conflicting school and work start times.

4.5.2 Traffic

All parents were concerned about unsafe levels of traffic on the route to school and/or around the school site (Table 1:5.j.iii) and this was seen as a key barrier to unescorted AST and/or cycling to school. In addition to traffic volume, parents described having witnessed dangerous driving including speeding around their child's school (Table 1.5.j.iv), which again contributed to concerns around road safety. Traffic was by far the biggest contributor to parents' concerns around safety due to fears of children being involved in accidents.

4.5.3 Infrastructure

Parents reported feeling more confident in their child's ability to negotiate the school route when there were fewer roads to cross or where appropriate crossings were provided. Where parents were discussing unescorted AST, many felt that they would be more confident when traffic lighted crossings were accompanied by a crossing guard (lollipop person; Table 1.5.j.v). Most parents felt there was a significant issue with parking around their child's school. Parents who drove felt there was insufficient parking and some were actually put off from driving children to school as a result suggesting in some cases a lack of parking near school may facilitate AST (Table 2). However, many parents felt that the situation around school parking presented a safety issue for those children walking to school by making it difficult to cross safely (Table 1.5.j.vi) suggesting it may also discourage parents from allowing unescorted AST (Table 2).

Issues of infrastructure appeared more salient when parents were considering cycling to school (Table 1.5.j.vi). A number of parents reported that the route would not appropriately accommodate children cycling which added to the potential dangers. Similarly, schools did not appear to provide adequate storage facilities for bikes. Two parents who had previously allowed children to cycle to school reported this as the main barrier to cycling (Table 2). However, amongst a number of parents there was a lack of awareness of bike storage (Table 1.2.biv).

4.5.4 Weather and resources

Weather was mentioned as a factor that impacted upon the school journey and for a small number of parents this significantly influenced travel mode (Table 1.5.j.vii). For some, bad weather made travelling to school by motorised transport (car, bus or taxi) more likely. For others, nice weather could prompt a shift in the opposite direction. However, the impact of weather was ususally related to what resources parents had available to allow them to alternate between travel modes. For

example, parents could only use the car as an alternative where they had access to a car, and this included having the funds to pay for a taxi. Similarly, parents were more likely to see walking as a viable option when they had sufficient time to allow them the opportunity, and children had the appropriate outdoor clothing to allow them to walk comfortably in inclement weather. This suggests that weather and access to resources can mediate the relationship between behavioural intention and actual travel behaviour. With regards to cycling, more than half of children owned bikes while only two had ever cycled to school suggesting that whilst having access to a bike is clearly necessary, it is not a sufficient facilitator for cycling to school.

4.6 Demographic influences

As a result of purposive sampling methods overall rates of driving and AST did not differ by child's age or ethnicity. Nor was there any suggestion from parents that boys and girls travelled differently or that gender influenced parents' decisions around school travel. However, it was clear that children's age had a strong influence on unescorted AST and that this was related to parents' perceptions of children's skills and abilities. Of the four children that had walked to school without an adult, all were aged nine or above and all were White British. None of the South Asian primary school children had ever travelled to school without an adult although reasons for this were not explicit. Parents whose children walked to school without an adult demonstrated an awareness of the possible risks of them doing so. There were, however, distinctly fewer reports of fears and worries amongst these parents. All expressed confidence in their children's abilitites and an aim of preparing children for independent travel to and from secondary school.

Half of parents were in employment and of these five regularly drove children to school, four had social support which meant children were at least occasionnally accompanied in active travel to school, and one was able to walk with their child as they worked at the same school with corresponding hours. By contrast, the vast majority of parents whose children were accompanied to school were not in employment and were mainly made up of South Asian mothers. Discounting distance, being a working parent was the most commonly reported reason for driving children to school.

5 Discussion

The results of this study highlight the complexity of school travel behaviours and the range of individual and structural influences on parents' choices of travel mode. For most parents, mode choice can be relatively changeable in response to fluctuations in context, such as the availability of

time, material and social resources. This supports assertions that there is a greater degree of flexibility in people's travel behaviour than is normally assumed (Chatterton et al., 2015) and that this existing flexibility might be exploited in order to promote more lasting shifts in behaviour.

Walking was the preferred mode of AST, with few considering cycling as an option and there was a clear distinction drawn between children walking with and without an adult chaperone, with a strong preference for the latter for primary aged children. Findings suggest a distinct set of school travel behaviours with separate and overlapping individual, social and environmental barriers and facilitators and these have been incorporated into a conceptual framework shown in Figure 3. Unlike previous models of school travel this framework highlights the role of parents' perceptions as barriers to AST, and attempts to show how these perceptions interact with environmental barriers. However, it is worth noting that while this model offers a 'good fit' for the majority of the current sample, for a small number of parents certain factors, such as distance or lack of access to a car, were particularly dominant, limiting choice and reducing flexibility in terms of travel mode.

Figure 3 about here

Escorted school travel: motor travel vs AST

Distance and time constraints were the most commonly reported barriers to escorted active travel, and in a number of cases were highly related. Children who walked to school lived within a twenty minute walk of the school site, and in most cases the journey was much shorter. However, children whose parents also needed to make the journey to work or make additional school drop-offs were more likely to be driven, particularly when they lived some distance from the school. Distance has consistently been found to be a commonly cited reason for driving children to school and/or children not engaging in AST (Ahlport et al., 2008; Faulkner et al., 2010; Garrard, 2011). In recent years the length of school journeys has increased by nearly a quarter (Department for Transport, 2014). This has coincided with the introduction and strengthening of the role of parents' choice in school selection as well as increased autonomy within the school sytem itself. The average primary school journey in the UK is now 1.6 miles, further than the 1 mile journey most parents seem willing for primary aged children to make on foot (Chillón et al., 2015). This suggests that at a structural level current policies around school selection may be a significant influential factor on levels of AST. The role of the school system is further reinforced by reports from parents that failure to get children into a local school, or to get multiple children into the same school has meant travelling greater distances and/or increased the number of necessary trips. Lack of sufficient places at local schools

and schools admissions policies which emphasise factors other than ease of travel may also be impacting on school travel behaviour.

One of the most commonly reported demands on parents was getting to work on time, which often meant integrating the work and school commutes into a single journey. Within the current sample, working parents were much less likely to accompany their children in active travel, opting instead to drive. Where working parents were able to walk their children to and from school, this was because their working hours allowed for it and did not conflict with the normal school day. This supports findings from previous research that convenience is an important factor in parents' decision making around school travel mode (Ahlport et al., 2008; Faulkner et al., 2010). Linking other trips into the school journey was an important factor in the perceived convenience of taking the car. In addition to the work commute, taking children to after school activities and appointments necessitated this.

