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Factors influencing travel mode choice among families with young children (aged 0–4): a review of the literature

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ABSTRACT

Life events, such as the birth of a child, disrupt habitual travel behaviour and provide a valuable opportunity to influence the adoption of sustainable transport practices. However, in order for sustainable travel practices to be adopted, an understanding is required of the factors that influence travel mode choice among families with young children. Research in this field is particularly timely given many in the millennial generation, a comparably large cohort, are approaching this life stage. This comprehensive literature review develops a framework of factors influencing travel mode choice among families with young children. The findings reveal a multitude of factors influence decisions about mode choice, and, in particular, encourage travel by car, when travelling with young children. The paper concludes with an agenda for future research about travel among families with young children, a largely overlooked group of transport users.

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Young children's travel; travel behaviour change; life events; parenthood; car dependence; public transport

1. Introduction

While the private car has made great advances in personal mobility possible, high levels of car use have created a myriad of societal problems, ranging from rises in obesity (Anderson & Butcher, 2006; Frank, Andresen, & Schmid, 2004) and social inequities (Currie et al., 2010; Mackett, 2014) to increasing congestion (Hymel, 2009; Stradling, Meadows, & Beatty, 2000) and environmental degradation (Banister, Anderton, Bonilla, Givoni, & Schwanen, 2011; Fenger, 1999). To mitigate these problems, approaches to change travel behaviour to reduce car use are urgently sought (Chapman, 2007). Life events, such as a change in life stage, disrupt habitual behaviour and provide a valuable opportunity to influence the adoption of sustainable transport modes (Beige & Axhausen, 2012; Clark, Chatterjee, Melia, Knies, & Laurie, 2014; Verplanken & Wood, 2006). The life event of childbirth is one such occasion during which changes to habitual travel practices occur.

Although car dependency tends to increase among families with young children (Klößner, 2004; Prillwitz, Harms, & Lanzendorf, 2006; Ryley, 2006), there is increasing reason to

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think that car use can be reduced among this group. Recent research highlights a diverse set of mobility practices among families with young children in more developed nations (Lanzendorf, 2010; McLaren, 2016; Schwanen, 2011). This indicates that, at least in certain environments, it is feasible for less car-orientated travel practices to be adopted by families with young children. Furthermore, while private cars provide an important means of accessing activities and services for families with young children, high levels of car use create significant ongoing financial burdens (Currie & Senbergs, 2007; Dodson & Sipe, 2007; Mattioli, Lucas, & Marsden, 2016) and can contribute to worsening health outcomes (Beavis & Moodie, 2014; Douglas, Watkins, Gorman, & Higgins, 2011; Mackett, 2002, 2014).

The detrimental health and economic consequences of high levels of car use, as well as a large cohort of millennials on the cusp of embedding new mobility practices (Delbosc, 2016; Delbosc & Nakanishi, 2017), provide good reasons to want to encourage sustainable travel habits among families with young children. While an extensive body of literature has examined travel habits of school-age children and their families (Buliung, Mitra, & Faulkner, 2009; Faulkner, Buliung, Flora, & Fusco, 2009; Fyhri, Hjorthol, Mackett, Fotel, & Kytta, 2011; Larsen et al., 2009; McDonald, 2007; McMillan, 2007), this literature does not focus on the valuable opportunity presented by the disruption to household travel habits resulting from the birth of a child.

Young children (aged 0–4) have specific travel needs which can affect parental mode choices. In order to encourage the adoption of sustainable travel practices during the transition to parenthood, we need to understand what factors influence mode choice when young children are present. Furthermore, we need to understand the feasibility and implications of reducing car use among families with young children. This paper aims to consider these two matters and develops a framework of factors influencing mode choice among families with young children. It does this by synthesising the results of a comprehensive literature review on the travel behaviour of families with young children.

After setting out the literature search methodology, this paper goes on to discuss the implications of reducing car use among this household group. Next, the factors that influence mode choice for adults travelling with young children are outlined. This is followed by a discussion of how the factors that prove a barrier to travelling by alternative modes might be best addressed through policy or infrastructure changes. Finally, an agenda for future research regarding travel among families with young children is suggested.

