



Children's travel behaviour and its health implications

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ABSTRACT

Children's travel behaviour varies from that of adults in several ways: they have less choice about where they go and often they are not allowed to travel unescorted by an older person. The factors that influence children's travel behaviour have changed in recent years, with the development of car-oriented lifestyles, increased numbers of mothers in employment and changes in attitudes towards children's independent mobility. The purpose of this paper is to examine the nature of children's travel behaviour and its implications for their volumes of physical activity and so for their health. After considering the nature of children's travel behaviour and the factors that influence it, the effects of children's travel behaviour on their volumes of physical activity are discussed; then some measures being adopted in Britain to reverse the adverse trends are described. Conclusions are drawn in terms of the policy implications.

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1. Introduction

Children have physical and mental characteristics that influence their travel behaviour and make it different from that of adults. They are smaller and weaker than adults: they cannot walk as far or fast and are more vulnerable to outside forces such as cars and threatening adults. They do not have legal autonomy: they are dependent on their parents and other adults such as teachers for their welfare and protection. They are developing physically and mentally which means that their capabilities change significantly over time. As part of the development process, they need to learn how to take decisions such as how to cross the road. It also means that parents and society have to balance the need for protection of children against the need to allow them to develop the independence that they will need in later life.

In order to drive a car, it is necessary to pass a driving test, typically, in Europe, at a minimum age of 17 or 18. Anyone younger than this who wishes to travel by car must be driven by someone else. Because they are vulnerable and need care by adults, young children cannot be left at home without adult supervision. It is a matter of judgement for parents and society at what age it is appropriate for children to be left at home alone or with siblings. This means that many children either make journeys with parents as a form of childcare, often in a car, or are taken to other people's homes to be supervised. Either way, they make journeys simply to protect them from the perceived risks of being at home without adult supervision.

Family life has become more complex in many countries, with more mothers employed, often part-time. There has also been increasing concern about the perceived risks of allowing children out without adult supervision including traffic danger and possible abduction by adults. A related trend has been the shift from free play where children simply go out of the home to play in the street, park or countryside to organised activities where children participate in activities such as football lessons or dance classes. These latter activities take place at specific locations, often not very close to the home, so the only convenient way to reach many of them is by car. These factors have made family life more complex, often revolving around the use of cars to escort children to their various activities, to the extent that many children's lifestyles are dependent on the car (Mackett, 2002).

There is considerable evidence that lack of physical activity can lead to a number of adverse health conditions including obesity (Department of Health, 2004; Riddoch, 1998). As in many other countries, the proportion of children in Britain who are overweight and obese is increasing (Donaldson, 2003). Biddle et al. (1998) state that moderate intensity activities for children may include brisk walking, cycling, swimming, most sports or dance, and that such activities may be carried out as part of transportation, physical activity, games, sport, recreation, work or structured exercise, and for younger children, as part of active play. Hence, the normal everyday events in which children participate, including travelling to and from school, can contribute to fulfilling their daily requirement for physical activity, which in turn, can lead to healthier lives.

The purpose of this paper is to examine evidence on how children's travel behaviour may be having an adverse impact on their lives, and then to consider some initiatives to increase their levels of walking and cycling, and so make them healthier. Most

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of the discussion will be about Britain, but similar trends are occurring elsewhere and some international comparisons will be made.

2. The nature of children's travel behaviour

Much of the comprehensive evidence about travel behaviour over time in Britain comes from the National Travel Survey (NTS) which is a large household survey carried out for the Department for Transport since 1965. It is now carried out continuously with results published annually. Comparisons over time can be made, but changes in definition and questions mean that it is not possible to make comparisons over the whole period. All the information in this section of the paper is based on NTS (Department for Transport, 2004, 2011; Department for the Environment, Transport and the Regions, 2000) unless otherwise stated. More detailed figures may be found elsewhere (Mackett, 2010). Much of the other evidence in the paper on children's physical activity and independent mobility comes from research led by the author and carried out at UCL on a project on children's car use conducted 2001–2004 (see <http://www2.cege.ucl.ac.uk/cts/research/chcaruse/>) and the CAPABLE project carried out 2004–2006 (see <http://www.casa.ucl.ac.uk/capableproject/>) (CAPABLE=Children's Activities, Perceptions and Behaviour in the Local Environment). The international comparisons come from a project on children's active travel and independent mobility in Britain, Denmark, Finland and Norway, led by the Norwegian Institute of Transport Economics (Fyhri et al., 2011).