It is, however, important to acknowledge that the perceived convenience of car travel does not in itself act as a barrier to AST. Amongst current participants there were a number of working parents who used the car for the work commute but whose children walked to school at least several days a week. In most cases this was because parents had access to some level of social support, either family or a paid child-minder, who could take on the responsibility of walking the child to school. In a small number of cases it was because children made their own way to school on foot. For all of these parents dropping children at school in the car was seen as the least convenient option given alternatives that allowed them to bypass the school journey completely. The variability in travel decisions between parents, and between days at an individual level, reinforces Zuniga's (2012) assertion that the impact of potential barriers can vary according to a parent's approach. Successful negotiation of barriers depends on parents' capacity and inclination. This might indicate that building working parents' capacity by providing them with support for the school run, or making unescorted travel a favourable alternative could increase rates of AST.

5.1 Unescorted active school travel

The choice to allow children to walk to school without an adult was uncommon within our sample. Only a small number of parents had permitted children to do so and this was facilitated by parents' belief that children could travel safely, and a desire to build children's independence before the transition to secondary school. There was a tendency for parents to consider children of primary age too young to make the journey without a chaperone, believing them to be lacking the necessary skills to negotiate the route to school and fearing the risk from strangers and road traffic accidents. In line with other studies (Chillón et al., 2015; Mammen et al., 2012) concern about child safety was

a significant barrier to unescorted AST, and reflects a significant downward trend in children's independent mobility across recent decades. In England, rates of walking home from school unaccompanied amongst primary age children have fallen from 86% in 1971, to 25% in 2010 (Shaw et al., 2015). This significant drop has been driven by fewer 7-8 year olds being allowed to make the journey unaccompanied (80% 1971, 6% 2010), demonstrating that children are being given this independence much later than ever before. This has led to an increase not only in the number of children being driven to school, but also in rates of children being accompanied in AST. This supports, in part, Faulkner et al.'s (2010) assertion that safety considerations impact on escort decisions rather than choices of travel mode.

In this study, the necessity for children's school travel to be chaperoned seemed to be driven purely by perceptions of danger for the child, particularly from traffic. Speeding and inattentive driving en route and around the school site were a major concern. A lack of confidence in children's road safety skills was a key barrier to unescorted AST. It has been suggested that restricting independence delays, rather than removes, risk and that allowing children increasing levels of independence in their travel may be an important opportunity to 'develop and consolidate' skills (Shaw et al., 2015). Furthermore, when independent mobility is limited, so too are children's opportunities to demonstrate their capabilities to parents.

Reductions in the number of road accidents involving young children may suggest that parents' perceptions of road traffic risk is inflated. However, fewer accidents may simply reflect changes in travel behaviour (Hillman et al., 1990). For example, there has been a reduction in independent mobility in this age group which may have reduced their involvement in accidents. This possibility is supported by the steep increase in pedestrian injuries and fatalities between the 8--11year age band and 12-15 year band, when children enjoy much more freedom of movement (Department for Transport, 2013). However, it is important to consider that accident rates and therefore actual risk can differ across neighbourhoods and that parents' perceptions can be influenced by their location. Neighbourhoods characterised by less traffic danger have been found to be associated with increased rates of independent mobility. In the case of the current sample living in urban, densely populated areas, high perceptionss of risk from traffic may have some basis in reality. Improving parent's perceptions of route safety by addressing traffic issues or providing safer crossings near schools may therefore be of equal or greater importance than improving children's road safety skills. This is because, by improving the perceived safety of the route to school, it is likely that parents' confidence in children's ability to negotiate that route will increase. Changes in infrastructure may be particularly relevant for children's cycling. Parents have been found to prefer substantially

segregated cycle routes for primary aged children, contrasting with the traditional approach to cycling infrastructure found in the UK (Aldred, 2015). However, individuals' perceptions of cycling risk involve attributions of competence and infrastructure and are influenced by wider social perceptions of risk (Manton et al., 2016). Addressing the collective perception of cycling as unattainable may therefore be necessary in order to shift travel norms, and a combination of structural and population level interventions may be more likely to promote cycling (Spotswood et al., 2015).

5.2 Moderators and mediators

Previous research has demonstrated that both child and parent socio-demographics can impact upon children's school travel behaviour. Within the current sample, there were no obvious cultural or ethnic differences in the factors that influenced parents' choices of travel mode. Barriers and facilitators were common to both White British and South Asian parents. However, South Asian mothers reported walking their children to school more frequently and this seemed to be related to the fact that fewer South Asian mothers were in full time employment. Similarly, none of the South Asian parents reported children having made the journey independently, but again this might reflect that more South Asian mothers had the opportunity to escort their children to school and unescorted travel was not a neccessity. Whether or not parents worked, together with car ownership, seemed to be the only significant socio-economic influences on travel mode choice. Even where parents who had access to a car did not generally drive children to school, having a car available meant that driving could be seen as a 'backup', particularly in bad weather. Working parents who drive may therefore be a potential target population for intervention.

Whereas previous studies have found that boys are more likely to engage in active travel and demonstrate more freedom in mobility (Davison et al., 2008; O'Brien et al., 2000; Panter et al., 2008; Prezza et al., 2001; Stewart, 2011), this study found no difference between genders. Gender did not appear to factor into parents' decision making for primary aged children. However, age did emerge as an important aspect of parents' reasoning, given their tendency to use it as an indication of children's ability to make the journey to school independently. Parents saw the transition to secondary school as a cue for children's readiness to engage in unescorted AST. However, given that the largest proportion of road accidents amongst children happen in this age group (Keep and Rutherford, 2013) there may be a need to cement their skills in independent travel before they make this move.

Strengths and limitations

The current study had a number of strengths including (1) the involvement of a multicultural sample of parents living in predominantly deprived areas, and (2) the recruitment of parents with a range of current school travel behaviours. Including a diverse sample, with children from across primary school age groups, is novel and addresses limitations of previous research. A further strength of the study is its use of a theoretical framework for data collection and analysis. The TDF acted as a guide to discussions with parents, enabling questioning on specific factors relating to AST, without limiting the breadth of exploration of school travel behaviours. The use of the TDF as part of a robust framework analysis also provided insights beyond simply identifying key factors in the travel choices parents make. It highlighted interactions between those factors and offered additional detail regarding those interactions. For instance, rather than simply pointing to a relationship between age and levels of unescorted AST, the TDF revealed how age was related to parents perceptions that younger children lack the necessary skills to travel unaccompanied, and how this in turn was related to concerns about safety and fear of accidents. This should help interventions to identify key areas to target.