2. Search methods

In August 2016,¹ a literature search was conducted to retrieve records that examine the travel patterns of young children or provide findings relating to the factors which influence mode choice among families with young children. Young children are defined in this paper as aged between 0 and 4. A search was conducted in Compendex, Scopus, TRID, Web of Science and World Transit Research databases, for records published within the previous two decades, using the following two search strings:

- (a) small child* OR young child OR preschool age OR preschool age OR preschooler OR toddler OR baby*

AND

(b) active trans* OR walking OR cycling OR car OR public trans* OR train OR tram OR bus OR travel OR mobility.

A record was retrieved if at least one term from each of the two search strings appeared in either the title or abstract.

A large number of research papers were retrieved (6695). All duplicate records were removed (1123). A large number of records were excluded which related to: car seat practices and policies; children's traffic safety; school-age children's active travel; children's independent mobility; and the development of mobility aids for children with disabilities. The titles and abstracts of records were screened, and records were included if they met the following criteria:

- Published, in English, between September 1996 and April 2017;
- The study participants included children aged between 0 and 4, or, parents or guardians of children aged between 0 and 4 (studies that encompassed participants aged between 0 and 4 and older children were also included);
- The study explored either mode use of young children or provided some relevant findings relating to factors which influence mode choice among families with young children.

At the conclusion of the screening process, 28 records remained. Due to the low number of relevant records retrieved, a further search was undertaken, involving reviewing the citations and references of the selected 28 records. A further 10 records were retrieved. At the conclusion of these searches, 39 records were evaluated. After evaluating each of the 39 records, 28 records² were deemed to meet the inclusion criteria.³

Only two papers specifically examined the travel patterns of young children and no papers examine the factors which influence mode choice among families with young children. The limited number of relevant records examining young children's travel raises a number of questions. Given the vast body of literature on school-age children's travel, why is there so little research on young children's travel and, in particular, factors influencing mode choice? The next section explores the implications of reducing car use among families with young children. This is followed by the literature search findings regarding the factors influencing mode choice among families with young children.

3. Travel behaviour of young children and their families

3.1. Car use among families with young children

Households with young children face a number of spatial and time constraints in meeting their travel needs (Dowling, 2015; Schwanen, 2011; Wheatley, 2014). Accommodating childcare, employment and household responsibilities can restrict the time available for parents to meet their own and their child's travel demands (Dowling, 2015). Family style housing tends to be located in outer urban areas where activities and workplaces are dispersed over greater distances. These constraints to mobility practices of families with young children mean policies restricting car use, such as work-place parking constraints, can exacerbate levels of stress in dual-earner households, particularly for women (Wheatley, 2014).

Moreover, research examining the experience of parents on low-incomes, living in auto-orientated areas with no or limited access to cars, highlights the importance of cars to maintaining a child's health and well-being (Bostock, 2001; Fritze, 2007; McCray, 2000). Not only do children from low-income households have fewer trips for sports and recreation activities (McDonald, 2006), they also forgo trips to healthcare and social services (Fritze, 2007; McCray, 2000). Compared to adult's travel for work, children's trips, such as for recreation and sports, may be considered a lesser priority. In responding to car restriction measures, parents may well reduce car trips of this nature. If no alternative transport modes are available, the inability to partake in these activities will likely have a detrimental impact on a child's health and well-being.

Nevertheless, high levels of car use among households with young children can have detrimental health and economic consequences for families with young children. Purchasing a private car to manage the travel needs of an expanding household can create an ongoing financial burden (Dodson & Sipe, 2007; Mattioli, Lucas, et al., 2016). Car-dependent parents and children lose opportunities to gain incidental physical activity, otherwise gained through active travel contributing, to worsening health outcomes (Anderson & Butcher, 2006; Frank et al., 2004). Young children lose opportunities to cultivate independent travel habits with corresponding impacts on their overall health and well-being (Fyhri et al., 2011; Mackett, 2002; Mackett, Lucas, Paskins, & Turbin, 2005).

Furthermore, households with young children form a sizeable population group. In Australia, for instance, 13% of households are home to at least one dependent child aged 0–4 (ABS, 2013). If households are able to maintain sustainable travel behaviour during early child-rearing years, when constraints to using alternative modes with children are often the greatest, they are more likely to retain this behaviour as their children age. Changing travel behaviour among this group, then, could have a significant long-term impact on reducing the negative externalities associated with high levels of car use.