Children and adults travel for different reasons. For adults (aged 17 or over), 20% of their trips are commuting to work and 4% are business trips. There are very few of these for children (aged under 17), but 27% of their trips are to education. More interestingly, the links between adult and children's travel behaviour are shown by considering escort trips. These are trips made accompanying someone else on a trip for the benefit of that other person. 4% of adults trips are education escort, but interestingly 4% of children trips are also education escort. These are children accompanying a parent taking other children, probably siblings, to school. However, these are not the majority of escort trips. For adults, 8% of their trips are 'other escort'. Whilst some of these will be to accompany other adults, such as taking an elderly relative to the doctor, it is very likely that the majority are taking children to their friends, after school activities, and so on. Even more interestingly, 16% of children's trips are other escort trips: many of these are the trips where the child is being taken because their parent is not prepared to leave them at home without adult supervision. 42% of all escort trips are by car. This suggests two things: first, children are spending quite a lot of time travelling in cars as a form of mobile child care and, second, meeting the needs of children is generating a lot of car trips (Mackett, 2003). This latter issue is illustrated by the fact that 90% of households with dependent children owned one or more car according to the 2001 Census of Population compared with 73% of all households (Office of National Statistics, 2010). Multiple car ownership is also much higher in households with children. The more cars owned by a household, the less walking the children do, so as car ownership increases, the fewer walking trips children make (Mackett, 2011).

Car use by children has grown over time, from 35% of trips in 1985/1986 to 53% in 2009. This has mostly been at the expense of walking which decreased from 47% in 1985/1986 to 38% in 1996/1998 and 34% in 2009. Cycling also declined from 4% in 1985/1986 down to 2% in 1996/1998. It has stayed at this level since. Children walk more than adults (34% of trips compared with 22% of adult trips in 2009). Children and adults cycle the same amount overall, at 2% of their trips. However, the group that cycles the

most is boys aged 11–16 who make twice as many trips as other males, four times as many as girls of the same age, and nearly three times the overall average. Bicycle ownership is also higher amongst children than adults: 87% of children aged 5–10 and 76% of children aged 11–16 own a bicycle compared with 42% for the whole population. It should be borne in mind that cycling is a form of recreation as well as a means of travel and that many children cycle off the road, often from a young age, and only venture on to the road at a later stage in their development.

In Britain there is considerable discussion about the use of the car to take children to school. In fact, it has not changed very much in recent years: in 1995/1997 38% of children aged 5–10 travelled to school by car whereas in 2009 it was 42%. The equivalent figures for children aged 11–16 were 20% and 22%, respectively. However, back in 1985/1986 the levels were 22% for the younger children and 10% for the older ones. This suggests that the big shift to the car for the school journey was between 1985/1986 and 1995/1997 when the levels doubled. The late 1980s was an era of rapid economic growth in Britain following the deregulation of the financial markets in 1982 which led to a significant increase in car ownership and considerable urban decentralisation.

One of the reasons why there has been a long-term shift from walking to the car for the journey to school is the increasing distance between the home and school, which increased from 1.8 km in 1985/1986 to 2.6 km in 2009 for children aged 5–10 and from 3.7 km to 5.4 km over the same period for children aged 11–16. This may be associated with the policy of encouraging choice of school, which means that many children are sent to a school that is not the nearest to their home because of parental perception of the relative quality of schools. The availability of a car makes it possible to choose from a wider range of schools. Once it has been decided to send a child to a school that is beyond a reasonable walking or cycling distance so that the car has to be used, the distance from home to school does not matter very much. It also means that policies to shift children from the car to walking or cycling should be focused on the school choice procedure rather than after the child has started there.