While the nature of the current sample can be seen as a strength of this study, it may also be a limitation. A multicultural sample such as this one is representative of the West Yorkshire population, but it may not be representative of other areas. Similarly, the current sample included areas of high deprivation. Given that findings suggest interventions might be best targeted at working parents, this could indicate that less deprived communities will benefit more from intervention given higher rates of employment. Further qualitative studies should therefore be conducted with middle-income parents who are likely to have higher rates of car ownership and a greater proportion of two-working-parent families. A final limitation of the study is that it included parents but did not involve children. As previously discussed school travel behaviours involve parent-child dyads and it is possible that the current investigation has missed factors unique to the child's experience. However, qualitative studies that have involved children have shown significant commonality in the barriers they report, and those reported by parents (Ahlport et al., 2008; Kirby and Inchley, 2009). Furthermore, in children of primary age, choices of travel mode and restrictions on travel are most likely to come from parents.

5.3 Conclusions

There are a number of implications for areas for intervention and future research provided by the findings of this study. Firstly, working parents have emerged as a promising target group for

intervention to promote AST, given the high level of car use in this population. At a structural level, providing parents with flexible working arrangements may allow them the option to accompany children in AST. However, given that many parents rely on use of the car for the work commute, and the convenience of making a single onward journey, this may not be sufficient to promote a change in behaviour. Instead, providing some level of social support, in the form of other adults who can take on responsibility for getting children to school, may facilitate increases in escorted AST. To date, these types of interventions have been predominantly school led and have focused on the provision of walking school bus programmes (Chillón et al., 2011). Both the literature and parents themselves report limited success of walking buses, and parents' reports suggest this could be a result of poor targeting and dependence on volunteer chaperones. Successful interventions will need to consider accessibility and sustainability as part of the development process.

Encouraging working parents to consider unescorted AST, for those in older age groups at least, is also likely to produce significant shifts in behavior. Findings suggest that interventions should focus on reducing concerns about children's safety on the way to school and increasing confidence in children's ability to make the journey without an adult. Interventions that aim to improve children's road safety skills and/or improve safety of the route may therefore be beneficial. However, before developing strategies, research should look to establish how well parents' perceptions reflect reality, with regards to both children's abilities and the risks to children en route.

The potential role of structural level interventions has been further supported by the findings of this study. Distance is clearly one of the most influential issues for parents regarding school travel, with shorter distances facilitating both escorted and unescorted AST. At an individual level, parents are limited in what actions they can take to reduce the length of the school journey. However, local and school level policies which emphasise school travel in relation to admissions are likely to facilitate shorter journeys. Policies relating to spatial planning can also impact upon distance as well as the safety of routes to school. Planning policies which prioritise sustainable school travel in decisions on school sitings, both in terms of new school developments and the expansions of existing school sites, may therefore provide significant shifts in travel behaviour. Likewise, making existing school environments more AST 'friendly' through the provision of supportive infrastructure and/or reduction of motor vehicle dominance may also be effective. However, it is probable that a coordinated approach, involving planners, policy makers, educators and parents , is likely to have the most significant impact on school travel behaviour.

References

Ahlport, K.N., Linnan, L., Vaughn, A., Evenson, K.R., Ward, D.S., 2008. Barriers to and facilitators of walking and bicycling to school: formative results from the non-motorized travel study. Heal. Educ Behav 35, 221–244. doi:10.1177/1090198106288794

Aldred, R., 2015. Adults' attitudes towards child cycling: A study of the impact of infrastructure. Eur. J. Transp. Infrastruct. Res. 15, 92–115.

Arnott, B., Rehackova, L., Errington, L., Sniehotta, F.F., Roberts, J., Araujo-Soares, V., 2014. Efficacy of behavioural interventions for transport behaviour change: systematic review, meta-analysis and intervention coding. Int. J. Behav. Nutr. Phys. Act. 11, 133. doi:10.1186/s12966-014-0133-9

Barnes, J., Chatterton, T., 2016. An environmental justice analysis of exposure to traffic-related pollutants in England and, in: Proceedings of the 24th International Conference on Modelling, Monitoring and Management of Air Pollution Greece, 20-22 June 2016. Wessex Institute of Technology Press, Southampton, UK, pp. 20–22.

Beelen, R., Hoek, G., van den Brandt, P.A., Goldbohm, R.A., Fischer, P., Schouten, L.J., Armstrong, B., Brunekreef, B., 2008. Long-Term Exposure to Traffic-Related Air Pollution and Lung Cancer Risk. Epidemiology 19, 702–710.

Bere, E., van der Horst, K., Oenema, A., Prins, R., Brug, J., 2008. Socio-demographic factors as correlates of active commuting to school in Rotterdam, the Netherlands. Prev Med 47, 412–416. doi:10.1016/j.ypmed.2008.06.019

Bringolf-Isler, B., Grize, L., Mader, U., Ruch, N., Sennhauser, F.H., Braun-Fahrlander, C., 2008. Personal and environmental factors associated with active commuting to school in Switzerland. Prev Med 46, 67–73. doi:10.1016/j.ypmed.2007.06.015

Brook, R.D., Rajagopalan, S., Pope, C.A., Brook, J.R., Bhatnagar, A., Diez-Roux, A. V, Holguin, F., Hong, Y., Luepker, R. V, Mittleman, M.A., Peters, A., Siscovick, D., Smith, S.C., Whitsel, L., Kaufman, J.D., Epidemiology, on behalf of the A.H.A.C. on, Prevention, C. on the K. in C.D., Council on Nutrition, P.A., Metabolism, 2010. Particulate Matter Air Pollution and Cardiovascular Disease: An Update to the Scientific Statement From the American Heart Association. Circulation 121, 2331–2378. doi:10.1161/CIR.0b013e3181dbece1

Brunekreef, B., Holgate, S.T., 2002. Air pollution and health. Lancet 360, 1233–1242. doi:http://dx.doi.org/10.1016/S0140-6736(02)11274-8

Carlson, J. a, Sallis, J.F., Kerr, J., Conway, T.L., Cain, K., Frank, L.D., Saelens, B.E., 2014. Built environment characteristics and parent active transportation are associated with active travel

to school in youth age 12-15. Br. J. Sports Med. 1–7. doi:10.1136/bjsports-2013-093101

Chatterton, T., Williams, D., Marsden, G., Mullen, C., Anable, J., Docherty, I., Faulconbridge, J., Cass, N., Roby, H., Doughty, K., 2015. Flexi-Mobility : Helping Local Authorities Unlock Low Carbon.

Chen, H., Goldberg, M.S., Villeneuve, P.J., 2008. A systematic review of the relation between long-term exposure to ambient air pollution and chronic diseases. Rev Env. Heal. 23, 243–297.