These considerations suggest that while cars provide important mobility benefits to families with young children, high levels of car use can also be seen as problematic. However, generalised approaches to restrain car use must be used cautiously as they may disproportionately burden this household group (Wheatley, 2014). Instead, removing barriers to using public and active transport for adults with young children will help make travel by these modes more attractive. In order to remove barriers to using alternative modes, an understanding of the factors that influence travel mode choice when young children are present is required. The next part of this section turns attention to this topic.

3.2. What factors influence mode choice among families with young children?

A range of literature has provided findings regarding factors which influence mode choice among families with young children. This reveals a multitude of factors that influence decisions about mode choice, and, in particular, encourage travel by car, when travelling with young children. A thematic analysis of the findings was conducted and the factors influencing mode choice were broadly grouped into four categories: (1) structural (built environment, transport infrastructure, transport operations and policy); (2) psychosocial (attitudes, social norms, intentions and perceptions); (3) household characteristics; and (4) features of young children's travel. The literature derives primarily from Europe, North America, and Australia. With the exception of several European countries that

have a strong cycling culture, the countries have a primarily auto-orientated transport system (Pucher & Buehler, 2008).

Table 1 helps create a preliminary view of factors that influence mode choice when travelling with young children. Determining the relative significance of each factor, and differences in how individuals may respond to each factor, is difficult and beyond the scope of this paper. For instance, extensive bodies of literature have examined differences in travel by characteristics such as gender (Hanson, 2010; Rosenbloom, 1993), immigration status (Blumenberg, 2009; Chatman & Klein, 2009) and income (Dargay, 2001; Pucher & Renne, 2003). These differences are likely to carry through to how individuals travel with young children. In

Table 1. Preliminary framework of factors influencing mode choice when travelling with young children.

Factors	Evidence	Hypothesised impact on mode choice			
		Active transport	Public transport	Ride source/ share car	Private car
<i>Structural</i>					
Inadequate or non-existent cycling infrastructure	[1, 14]	–	+	+	+
Poor quality or non-existent pedestrian infrastructure	[2, 3]	–	–	–/+	+
Physically inaccessible public transport	[4, 5]	+	–	+	+
Infrequent or indirect services	[6]	+	–	+	+
Requirement to collapse pram/pushchair	[7, 4]	+	–	+	+
Low density, single land-use	[5, 8]	–	–	–	+
Increasing travel distances	[9, 10]	–	–	?	+
High traffic speeds	[11]	–	–	+	+
Actual costs of transport	[3, 11]	+	–	–	–
Car share vehicle equipped with car seat	[13]	–	–	–/+	–
Car parking constraints	[14]	+	–/+	?	–
<i>Psychosocial</i>					
Perceptions of “good parenting”	[15]	–	–	?	+
Social norms of auto-ownership and parenthood	[16]	–	–	–	+
Perceived high costs of travel by public transport	[17]	+	–	?	+
Motivation to reduce car dependency	[5, 18]	+	+	?	–
Negative perceptions of walking	[19]	–	– / +	+	+
Perceptions of safety	[20]	–	–	?	+
<i>Household characteristics</i>					
Increasing car ownership	[21]	–	–	–	+
Increasing income	[21]	–	–	–	+
Dual-income households	[22]	–	–	–	+
Number of dependent children	[23, 24]	–	–	–	+
Recent immigrant	[25]	+	?	?	?
<i>Characteristics of travel with young children</i>					
Carrying child-related equipment	[17, 26]	–	– / ?	+	+
Ability for child to explore local environment	[11, 26]	+	+	–	–
Ability to attend to child while travelling	[17, 27]	+	+	–	–
Developing physical capability to walk or cycle long distances	[26, 28]	–	–	?	+