In 2009, 16% of children aged 5–10 who lived within 1.6 km of their school travelled by car. The equivalent figure for children aged 11–16 was 7%. It would be possible for many of these children to walk to school, but the reason many of them travel by car may be associated with the nature of life within their household: a parent may be making a trip to work or elsewhere in the same direction at the same time, so it is convenient for them to travel together, giving them the chance to chat. It was found in the CAPABLE study that 50% of the trips to school by car were part of a trip to work by the parent and another 18% were going on to other destinations. This means that even if these children switched to walking to school, there would not be an equivalent drop in the number of cars on the road in the morning peak.

The use of the car to school has been seen as a problem in newspapers in Britain in recent years, mainly because of the growth in the number of cars taking children to school in urban areas between 0800 and 0859 during term time as a percentage of car trips which increased from 7% in 1985/1986 to 14% in 2009. The delays to other traffic caused by the perceived congestion caused by parents, usually mothers, taking children to school sometimes leads for calls to encourage children to walk to school in the belief this would lead to significant reductions in the levels of congestion in the morning peak. As indicated above, because many of the trips are part of longer trips to other destinations the decrease in traffic would probably be less than many people believe.

The perception of the problems cars cause during the morning peak is interesting, because most car use by children is not to and

from school but for other activities, such as friends, relatives, after school clubs and shopping: of the 55% of car trips by children in 2008, only 9% were to and from school while the other 46% were to and from other activities. Putting it another way, while 31% of trips to school were by car, 74% of non-school trips were by car. This suggests that if there is concern about the use of the car by children, for example, because they are not walking or cycling enough, attention should be paid to non-school trips.

The perception of the risk that traffic poses to children is indicated by the fact that 'traffic danger' is the top reason why children walking to school are accompanied by an adult (56% of children aged 7–13: it has stayed at about this level since 2002). 59% of all children aged 7–13 were accompanied to school by an adult: this figure has also been fairly constant over recent years. It is known that it has increased over a longer period. Pooley et al. (2005) found evidence of this from interviews carried out in Manchester and Lancaster. They found that about 40% of people born in 1932–1941 travelled to school alone at the age of 10–11, whereas about 9% of those born in 1990–1991 travelled alone at that age. Hillman et al. (1990) looked more broadly at the issue of children being allowed out independently. They found that in England, 80% of 7–8-year olds were allowed to go to school alone in 1971. By 1990 this had dropped to 9%.

The issue of children's independent mobility was explored in depth in the CAPABLE project. It was found that the average age at which children were allowed to go out alone was about eight, with boys being allowed out about 6 months younger than girls (Mackett et al., 2005a). However, children's independence is a complex subject, which is partly influenced by the children's perceptions and behaviour. It was found that more boys than girls aged 8 to 11 in Cheshunt in Hertfordshire were allowed out alone. But when being allowed out with older siblings and friends was taken into account, the difference between the genders partly disappeared, with only 15% of boys and 19% of girls not allowed out without an adult. Girls tend to be more sociable than boys, so it may be that the difference is more due to girls preferring to go out with their friends rather than parents insisting that girls cannot go out alone (Brown et al., 2008).

In the CAPABLE study it was found that independence had some important effects on how children behave. Children who were allowed out either alone or with friends, went to a friend's house and somewhere outdoors after school more often than children who were not allowed out without an adult. Going to a friend's house is

likely to be associated with the formation of social networks (Brown et al., 2008) and going somewhere outdoors is likely to be associated with being active; both of these are important for children's development. Conversely, the children not given independence were more likely to stay at home or go to indoor venues if they went out. Page et al. (2009) have found that greater levels of independent mobility were associated with greater volumes of physical activity on weekdays. The level of children's independent mobility may be influenced by the nature of the built environment. Waygood and Kitamura (2009) showed that children's independent mobility increased with increasing urban density, but Mackett et al. (2005a) found that children's independent mobility was higher in Hertfordshire, a relatively rural area north of London, than in Lewisham, an inner urban area of London with high levels of street crime. This suggests that it is not just density but the nature of the built environment that influences levels of physical activity.