Chillón, P., Evenson, K.R., Vaughn, A., Ward, D.S., 2011. A systematic review of interventions for promoting active transportation to school. Int. J. Behav. Nutr. Phys. Act. 8, 17. doi:10.1186/1479-5868-8-10

Chillón, P., Hales, D., Vaughn, A., Gizlice, Z., Ni, A., Ward, D.S., 2014. A cross-sectional study of demographic, environmental and parental barriers to active school travel among children in the United States. Int. J. Behav. Nutr. Phys. Act. 11.

Chillón, P., Panter, J., Corder, K., Jones, A.P., Van Sluijs, E.M.F., 2015. A longitudinal study of the distance that young people walk to school. Health Place 31, 133–137. doi:http://dx.doi.org/10.1016/j.healthplace.2014.10.013

COMEAP, 2006. Cardiovascular Disease and Air Pollution: A report by the Committee on the Medical Effects of Air Pollutants (RPRT). The Committee on the Medical Effects of Air Pollutants.

Cooper, A.R., Andersen, L.B., Wedderkopp, N., Page, A.S., Froberg, K., 2005. Physical Activity Levels of Children Who Walk, Cycle, or Are Driven to School. Am. J. Prev. Med. 29, 179–184. doi:http://dx.doi.org/10.1016/j.amepre.2005.05.009

Davison, K.K., Werder, J.L., Lawson, C.T., 2008. Children's active commuting to school: current knowledge and future directions. Prev Chronic Dis 5, A100.

Department for Communities and Local Government, 2015. The English Index of Multiple Deprivation (IMD) 2015 – Guidance.

Department for Environment Food and Rural Affairs, 2015a. Valuing impacts on air quality: Updates in valuing changes in emissions of Oxides of Nitrogen (NOX) and concentrations of Nitrogen Dioxide (NO2) (GOVDOC).

Department for Environment Food and Rural Affairs, 2015b. Improving air quality in the UK Tackling nitrogen dioxide in our towns and cities.

Department for Transport, 2014. National Travel Survey: England 2013 - Statistical Release (AGGR).

Department for Transport, 2013. Reported Road Casualties Great Britain: 2013 Annual Report 1–11.

DiGuiseppi, C., Roberts, I., Li, L., Allen, D., 1998. Determinants of car travel on daily journeys to

school: cross sectional survey of primary school children. BMJ 316, 1426–1428.

Faulkner, G., Richichi, V., Buliung, R., Fusco, C., Moola, F., 2010. What's "quickest and easiest?": parental decision making about school trip mode. Int. J. Behav. Nutr. Phys. Act. 7, 62.

Faulkner, G.E.J., Buliung, R.N., Flora, P.K., Fusco, C., 2009. Active school transport, physical activity levels and body weight of children and youth: A systematic review. Prev. Med. (Baltim). 48, 3–8. doi:http://dx.doi.org/10.1016/j.ypmed.2008.10.017

Freire, C., Ramos, R., Puertas, R., Lopez-Espinosa, M.-J., Julvez, J., Aguilera, I., Cruz, F., Fernandez, M.-F., Sunyer, J., Olea, N., 2010. Association of traffic-related air pollution with cognitive development in children. J. Epidemiol. Community Health 64, 223–228. doi:10.1136/jech.2008.084574

Garrard, J., 2011. Active travel to school: literature review (RPRT).

Gauderman, W.J., McConnell, R., Gilliland, F., London, S., Thomas, D., Avol, E., Vora, H., Berhane, K., Rappaport, E.B., Lurmann, F., Margolis, H.G., Peters, J., 2000. Association between Air Pollution and Lung Function Growth in Southern California Children. Am. J. Respir. Crit. Care Med. 162, 1383–1390. doi:10.1164/ajrccm.162.4.9909096

Gauderman, W.J., Urman, R., Avol, E., Berhane, K., McConnell, R., Rappaport, E., Chang, R., Lurmann, F., Gilliland, F., 2015. Association of improved air quality with lung development in children. N Engl J Med 372, 905–913. doi:10.1056/NEJMoa1414123 10.1056/NEJMoa1414123.

Gehring, U., Gruzieva, O., Agius, R.M., Beelen, R., Custovic, A., Cyrys, J., Eeftens, M., Flexeder, C., Fuertes, E., Heinrich, J., Hoffmann, B., de Jongste, J.C., Kerkhof, M., Klümper, C., Korek, M., Mölter, A., Schultz, E.S., Simpson, A., Sugiri, D., Svartengren, M., von Berg, A., Wijga, A.H., Pershagen, G., Brunekreef, B., 2013. Air Pollution Exposure and Lung Function in Children: The ESCAPE Project. Environ. Health Perspect. 121.

Greves, H.M., Lozano, P., Liu, L., Busby, K., Cole, J., Johnston, B., 2007. Immigrant families' perceptions on walking to school and school breakfast: a focus group study. Int J Behav Nutr Phys Act 4, 64. doi:10.1186/1479-5868-4-64

Ha, S., Hu, H., Roussos-Ross, D., Haidong, K., Roth, J., Xu, X., 2014. The effects of air pollution on adverse birth outcomes. Environ. Res. 134, 198–204. doi:http://dx.doi.org/10.1016/j.envres.2014.08.002

Health and Social Care Information Centre, 2014. Statistics on Obesity, Physical Activity and Diet: England 2014 (RPRT).

Hillman, M., Adams, J., Whitelegg, J., 1990. One False Move: A Study of Children's Independent

Mobility | Policy Studies Institute publications. Policy Studies Institute, London.

Kampa, M., Castanas, E., 2008. Human health effects of air pollution. Environ. Pollut. 151, 362–367. doi:http://dx.doi.org/10.1016/j.envpol.2007.06.012

Keep, M., Rutherford, T., 2013. Reported Road Accident Statistics.

Kirby, J., Inchley, J., 2009. Active travel to school: views of 10-13 year old schoolchildren in Scotland. Health Educ. 109, 169–183. doi:doi:10.1108/09654280910936611

Laurent, O., Hu, J., Li, L., Cockburn, M., Escobedo, L., Kleeman, M.J., Wu, J., 2014. Sources and contents of air pollution affecting term low birth weight in Los Angeles County, California, 2001–2008. Environ. Res. 134, 488–495. doi:http://dx.doi.org/10.1016/j.envres.2014.05.003

Maizlish, N., Woodcock, J., Co, S., Ostro, B., Fanai, A., Fairley, D., 2013. Health Cobenefits and Transportation-Related Reductions in Greenhouse Gas Emissions in the San Francisco Bay Area. Am. J. Public Health 103, 703–709. doi:10.2105/ajph.2012.300939

Mammen, G., Faulkner, G., Buliung, R., Lay, J., 2012. Understanding the drive to escort: a cross-sectional analysis examining parental attitudes towards children's school travel and independent mobility. BMC Public Health 12, 1–12. doi:10.1186/1471-2458-12-862

Manton, R., Rau, H., Fahy, F., Sheahan, J., Clifford, E., 2016. Using mental mapping to unpack perceived cycling risk. Accid. Anal. Prev. 88, 138–149. doi:http://dx.doi.org/10.1016/j.aap.2015.12.017

Martin, S., Carlson, S., 2005. Barriers to children walking to or from school--United States, 2004. MMWR Morb Mortal Wkly Rep.