Note: 1 (Gaffga & Hagemester, 2016); 2 (Andrews et al., 2014); 3 (Bostock, 2001); 4 (Fritze, 2007); 5 (McLaren, 2016); 6 (McCray, 2000); 7 (Dols, Pons, Alcalá, Valles, & Martín, 2013); 8 (Guthrie & Fan, 2016); 9 (Caroli et al., 2011); 10 (Oxford & Pollock, 2015); 11 (Pooley et al., 2014); 12 (Rubin et al., 2014); 13 (Dowling, 2015); 14 (Thomas, 2016); 15 (Dowling, 2000); 16 (Sattlegger & Rau, 2016); 17 (Price & Matthews, 2013); 18 (Lanzendorf, 2010); 19 (Currie, Gray, Shepherd, & McInnes, 2016); 20 (Bean, Kearns, & Collins, 2008); 21 (McDonald, 2006); 22 (Wheatley, 2014); 23 (McQuaid & Chen, 2012); 24 (Scheiner, 2014); 25 (Rothman et al., 2016); 26 (Birken et al., 2015); 27 (Taubman-Ben-Ari & Noy, 2011); 28 (Zwerts, Janssens, & Wets, 2008).

Symbols: –, negative impact on mode; +, positive impact on mode; –/+, neutral impact on mode; ?, unknown. Source: Author’s synthesis.

particular, as women tend to carry out the majority of childcare in developed nations (OECD, 2016), features particular to women's travel are likely to exert a greater influence on young children's travel patterns. Moreover, many differences between the studies and the location in which they were undertaken make comparability difficult. Nevertheless, overall, it is clear that most factors favour private car and discourage public transport use.

3.2.1. Structural factors

Mixed-use, medium- and high-density built environments with good quality active and public transport infrastructure are widely acknowledged to encourage travel by sustainable transport modes (Buehler, Pucher, Gerike, & Götschi, 2017; Ewing & Cervero, 2010). Unsurprisingly then, several studies associated greater travel distances, low-density residential housing or poor quality pedestrian and cycling infrastructure with increasing car orientation of young children (Andrews, Rich, Stockdale, & Shelley, 2014; Caroli et al., 2011; Oxford & Pollock, 2015). Inadequacies of public transport infrastructure, such as lack of step-free access (Fritze, 2007; Lanzendorf, 2010), and operations, such as infrequent and indirect services (McCray, 2000), deter use when travelling with young children. Cycles and cycle equipment designed for travelling with children, such as adult tricycles and bike trailers, are often accommodated poorly in cycling infrastructure. Cycle ways that are too narrow, or include tight turns and bollards, are difficult to negotiate with the wider width characteristic of these types of cycles (Gaffga & Hagemeister, 2016). Poorly kept or non-existent footpaths and pedestrian crossings, as well as levels of traffic noise and high traffic speeds, make walking with young children relatively unattractive and, often, unsafe (Andrews et al., 2014; Pooley et al., 2014).

Nonetheless, despite the inadequacies of cycling infrastructure, a recent qualitative study examining use of electric assisted bicycles by parents with young children emphasises the advantages this mode presents in densely populated urban environments (Thomas, 2016). The convenience provided by the e-bike, particularly in terms of ease of parking, was the main motivation for parents to choose this mode over available alternatives.

Although policies regarding child transit ticketing are not specifically discussed in the literature, several studies identified cost as a barrier to using public transport, particularly when travelling as a family group. The high cost can result in forgoing trips (Fritze, 2007; McCray, 2000) and make travel by private car more attractive, particularly when travelling as a family group (McLaren, 2016; Price & Matthews, 2013; Rubin, Mulder, & Bertolini, 2014).

A further factor not specifically discussed in the literature is the ability to use alternatives to conventional car ownership. Car-sharing and ride sourcing (for instance, Uber or Lyft) schemes tend to be located in dense inner-urban areas restricting access to them to those who live within close proximity of a car share. Furthermore, car seats are only included in some vehicles of car-sharing fleets (Dowling, 2015) and, in most jurisdictions, are not required in ride sourcing vehicles. Even when a car share or ride sourcing vehicle is in close proximity, the lack of a car seat may be a further barrier to use.

3.2.2. Psychosocial factors

While structural constraints influence parental mode choice, psychosocial factors also play an influential role (Andrews et al., 2014; Mattioli, Anable, & Vrotsou, 2016; Sattlegger & Rau, 2016). Sattlegger and Rau (2016), in a study examining the motivations of carless households in Europe, show that the parents of young children who choose to be carless in car dominant settings felt social norms associated with parental car use meant their decision

was viewed negatively by their peers (Sattlegger & Rau, 2016). Although psychosocial factors tend to influence mode choice in favour of the car, Lanzendorf (2010) in a qualitative retrospective survey of 20 parents of small children in Germany also shows some parents exerted a strong attachment to non-motorised transport, which they adapted to continue using with their young children (Lanzendorf, 2010).