In the study of children's travel in Britain, Denmark, Finland and Norway (Fyhri et al. 2011), it was found that car use to school in Britain was about twice as high as in any of the other countries. For younger children, walking was higher in Britain than any of the other countries, but this was because of the very low levels of cycling in Britain. For older children it was higher than in Denmark and Finland for the same reason. It is not possible to tell for Norway because the walking and cycling figures were combined. Despite these differences, the same trend of increased car use to school was being followed in all four countries. Part of the reason for this was that average distances from home to school were increasing in all four countries, partly because of the merger of schools into larger units. Concern about traffic danger was the most significant reason why parents accompanied their children to school in Britain and Denmark, while it was the school being on the route to the parent's workplace that was the major factor in Norway. Only in Britain were the perceived risks posed by adults towards children a significant factor. Similar trends in family life were found in the four countries with the majority of females employed, often part-time, and higher levels of car ownership in households with children than other households. Another common trend was the growth in the number of children with mobile phones, which meant that children could be allowed out without an adult but with the reassurance for the child and parent that the child could communicate with the parent if he or she were lost or felt at risk. It also meant that the child could summon the parent to be collected by car which may be a contributory factor in the growth in car use.

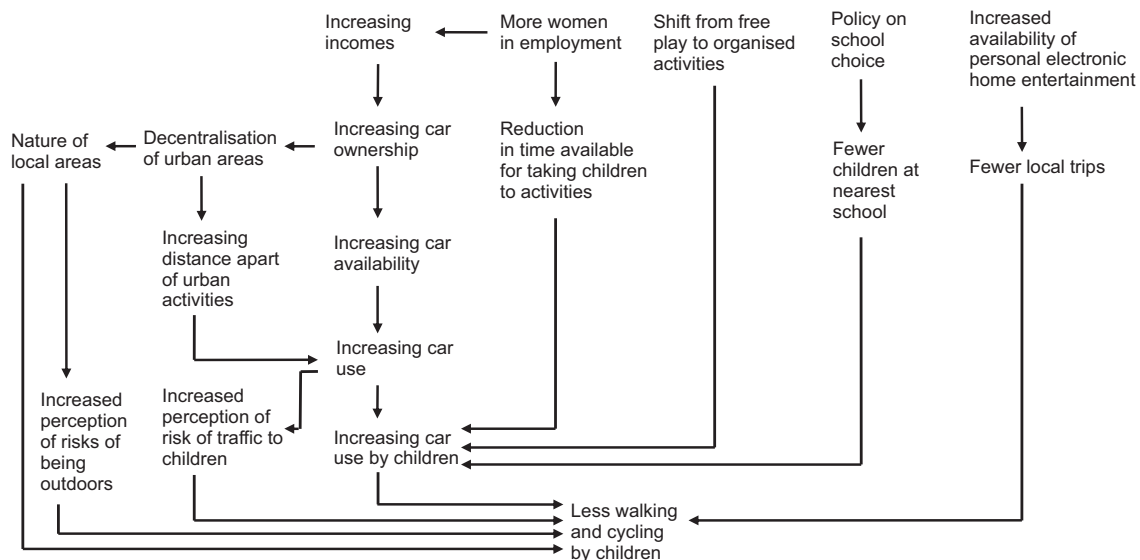


Fig. 1. The influence of modern life on children's walking and cycling levels.