McMillan, T.E., 2005. Urban Form and a Child's Trip to School: The Current Literature and a Framework for Future Research. J. Plan. Lit. 19, 440–456. doi:10.1177/0885412204274173

Michie, S., Johnston, M., Abraham, C., Lawton, R., Parker, D., Walker, A., Psychological Theory, G., 2005. Making psychological theory useful for implementing evidence based practice: a consensus approach. Qual. Saf. Health Care 14, 26–33. doi:10.1136/qshc.2004.011155

Mitchell, G., Dorling, D., 2003. An Environmental Justice Analysis of British Air Quality. Environ. Plan. A 35, 909–929. doi:10.1068/a35240

Newby, D.E., Mannucci, P.M., Tell, G.S., Baccarelli, A.A., Brook, R.D., Donaldson, K., Forastiere, F., Franchini, M., Franco, O.H., Graham, I., Hoek, G., Hoffmann, B., Hoylaerts, M.F., Künzli, N., Mills, N., Pekkanen, J., Peters, A., Piepoli, M.F., Rajagopalan, S., Storey, R.F., 2014. Expert position paper on air pollution and cardiovascular disease. Eur. Heart J. doi:10.1093/eurheartj/ehu458

O'Brien, M., Jones, D., Sloan, D., Rustin, M., 2000. Children's Independent Spatial Mobility in the Urban Public Realm. Childhood 7, 257–277. doi:10.1177/0907568200007003002

Ogilvie, D., Foster, C.E., Rothnie, H., Cavill, N., Hamilton, V., Fitzsimons, C.F., Mutrie, N., on behalf of the Scottish Physical Activity Research, C., 2007. Interventions to promote walking: systematic review. doi:10.1136/bmj.39198.722720.BE

Olsson, D., Mogren, I., Forsberg, B., 2013. Air pollution exposure in early pregnancy and adverse pregnancy outcomes: a register-based cohort study. BMJ Open 3. doi:10.1136/bmjopen-2012-001955

Panter, J., Corder, K., Griffin, S.J., Jones, A.P., 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. Int. J. Behav. Nutr. Phys. Act. 10. doi:10.1186/1479-5868-10-83

Panter, J., Jones, A., van Sluijs, E., 2008. Environmental determinants of active travel in youth: A review and framework for future research. Int. J. Behav. Nutr. Phys. Act. 5, 34.

Pedersen, M., Giorgis-Allemand, L., Bernard, C., Aguilera, I., Andersen, A.-M.N., Ballester, F., Beelen, R.M.J., Chatzi, L., Cirach, M., Danileviciute, A., Dedele, A., Eijsden, M. van, Estarlich, M., Fernández-Somoano, A., Fernández, M.F., Forastiere, F., Gehring, U., Grazuleviciene, R., Gruzieva, O., Heude, B., Hoek, G., Hoogh, K. de, van den Hooven, E.H., Håberg, S.E., Jaddoe, V.W. V, Klümper, C., Korek, M., Krämer, U., Lerchundi, A., Lepeule, J., Nafstad, P., Nystad, W., Patelarou, E., Porta, D., Postma, D., Raaschou-Nielsen, O., Rudnai, P., Sunyer, J., Stephanou, E., Sørensen, M., Thiering, E., Tuffnell, D., Varró, M.J., Vrijkotte, T.G.M., Wijga, A., Wilhelm, M., Wright, J., Nieuwenhuijsen, M.J., Pershagen, G., Brunekreef, B., Kogevinas, M., Slama, R., 2013. Ambient air pollution and low birthweight: a European cohort study (ESCAPE). Lancet Respir. Med. 1, 695–704. doi:http://dx.doi.org/10.1016/S2213-2600(13)70192-9

Pope, C., Ziebland, S., Mays, N., 2000. Analysing qualitative data. BMJ 320, 114–116. doi:10.1136/bmj.320.7227.114

Porta, D., Narduzzi, S., Badaloni, C., Bucci, S., Cesaroni, G., Colelli, V., Davoli, M., Sunyer, J., Zirro, E., Schwartz, J., Forastiere, F., 2015. Air pollution and cognitive development at age seven in a prospective Italian birth cohort. Epidemiology. doi:10.1097/ede.0000000000000405

Prezza, M., Pilloni, S., Morabito, C., Sersante, C., Alparone, F.R., Giuliani, M.V., 2001. The influence of psychosocial and environmental factors on children's independent mobility and relationship to peer frequentation. J. Community Appl. Soc. Psychol. 11, 435–450. doi:10.1002/casp.643

Ritchie, J., Lewis, J., 2003. Qualitative Research Practice: A Guide for Social Science Students and Researchers. Qual. Res. 356. doi:10.4135/9781452230108

Ritchie, J., Spencer, L., 1994. Qualitative data analysis for applied policy research, in: Bryman, A., Burgess, R.G. (Eds.), Analyzing Qualitative Data. pp. 173–194.

Royal College of Physicians, 2016. Every breath we take: the lifelong impact of air pollution. Report of a working party. London.

Shah, A.S., Lee, K.K., McAllister, D.A., Hunter, A., Nair, H., Whiteley, W., Langrish, J.P., Newby, D.E., Mills, N.L., 2015. Short term exposure to air pollution and stroke: systematic review and meta-analysis. BMJ 350, h1295. doi:10.1136/bmj.h1295 10.1136/bmj.h1295.

Shaw, B., Bicket, M., Elliott, B., Fagan-Watson, B., Mocca, E., Hillman, M., 2015. Children's Independent Mobility: an international comparison and recommendations for action (RPRT). Policy Studies Institute, London.

Sport England, 2015. Active People Survey 8.