Dowling (2000) demonstrates that in auto-orientated cities, cultures of good parenting are manifested through car use. Parents use cars as a means of safely transporting their child to destinations that best meet their needs and interests (Dowling, 2000). Nevertheless, in the nearly two decades since Dowling's influential paper on parental mobility, the negative aspects of car use – in particular, health implications and environmental costs – have entered mainstream discourse. Parents are increasingly reflecting on these negative aspects (Andrews et al., 2014; McLaren, 2016). The negative aspects of car use are, in fact, prompting some families to move away from conventional car-dependent suburban lifestyles to mixed-use locations where active transport can be readily incorporated into daily travel (McLaren, 2016). Nonetheless, McLaren (2016) highlights the precariousness of this change. While the intention to reduce car use is present, it is often impeded by inadequacies in urban design and alternatives to car use (McLaren, 2016).

3.2.3. Household characteristics

The number of dependent children in a household is associated with higher levels of car orientation (Scheiner, 2014; Taubman-Ben-Ari & Noy, 2011). Similarly, McDonald (2006), in a study of US national household travel data, demonstrates increases in household income and car ownership are associated with higher levels of car use by children. Compared with children from low-income households, children from households with higher incomes make more trips by car, in particular for sport and recreation (McDonald, 2006). Studies examining the experience of parents on low-incomes highlight that household income constraints mean that it is not only cars that are an unattainable mode of transport but, often, public transport too. In these situations, walking becomes the dominant form of transport. This creates barriers to accessing health and social services that perpetuate cycles of social disadvantage (Bostock, 2001; Fritze, 2007; McLaren, 2016).

The growth in dual-earner households has resulted in more families with young children accommodating both childcare responsibilities and employment demands within a standard working day. Cars are often considered the preferred mode of transport in order to successfully juggle these demands within time and spatial constraints (Wheatley, 2014). Declining active travel of school-age children has, in part, been attributed to a rise in time-poor dual-earner households (Dowling, 2015; Fyhri et al., 2011). However, not only are both parents increasingly likely to work but parents, in particular women, are taking shorter periods of parental leave. In Australia, for instance, the proportion of mothers in employment with a child less than a year old increased from just over a quarter in 1991 to nearly one in two in 2011 (Baxter, 2013). This suggests the pressures of managing these competing demands are occurring earlier in a family life cycle with corresponding impacts on young children's mode use.

3.2.4. Characteristics of travel with young children

Carrying additional child-related equipment can pose a challenge when accompanying a young child, especially when combined with carrying additional luggage or shopping

(Price & Matthews, 2013). Some other unique features of travelling with young children, not discussed in the literature, are likely to be relevant here too. For instance, the unpredictable nature of young children is more readily constrained when they are strapped in a car seat. The perceived disruption that a fractious child may cause other passengers may further deter adults from travelling with young children on public transport. Parents often have a strong preference to have immediate access to transport in case of a child's sickness or accident. This preference is most often met by access to a private car. Other factors can be drawn from the literature on school-age children's travel. All travel with young children is accompanied, alleviating many of the safety concerns that contribute to increasing car orientation of school-age children. Nevertheless, factors such as weather, while not discussed in the literature, are likely to influence young children's travel.

4. Addressing barriers to sustainable transport modes

The many factors, outlined in Table 1, help explain why car use dominates travel with young children. Structural factors such as poor access to affordable and accessible public transport or a lack of good quality active transport infrastructure facilitate an auto-mobile lifestyle, particularly in auto-orientated cities. These structural factors then reinforce psychosocial factors, such as social norms that strengthen the association between good parenting and auto-ownership.