Whilst the picture on children’s travel behaviour is complex, it is clear that the car plays a large part in the travel behaviour of children in Britain for a number of reasons including the complexity of modern life, parental perceptions of traffic danger and the possible risk of abduction, government policy giving parents the choice of school and the decentralisation of urban areas which has been partly caused by greater availability of the car. The effects of modern life on children’s walking and cycling are summarised in Fig. 1. In the next section the implications of these trends for children’s physical activity will be considered.

3. The impacts on children’s volumes of physical activity

Measurement of children’s physical activity was carried out in the Children’s Car Use and CAPABLE projects. By linking the times of activities from travel and activity diaries with records from accelerometers, it was possible to establish the intensity of each activity in terms of the number of activity calories consumed per minute: the greater the intensity, the greater the benefit in terms of physical activity. A three-level hierarchical classification system for the children’s descriptions of their activities from their diaries was developed (Mackett et al., 2005b). Table 1 shows the results at the top level of the hierarchy. It can be seen that playing is the most intensive activity, followed by clubs and other organised activities, and then travel, with being at home the least active. If, as discussed above, children are being guarded by their parents more than in the past, they are likely to be spending more time indoors. This situation is reinforced by the attractions of being indoors offered by computers with social networking sites, DVDs and games consoles.

Travel is shown to be fairly active in Table 1. The different modes require different amounts of effort by the user as shown in Table 2. Not surprisingly, walking is the most energetic and car the least. Cycling is second to walking, but this figure needs to be treated with caution because very few children cycled in the survey and the accelerometers probably underestimated cycling’s contribution to physical activity because of the nature of body movement when cycling. Bus journeys use more activity calories per minute than car journeys because bus journeys include an element of walking.

Because walking is more energetic than travelling by car, a child who switches from travelling by car to school to walking will use more calories. In order to illustrate the potential of such switching

Table 1
Intensity of various events undertaken by children in activity calories per minute.
Source: Children’s Car Use study.

At school	1.0
Clubs	1.7
Playing	2.2
Shopping etc.	1.1
At own home	0.6
At other people’s homes	0.9
Travel	1.6
Other	1.1
Overall	0.9

Table 2
Intensities of children’s travel in activity calories per minute.
Source: Children’s Car Use study.

Walking	2.3
Car	1.0
Bicycle	1.7
Bus	1.5
All travel	1.6

it was decided to compare the calories consumed walking to and from school for a week with 2 hours of physical education (PE) and games lessons which is the recommended standard. As Table 3 shows, for the older children, aged 12–13, walking to and from school for a week burned more activity calories than the PE and games lessons. This gives a good indication of the physical activity benefits of walking. This result has been cited in policy documents such as the Department of Health (2004) White Paper ‘Choosing Health: Making healthy choices easier’.

Not only was it found that walking uses more activity calories than travelling by car, which is not surprising, it was also found that children who walk to activities are more energetic in the activities when they arrive than those who travel by car (Table 4).

It was also found that children who walk more than they use the car are more energetic in all activities, on average, than those who use the car more than they walk, as shown in Table 5. In the projects on children’s travel and physical activity carried out at UCL, it was found that there was a positive relationship between the time spent walking and cycling and the proportion of the day spent in moderate-to-vigorous physical activity overall (Goodman et al. 2011).

Table 3
A comparison of the number of activity calories consumed in a week travelling to and from school with 2 h of PE or games lessons.
Source: Children’s Car Use study.

	Year 6 (age 10–11)		Year 8 (age 12–13)		Overall
	Boys	Girls	Boys	Girls	
Walk to and from school	209	201	522	625	374
Car to and from school	152	160	172	226	165
Bicycle to and from school	433	365	411	–	414
Bus to and from school	–	–	420	346	380
Overall travel to and from school	193	183	455	472	305
PE or games lessons for 2 h	326	307	388	499	371

Table 4
Intensity of various events in activity calories per minute, classified by the mode of travel used to arrive.
Source: Children’s Car Use study.