Spotswood, F., Chatterton, T., Tapp, A., Williams, D., 2015. Analysing cycling as a social practice: An empirical grounding for behaviour change. Transp. Res. Part F Traffic Psychol. Behav. 29, 22–33. doi:http://dx.doi.org/10.1016/j.trf.2014.12.001

Stewart, O., 2011. Findings from Research on Active Transportation to School and Implications for Safe Routes to School Programs. J. Plan. Lit. 26, 127–150. doi:10.1177/0885412210385911

Su, J.G., Jerrett, M., McConnell, R., Berhane, K., Dunton, G., Shankardass, K., Reynolds, K., Chang, R., Wolch, J., 2013. Factors influencing whether children walk to school. Health Place 22, 153–161. doi:http://dx.doi.org/10.1016/j.healthplace.2013.03.011

Sunyer, J., Esnaola, M., Alvarez-Pedrerol, M., Forns, J., Rivas, I., López-Vicente, M., Suades-González, E., Foraster, M., Garcia-Esteban, R., Basagaña, X., Viana, M., Cirach, M., Moreno, T., Alastuey, A., Sebastian-Galles, N., Nieuwenhuijsen, M., Querol, X., 2015. Association between Traffic-Related Air Pollution in Schools and Cognitive Development in Primary School Children: A Prospective Cohort Study. PLoS Med. 12, e1001792. doi:10.1371/journal.pmed.1001792

Timperio, A., Ball, K., Salmon, J., Roberts, R., Giles-Corti, B., Simmons, D., Baur, L.A., Crawford, D., 2006. Personal, Family, Social, and Environmental Correlates of Active Commuting to School. Am. J. Prev. Med. 30, 45–51. doi:http://dx.doi.org/10.1016/j.amepre.2005.08.047

van Sluijs, E.M.F., Fearne, V.A., Mattocks, C., Riddoch, C., Griffin, S.J., Ness, A., 2009. The contribution of active travel to children's physical activity levels: Cross-sectional results from the ALSPAC study. Prev. Med. (Baltim). 48, 519–524.

doi:http://dx.doi.org/10.1016/j.ypmed.2009.03.002

Walker Fairburn, J., Smith, G., Gordon, M., G., 2003. Environmental Quality and Social Deprivation (RPRT), R&D Technical Report E2-067/1/TR. Environment Agency, Bristol.

Woodcock, J., Edwards, P., Tonne, C., Armstrong, B.G., Ashiru, O., Banister, D., Beevers, S., Chalabi, Z., Chowdhury, Z., Cohen, A., 2009. Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport. Lancet 374, 1930–1943.

World Health Organization, 2010. Global recommendations on physical activity for health (RPRT). Switzerland.

Yang, L., Panter, J., Griffin, S.J., Ogilvie, D., 2012. Associations between active commuting and physical activity in working adults: Cross-sectional results from the Commuting and Health in Cambridge study. Prev. Med. (Baltim). 55, 453–457. doi:http://dx.doi.org/10.1016/j.ypmed.2012.08.019

Yeung, J., Wearing, S., Hills, A.P., 2008. Child transport practices and perceived barriers in active commuting to school. Transp. Res. Part A Policy Pract. 42, 895–900. doi:http://dx.doi.org/10.1016/j.tra.2007.12.007

Zhu, X., Lee, C., 2009. Correlates of Walking to School and Implications for Public Policies: Survey Results from Parents of Elementary School Children in Austin, Texas. J Public Heal. Pol 30, S177–S202.

Zuniga, K.D., 2012. From barrier elimination to barrier negotiation: A qualitative study of parents' attitudes about active travel for elementary school trips. Transp. Policy 20, 75–81. doi:http://dx.doi.org/10.1016/j.tranpol.2011.12.003

Figure Legends

Figure 1. Theoretical Domains Framework: domains and and content

Figure 2. Areas covered by interview topic guide with example questions

Figure 3. Conceptual framework of school travel, including barriers and facilitators to AST

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TDF Domain	Areas for exploration
Knowledge	• Does the individual know that they should be doing x? • Do they know why they should be doing x? • Do they know what x involves?
Skills	• Does the individual have the required skills to do x? • How easy/difficult is it for them to do x?
Social/professional role and identity	• Does the individual think *they* should do x? • Does it conflict with their professional/social identity?
Beliefs about capabilities	• How easy it for the individual to do x? (capabilities/external constraints) • What problems have they encountered? • How confident are they that they can do x, despite problems? • How capable are they of maintaining the behaviour?
Beliefs about consequences	• What do individuals think will happen if they do/do not do x? • What impact do they think this might this have? • Do the benefits outweigh the costs? • How will they feel if they do/don't do x?
Motivation and goals	• How much do individuals want to do x? • How much do they feel they need to do x? • Are there things they want to do/achieve that might interfere with x? • Are there incentives to do x?
Memory, attention and decision processes	• Is x something that the individual usually does? • Will they think/remember to do x? • Might they decide not to do x and why?
Environmental context of resources	• To what extent do physical or resource factors facilitate or hinder x? • Are there competing tasks and time constraints? • Are the necessary resources available to the individual?
Social influences	• To what extent do social influences facilitate or hinder x? • Does the individual observe others doing x?
Emotion	• Does doing x evoke an emotional response from the individual? • To what extent do emotional factors facilitate or hinder x?
Behavioural regulation	• What preparatory steps are needed to do x? • Are there things individuals can do that encourage x?
Nature of the behaviour	• What is the behaviour (x) and who needs to do what differently? • What does the individual currently do? • Is this a new behaviour or an existing behaviour that needs to become a habit? • Can the context be used to prompt the new behaviour?

Topic areas	**Example questions**
General	• *How does your child generally get to school? Are they accompanied by an adult for any portion of the journey? Who accompanies them? At what age did your child start making the journey without an adult?*
Knowledge	• *Why might it be important for children to walk or cycle to school? Do you know the quickest/safest route for your child to walk/cycle to school? Can you describe the route?*
Skills	• *How easy or difficult do you find it to walk your child to school/cycle with your child/ encourage your child to walk/cycle to school? Can you/ your child ride a bike? Do you/ does your partner drive?*
Social/professional role and identity	• *To what extent do you feel it is your/ a parent's responsibility to walk your/a child to school / encourage your/ a child to walk/cycle to school?*
Beliefs about capabilities	• *How confident are you that you can walk/cycle with your child to and from school/ that your child can safely walk/cycle to and from school?*
Beliefs about consequences	• *What do you think will happen if your child walks/cycles to school? What might the benefits be to walking/cycling to school? What might the negatives be of walking/cycling to school?*
Motivation and goals	• *How important is it to you that your child walk or cycle to school? Do you think the benefits of walking/cycling to school are worth the effort? Are there any incentives to you/your child?*
Memory, attention and decision processes	• *Is there anything that might make you consciously decide not / to let your child walk/cycle to school?*
Environmental context of resources	• *Are there any factors in your local area/at home/ in your day to day life that help or hinder your child walking or cycling to school? Does your child own a bike? Do you have access to a car?*
Social influences	• *What do your friends / family members think about children walking or cycling to school? Do they do it themselves with their own children? How do you think most children at your child's school get to and from school?*
Emotion	• *How do you feel about your child walking or cycling to school? When you think about your child walking or cycling to school without an adult, how do you feel?*
Behavioural regulation	• *What things do you need to prepare so that your child can walk/cycle to school? What other things make it easy or difficult for your child to walk/cycle to school?*
Nature of the behaviour	• *Have you ever walked your child to school before / Has your child ever walked/cycled to school before? What was your experience of this? Does your child travel in the same way every day?*