Nevertheless, alternatives to car use and ownership, such as car-sharing schemes, are increasingly being marketed to families with young children as an alternative to purchasing a second, or even a first car (Dowling, 2015). Less car-orientated travel behaviour, evident in some millennials, suggests that, as this cohort approaches parenthood, a life stage long associated with increased car use, they may be more open to using alternatives to car use and ownership when travelling with their children, than previous generations (Guthrie & Fan, 2016; McDonald, 2015). For instance, Guthrie and Fan (2016) examine the likelihood of using public transport by certain household characteristics in a medium-sized, auto-orientated city in the US between 2000 and 2010. The authors note that during this period many millennials transitioned into child-rearing age and also extensive improvements were made to the city's public transport network. In 2000, adults in a household with a child under 6 were less likely than other adults to use public transport. By 2010, this household characteristic was no longer associated with an adult being less likely to use public transport (Guthrie & Fan, 2016). This suggests that a transition away from car dependency may be possible for families with young children.

Moreover, recent research reveals the emergence of more varied travel patterns among families with young children (Lanzendorf, 2010; McLaren, 2016) than is often recognised in transportation research. This highlights that in some environments it is feasible for families with young children to use sustainable transport modes. For instance, Lanzendorf (2010), in a qualitative retrospective survey of 20 parents of small children in Germany, shows car use increased for some parents following the birth of their child but decreased for others (Lanzendorf, 2010). McLaren (2016), examining parents' travel behaviour in Vancouver, demonstrates a diverse spectrum of mobility practices among families with young children ranging from auto-dependency through

to multimodality and reliance on alternatives to conventional car ownership, both voluntarily and involuntarily.

Similarly, turning attention to nations with strong cycling cultures, such as the Netherlands and Denmark, provides an insight into what is possible in other localities. In Copenhagen, for example, approximately a quarter of families with at least two children have a cargo bike (Colville-Andersen, 2011 cited in Pucher & Buehler, 2012). This demonstrates that sustainable modes can be a mainstream transport options for families with young children, where the environment is favourable.

Evidence that parental mobility practices are not universally car orientated indicates that some factors, influencing mode choice when travelling with children, can be influenced. Some factors, particularly many household characteristics, are outside the influence of transport planners and policy-makers. Nonetheless, as outlined in Table 2, many factors that discourage travel by public or active transport can conceivably be influenced through policy formation or infrastructure changes. For instance, Ho and Mulley (2013) highlight the opportunity to grow patronage of public transport among families with young children through family fares that accommodate a variety of family compositions (Ho & Mulley, 2013). Psychosocial factors, such as perceived disruptions young children may present to other public transit riders, could be addressed through marketing campaigns making it clear families with young children are welcome on public transport services.

Table 2. Barriers to sustainable transport modes.

	Factors that <i>can</i> be influenced	Factors that <i>could</i> be influenced	Factors that <i>can not</i> be influenced
Structural	Inadequate or non-existent cycling infrastructure Poor quality or non-existent pedestrian infrastructure Physically inaccessible public transport Infrequent or indirect services Requirement to collapse pram / pushchair Low density, single land-use Increasing travel distances High traffic speeds	Car share/ride source vehicle equipped with car seat	
Psychosocial	Perceived high costs of travel by public transport Perceptions of safety Perceived disruption that a fractious child may cause other passengers	Perceptions of “good parenting” Social norms of auto-ownership and parenthood Negative perceptions of walking	
Household characteristics			Increasing car ownership Increasing income Dual-income households Number of dependent children
Characteristics of travel with young children		Carrying child-related equipment Preference to have immediate access to transport in case of a child’s sickness or accident	Developing physical capability to walk or cycle long distances

Source: Author’s synthesis.

Table 3. Research gaps – travel among families with young children.