	Walk	Car
PE or games lesson	3.5	2.4
Other school lesson	0.6	0.5
School break	2.0	1.7
Clubs	1.7	1.6
Playing	2.4	2.0
Shopping etc.	1.5	1.0
At another home	1.1	0.8
Overall	1.7	1.3

Table 5
Intensity of various events in activity calories per minute, classified by whether they travel more by walking or by car.
Source: Children’s Car Use study.

	Walk	Car
PE or games lesson	3.3	3.0
Other school lessons	0.6	0.6
School break	2.1	1.9
Clubs	2.0	1.5
Playing	2.5	1.9
Shopping etc.	1.3	1.0
At own home	0.6	0.6
At another home	1.1	0.8
Travel	2.1	1.2
Overall	1.0	0.9

It should be recognised that some children may choose to walk or cycle because they enjoy the opportunity to be physically active (or their parents may decide that it would be good for them to walk or cycle). More generally, some children may choose to be active by walking and cycling and taking part in other physical activities while others choose to avoid physical activity and are taken by car to various places, possibly reflecting parental lifestyles. This means there may be some self-selection so that the children who want to be active tend to choose the modes that require more physical effort.

Whilst it should be acknowledged that the relationships are not fully understood, it is clear that walking gives children more physical activity than travelling by car, and so the shift from walking to the car discussed above is, almost certainly, contributing to children's reduction in physical activity and so having adverse effects on their health. This is exacerbated by the shift from free play to organised clubs (National Institute of Child Health and Development, 2000), which, as the figures shown in Table 1 imply, is having an adverse effect on their volumes of physical activity. This is compounded by the fact that children tend to be taken by car to clubs whereas they are more likely to walk when they go out to play (Mackett and Paskins, 2008). Evidence of high levels of car use for children's organised activities has been found in Norway (Hjorthal and Fyhri, 2009).

Having shown that the trends in children's travel behaviour are causing reductions in their volumes of physical activity, this raises the question whether anything can be done to reverse the trends. It should be recognised that increasing car ownership is probably the major cause and it is very difficult to reverse this trend (Mackett, 2009). However a number of actions have been tried in Britain to encourage children to walk and cycle more. These are discussed in the next section.

4. Measures to increase children's walking and cycling

A number of measures to increase children's walking and cycling have been introduced in Great Britain. More detailed information can be found elsewhere (Mackett, 2010).

4.1. Physical measures

Examples of physical measures to increase children's walking and cycling that have been introduced in Great Britain include:

- Traffic calming, to make the area around a school safer from traffic;
- Safer routes which means making safer the routes to school that many children use to walk or cycle;
- School infrastructure including providing secure cycle parking and lockers;
- School crossing patrols with an adult stopping the traffic to enable children to cross the road safely.

4.2. Organising school trips

Various initiatives to organise trips to school have been implemented in Great Britain, one of which is walking buses. A walking bus is a group of children walking to school escorted by a small number of adult volunteers, stopping on the way to pick up more children. As part of the process of developing guidance on promoting physical activity for children the National Institute for Health and Clinical Excellence (2008) (NICE) examined four interventions to increase physical activity in terms of cost effectiveness. Of the four interventions of walking buses, free

swimming, dance classes and community sports, walking buses (based on evidence by Mackett et al. (2005c)) were found to be the most effective (Fordham and Barton, 2008).

4.3. Funding measures

The British Government funded a number of schemes including 111 posts across the country to enable 84 local authorities to employ travel plan co-ordinators in 2002, and then funded 250 school travel advisers to encourage the development of school travel plans. This was further encouraged by providing additional capital grant to schools to spend on measures identified in their travel plans. Grants were also awarded to schools which set up walking buses which were expected to attract trips out of cars.

4.4. Campaigns

Various campaigns have been set up including:

- 'Are you doing your bit?' about sustainable development by encouraging people to change their travel habits, including children travelling to school.
- The 'Healthy Schools Programme' based on a whole-school approach to physical and emotional well-being focussed on four core themes including physical activity.
- The 'Safe and Sound Challenge' to increase the number of children and young people who walked or cycled to school safely through innovative travel schemes.
- 'Bike it' launched by Sustrans, a charity committed to sustainable travel, to increase levels of cycling by encouraging schools to make the case for cycling in their school travel plans.