Theme	TDF Domain	Quotes
1. Complexity of school travel choices	a. Nature of behaviour	**i. Variability of travel:** *Mainly I walk but if she wants to come to breakfast club her dad…drops her off* (01) *…so the days that I work I'll take her to school and straight from school I need to shoot straight off* (05) *…if she stays at my mum's house she walks to school…* (14)
2. Knowledge, beliefs and motivation around AST	b. Knowledge	**i. Benefits of active travel:** *we want him to be more active… so we do prefer him to walk (04) It's good exercise…It's good for the child's health as well (07)* **ii. Routes to school:** *If we do walk we'll take side roads as far as possible as they're quieter (20) The longest way is more safer than the quickest way (04) there's always a lot of people from the school walking up and down at that sort of time and obviously the traffic is quite busy so there's a lot of people witnessing them and I tell them to keep to the main road rather than the short cuts* (15) **iii. Air quality issues:** *I think it is concerning but I don't feel that I know a lot about it to sort of comment much on it* (19) *Obviously I know it's bad cause it is isn't it? But I don't really think about it to be honest!* (10) **iv. Unsure of infrastructure:** *Don't know about cycling to school cause I'm just thinking about where would they park the bike – that would be an issue… I don't think so I've never seen one…I've never looked into it* (06)
	c. Beliefs about consequences	**i. Benefits of active travel:** *I want her to walk because it's good for her really cause at home she just gets the iPad or just watches cartoons (01) I think it wakes them up! Bit of fresh air, and walking…I'm sure it does something for your mental state (05) Well sociable as well, they meet other people on the road, independence, financial implications for us as a family, health benefits (15)* **ii. Concerns about safety:** *…so it's a bit dangerous you see* (01) *I'd rather him not cycle to school because there's so many dangerous roads for him to cross* (03) *You think they're not going to be safe.* (07) *If she was on her own someone might jump her or someone might take her cause there's so many stories about now isn't there?* (11) **iii. Positive attitude:** *I'd prefer to walk really but I find the bus a lot more convenient* (03) *I feel more positive about walking* (12) *I think positively about it if it was doable* (13) *It's quite important to me because I like them to be active* (16)

	d. Motivation and goals	i. **Transition to independent travel:** *Well we've spoke about it and we've both said that when she gets to year 6 I might try it but I've said might, I'm still not sure* (05) *Yeah, maybe in high school but not this school!* (11) *I wouldn't let her walk on her own just yet – I will when she's older.* (14) ii. **Independence as a goal:** *In a way if you start sending them they learn how to deal with the problems as well.* (08) *Yeah it's a recent thing… she was given a little more independence ready for when she goes to high school* (15) *she's going to be moving onto high school and I'm not going to be able to take her to school I feel she needs her independence, she needs to be able to manage roads* (16)
	e. Emotion	iii. **Fear and worry:** *Well if she's with me I'm alright, but if I think about her going out alone by herself it's a bit scary!* (01) *I'm already worrying - how are we gonna manage when she goes to a different school* (07) *Just scared. I wouldn't want them to go by themself.* (08)
3. Actual and perceived capability to engage in AST	f. Skills	i. **Children's road/personal safety skills:** *Crossing roads on his own and general street danger awareness, and if he walked he's got to go through a park on his own so there's lots of things* (03) *I don't think she can cross this main road at the bottom on her own even though there's a lollipop person down at the bottom of the road I still wouldn't cause I don't think she's really got that concept yet of crossing the road properly so I'm still showing her* (06) *I'm just not sure they would be able to get there safely without me. I'd worry about them crossing the roads – they can still be a bit silly.* (20) ii. **Children's cycling skills:** *…she might find it a bit difficult with the bike and trying to cross the road with it and she'd have to be shown a couple of times before she did it on her own* (11) *where we are to where the school is you have to go up quite a big hill so she'd struggle to walk that let alone cycle – she's quite a confident biker but no way could she bike it* (13) *…in terms of my daughter I wouldn't want her cycling to school just because she's a bit unsteady* (14)
	g. Beliefs about capabilities	i. **Beliefs about child's capabilities:** *No she's not confident no because when she walks she holds my hands you see so I don't think she'd be that confident* (01) *she has got*

		the skills but I think she needs to be a little bit more confident (05) *Even they're so confident. But still I'm not sure cause there's so much traffic in a morning, people driving crazy, I don't trust my child to take bike so far.* (08) ii. **Lack of perceived behavioural control:** *I think it's a luxury if you can take your own child to and from school every day so in an ideal world that would be me and I think it's important for it to be more but it's out of my control* (13) *so if I had to walk from my house to school it would take 40 minutes, 40 minutes back and then I'd have to get to work, and I'm pushing it anyway to be honest with you as school starts at quarter to nine* (14) *Because we need childcare from 8 o clock cause we both start work at 8 o clock and school doesn't start till 9 0 clock so the only option was childcare* (15)
4. Parent's role in school travel and support from others	h. Social role and identity	i. **Parental role:** *100% yep, it's my responsibility to make sure they get a good education, they get to school safe and they get back home safe…* (02) *I think yeah its parents job to get their kids to school and safely* (11) ii. **Monitoring role:** *Yeah I see her off because she doesn't have her own key, make sure she's in school* (06) *…I talk to her on phone all the way there, as soon as she leaves the house till she meets up and then in-between and then I ring her and make sure she's in the school grounds* (10) *I do follow her down so I'm watching her wherever she goes* (11)
	i. Social influences	i. **Social support:** *No, my mum walks her* (14) *Well the eldest daughter has a set routine cause of college so she helps out in the house so she does a set day and the other days are the child minder so we take them to the child minder and then go onto work. So the child minder actually walks them to school* (15) *I tend to drive the girls to the child minder because I have to go to work after I drop them off so it's just easier* (16) ii. **Social norms:** *Some of the them drive and some walk* (02) *It's very rare you see a bike* (06) *Most of them walk….Yeah, most of them walk* (08) *I think it's probably a mixture really* (15) *And do you have any idea whether any children do currently cycle to school? I don't think any of them do* (16)