Research questions	Background	Research
What trends are occurring in young children's travel?	Exploring the modes that young children use will help reveal trends and variations by different household characteristics. However, young children are an under-researched group of transport users and little is known about their travel patterns (McDonald, 2006; Oxford & Pollock, 2015).	<ul style="list-style-type: none"> • Establish whether broader societal changes, such as the rise of dual-income households or increasing expectations for young children to partake in extra-curricular activities, are influencing young children's mode use. • Explore if variations exist in young children's travel by household characteristics, such as income, location or number of dependent children.
What barriers exist to the uptake of alternatives to conventional car ownership by families with young children?	Over the past decade or so alternatives to car use and ownership have grown into mainstream transport options (Shaheen, Cohen et al., 2009; Kent, 2014). Some alternatives, such as car sharing or e-bikes, would seem to provide a suitable transport alternative to acquiring a second car (Dowling, 2015; Thomas, 2016)) yet little is known about how they are being utilised by families with young children.	<ul style="list-style-type: none"> • Understand families with young children's use of new and emerging alternative transport options. • Examine whether the increase in cycling equipment for carrying children (such as cargo-bikes or bakfiets) together with improvements in cycling infrastructure can increase mode choice among this group. • Determine the affect alternative transport solutions have on parent's long-term mobility decisions, such as car ownership.
What other factors influence mode choice when travelling with young children?	This review has demonstrated the many constraints faced by carers travelling with young children. However, other factors, such as the need for safety and privacy when travelling on public transport, are not discussed in the literature yet are likely to influence mode choice.	<ul style="list-style-type: none"> • A fuller account of the range of factors that may influence parental mode choice when travelling with young children.
How does the travel modes used as a young child influence travel attitudes, habits and choices as an adult?	Research examining the travel socialisation of school-age children suggests that attitudes, habits and beliefs regarding travel modes are embedded at a young age (Baslington, 2008). However, less is understood about travel socialisation of preschool age children and how this, in turn, affects travel attitudes and choices as the child ages.	<ul style="list-style-type: none"> • Examine whether the travel modes exposed to as a young child influence travel attitudes and choices as an adult.

Source: Author's synthesis.

5. Agenda for future research

This literature review has helped to construct an initial understanding of what influences travel mode choice among families with young children. While the majority of factors tend to discourage travel by alternative modes, this literature review demonstrates that some of these factors are within the influence of transport planners and policy-makers. Moreover, it has highlighted that it is both feasible and beneficial to encourage less car use among this group. However, to achieve a transition away from auto-dependency, a richer account of travel behaviour among families with young children is required. With this in mind, several important aspects of young

children's travel and factors influencing mode choice remain unanswered. These are outlined in [Table 3](#).

6. Conclusion

This literature review has demonstrated the majority of factors influencing mode choice among families with young children tend to facilitate car use. While cars provide an important means for families with young children to access activities and services, high levels of car use can be problematic. It has been suggested in this paper that to reduce car use among families with young children, it is more advantageous for policy-makers to focus on addressing the factors that discourage travel of alternative modes rather than introduce policies restricting car use. The framework setting out influences on mode choice when travelling with young children, and discussion of how factors discouraging travel by alternative modes might be best addressed through policy or infrastructure changes, provides a starting point for how less car-orientated travel behaviour may be adopted by parents of young children. However, further research examining parental preferences for mode choice when travelling with young children, and barriers and motivations to using sustainable travel modes, is required. This, in turn, will assist households with young children to adopt sustainable travel practices during a period when they are actively evaluating their mobility practices.

Notes

1. Two supplementary searches were conducted. In April 2017, the first supplementary search was conducted to retrieve any literature published since August 2016. One additional record was retrieved that met the inclusion and screening criteria. The second supplementary search, conducted in July 2017, aimed to retrieve relevant records published in the MEDLINE/PubMed database. This retrieved two additional records that met the inclusion and screening criteria.
2. This includes the three records retrieved during supplementary searches.
3. The following records are included in the literature review findings: 1 (Gaffga & Hagemester, 2016); 2 (Andrews et al., 2014); 3 (Bostock, 2001); 4 (Fritze, 2007); 5 (McLaren, 2016); 6 (McCray, 2000); 7 (Dols et al., 2013); 8 (Guthrie & Fan, 2016); 9 (Caroli et al., 2011); 10 (Oxford & Pollock, 2015); 11 (Pooley et al., 2014); 12 (Rubin et al., 2014); 13 (Dowling, 2015); 14 (Thomas, 2016); 15 (Dowling, 2000); 16 (Sattlegger & Rau, 2016); 17 (Price & Matthews, 2013); 18 (Lanzendorf, 2010); 19 (Currie et al., 2016); 20 (Bean et al., 2008); 21 (McDonald, 2006); 22 (Wheatley, 2014); 23 (McQuaid & Chen, 2012); 24 (Scheiner, 2014); 25 (Rothman et al., 2016); 26 (Birken et al., 2015); 27 (Taubman - Ben-Ari & Noy, 2011); 28 (Zwerts et al., 2008).

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