4.5. Educational programmes

A number of educational programmes have been set up including pedestrian training projects such as 'Kerbcraft' in which parent volunteers take 5- to 7-year old children out to teach them road safety skills, and educational programmes like 'Making Choices' aimed at children aged 10–12 to encourage safe walking and cycling.

4.6. Information

In 1998 the British Government set up the School Travel Advisory Group (STAG) to spread best practice and identify practical ways of reducing car use to school, and increase safety on the journey. It has issued various sets of guidance mostly aimed at local authorities. Some of these have been in partnership with other government departments.

4.7. The effectiveness of measures for increasing children's walking and cycling

Whilst it should be acknowledged that a wide range of initiatives have been tried to increase children's volumes of walking and cycling, it should also be recognised that there has been a lack of systematic evaluations of the initiatives. Put simply, it is not known what works and what does not. Without effective evaluation there is a serious danger of resources being wasted by being put into schemes that do not encourage more walking and cycling.

5. Conclusions

This paper has shown that children have different patterns of travel from adults, partly because they take part in different

activities, but also because parents tend to supervise their children because of perceived threats to their safety, which mean that children make many trips, often by car, simply as a form of child care. Children are walking and cycling less than they did in the past, with a considerable increase in the number of trips they make by car. Walking and cycling burn more calories than use of the car so the shift to the car has led to a reduction in physical activity. In addition to the direct effects, it has been shown that children who walk to activities tend to be more active when they arrive, and that children who walk a lot tend to be more active in everything they do than those who travel mainly by car.

One reason that children travel to school by car more than they used to, is because trips to school are longer than they were. This is, almost certainly, associated with the policy of giving parents the choice of schools. As a result of this policy, children are walking and cycling less to school, hence being less physically active. Once the choice of school has been made, for many children the mode of travel to school has been determined. This suggests that interventions to reduce car use to school should not focus on the current travel mode to school: instead they should concentrate on the choice of school. Another trend is the decreasing proportion of children who are allowed to go out without an adult because of parental concerns about the perceived risks. This has implications for the children's volumes of physical activity and the establishment of real social networks, both of which are important elements of children's development.

A major issue underlying the reduction in children walking and cycling has been the increase in car use. This has led to increases in traffic on the road in the morning peak. However, many children are dropped at school by parents driving to work and elsewhere, which means that even if the children switched to walking or cycling, there would not be an equivalent reduction in traffic during the morning peak.

It has been shown that a variety of measures have been introduced to encourage children to walk and cycle more. A major issue is the lack of systematic evaluations of the initiatives to see which of them are effective. Most of the measures have been targeted at the journey to school and it is not clear whether there are many children who can switch from the car because of earlier decisions about the choice of school. It is also not clear whether, even if more children were encouraged to walk and cycle to school, this would translate into a significant modal shift for non-education trips because of parental involvement in children's travel decisions reflecting their concerns about the perceived risks and, possibly, parents' preference to use the car.

Because of various campaigns, parents are recognising the health risks to children associated with sedentary lifestyles. They may translate this into encouraging children into going out more to play and walk about. This may in turn encourage them to allow the children out without an adult once they have sufficient confidence in their children to let them do so: this may lead to children having greater independent mobility with more opportunity for physical activity.

A number of important policy issues have been identified here. These include addressing the issues of increasing car ownership and use, consideration of the policy of allowing parental free choice of school, considering ways of addressing parental perceptions of the risks of allowing children out without an adult, and evaluating the various initiatives to increase children's walking and cycling. Some of these are very difficult issues to address and will require considerable determination and expenditure to tackle. However, the cost of not addressing them, in terms of both personal well-being and national expenditure is huge, for example because of the decrease in health resulting from conditions associated with reduced physical activity. This means that action is required now.

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