5. Environmental and policy influences	j. Environmental context	**i. Distance:** *we live local and no point bringing them in the car* (01) *I think we're just a bit too far to be honest It'd be over half an hour walking* (20) **ii. Time constraints and multiple trips:** *It is purely distance and also time because I've got to work and so if I'm dropping off before work I've got to then get my son to the child-minder's after dropping her off* (13) *…the school is in-between work and my mums house so it makes sense to drive and then go to work* (14) *cause we both start work at 8 o'clock and school doesn't start till 9 o'clock so the only option was childcare* (15) **iii. Traffic:** *because cause 9 o'clock it's just too, too busy down there, cars are coming in and doing turns… some cars don't even indicate so you don't know if they're going to turn left or right* (06) *The traffic's just awful at that time, and the way some people drive…* (20) *Well the side roads – there's a lot of cars parked there on the main road off the sort of main road, they're parked everywhere really* (01) **iv. Supportive infrastructure:** *but there's a lollipop man at the traffic lights and he presses the light and lets them across, so if he was all the way here I know he'd be crossing over safely* (02) *…they recently put it zebra crossing. There wasn't one before. Oh and that's helped? Yeah, a lot.* (07) *it's not a very cycle friendly area, it's not too far from a main road, there's no pavements and the roads are quite busy and narrow* (13) *yeah because there isn't any storage for bikes at the school* (16) **v. Weather and resources:** *so my intentions always there and the only thing that will ever dent it is my knee or the weather but I pretty much see it through if I say I'm going to do it then I'll do it* (05) *When it's raining, when we are late, when it's like the weather is at the worst… we used to take taxi for her* (12) *I just think the weather doesn't matter as long as you're wearing the right clothes but I think people don't think it's as important as probably what it should be and if they've got the day off then they might casually walk to school if the weather is fine but otherwise it's kind of always a car thing* (13) *No, and if people aren't working then they will generally walk their children to school if the weather is nice* (14) *if it is tipping it down we might use the car but 9 times out of 10 we walk up anyway* (16)

Table 1 Results of Framework Analysis with quotes to illustrate the domains from the Theoretical Domains Framework

Outcome	Barriers	Facilitators
Adult escorted AST	*Distance:* • *living >20 minutes from school* *Time saving and incorporating multiple trips:* • *work/school hours conflict* • *incorporating work commute* • *children at different schools* • *after school activities* • *changes to routine (eg. appointments)*	*Distance:* • *living in close proximity to school* *Parking around school* *Social support* • *another adult/older sibling to accompany child*
Unescorted AST	*Traffic en route* • *busy roads* • *dangerous driving* *Parking around school* *Perception that child lacks road safety skills* *Concerns about safety* *Fear and worry*	*Confidence in child's ability* *Goal to develop child's independence* *Route includes staffed crossings* *Social support (peers)* • *peers/friends to accompany child*
Cycling to school	*Traffic en route* • *busy roads* • *dangerous driving* *Perception that child lacks cycling skills and/or stamina* *Concerns about safety* *Fear and worry* *Lack of supportive infrastructure*	*Confidence in child's ability* *Route accommodates cycling* *Appropriate cycle storage at school*
Mediators		
	Bad weather and: • *access to a vehicle* • *lack of appropriate outdoor clothing*	*Good weather and:* • *time and opportunity*

Table 2 Parent reported barriers and facilitators to active school travel

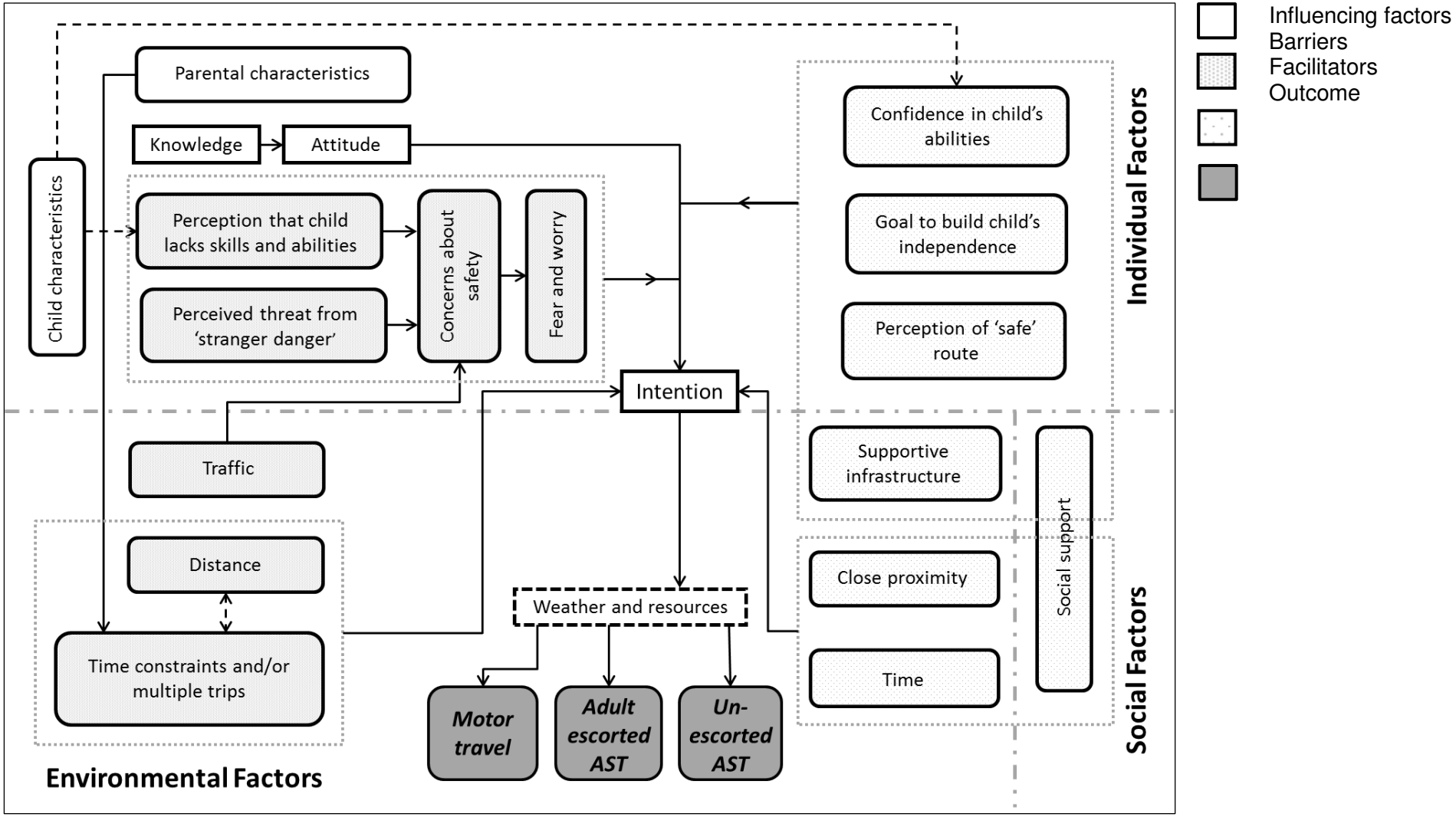

Figure 3 Conceptual framework of school travel, including barriers and facilitators to active school travel