CHILDREN'S TRAVEL BEHAVIOUR AND ITS IMPLICATIONS FOR THEIR HEALTH

Roger L Mackett, Centre for Transport Studies, University College London

ABSTRACT

Children's travel behaviour is different from that of adults in several ways, for example, they have less choice about where they go, because parents control many of their trips, and they are often not allowed to travel unescorted by an older person, so there tend to be interdependencies with other people's travel. There have been a number of changes in the factors that influence children's travel behaviour in recent years, including the development of car-oriented lifestyles, increased numbers of mother 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 the implications of this for their volumes of physical activity and so for their health. The paper draws upon research carried out in projects carried out at the Centre for Transport Studies at University College London on children's travel and physical activity. The paper commences by considering the nature of children's travel and how it differs from that of adults. Trends in children's travel and the influence of factors such as the effects of increasing separation of home and school and children's independent mobility are considered. The impacts of children's travel patterns on traffic and on their health are discussed. Having shown that the trends in children's travel behaviour are causing reductions in their volumes of physical activity, a number of actions being adopted in Britain to try to reverse the trends, are described. Conclusions are drawn in terms of the implications for policy and how some of the difficult issues raised in the paper can be addressed.

Key words: children, travel behaviour, health, physical activity

INTRODUCTION

The proportion of children in Britain who are overweight and obese is increasing (Donaldson, 2003). 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). Biddle, Cavill and Sallis (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, should lead to healthier lives.

Children's travel behaviour differs from that of adults in several ways: for example, they have less choice about where they go, because parents control many of their trips, and they are often not allowed to travel unescorted by an adult, so there tend to be interdependencies with other people's travel. There have been a number of changes in the factors that influence children's travel behaviour in recent years, including the growth in car ownership and changes in attitudes towards children's independent mobility.

In this paper, it is shown that volumes of children's walking and cycling are decreasing, which, based upon the linkages implied above, is probably having an adverse impact on their health. More generally, the purpose of the paper is to assemble data on children's travel behaviour, to compare it with that of adults and to examine the impacts on traffic and physical activity volumes. The analysis is based upon data from the British National Travel Survey and from research projects involving the author. The trends in children's independent mobility and their implication for children's travel behaviour are examined followed by consideration of the impacts of children's travel behaviour on traffic and children's volumes of physical activity. After showing that the recent trends in children's travel behaviour are having an adverse effect on their health, some of the measures that are being adopted in Britain to reverse the trends are then discussed. Conclusions are drawn in terms of the implications of the trends and what can be done about them.

THE ANALYSIS OF CHILDREN'S TRAVEL

The data analysed in this paper comes from two sources: the British National Travel Survey (NTS) and research undertaken by the author. The National Travel Survey is a large travel survey that has been undertaken since 1965 for the UK Department for Transport. It was originally carried out spasmodically for periods of two or three years, but is now carried out continuously, with results published annually. This means that comparisons can be carried out over quite long periods. However changes in the questions asked and changes in definitions mean that it is not possible to make comparisons over the whole period over which NTS has been conducted. Where possible, results are shown for periods for about ten years, with the latest figures shown to illustrate the current picture. In some cases, special tabulations have been obtained. Sometimes these are combined over several years to ensure that the numbers in each cell in the matrix are sufficient to preserve confidentiality. NTS defines a child as a person under the age of seventeen.

The other source is research into children's travel behaviour has been undertaken in three projects, carried out at the Centre for Transport Studies at University College London:

- 'Reducing children's car use', from 2001-2004, in which various surveys were carried out including questionnaire surveys of children and their parents and fitting a sample of children with accelerometers and asking them to keep travel and activity diaries; this is referred to as 'The Children's Car Use project' below; more information about this project is available in Mackett et al (2005b) and Mackett and Paskins (2008) and at http://www2.cege.ucl.ac.uk/cts/research/chcaruse/ .
- CAPABLE (Children's Activities, Perceptions and Behaviour in the Local Environment) in which children were also fitted with GPS (Global Positioning Satellite) monitors; much of the emphasis was on looking at children's independence; this is referred to as the CAPABLE project below; more information is available about this project in Mackett et al (2007) and Brown et al (2008) and at http://www.casa.ucl.ac.uk/capableproject/ .
- A comparative study of children's independent movement in Britain, Denmark, Finland and Norway (led by the Transport Economics Institute in Oslo); only the data on children's travel from Britain are used in this paper.

THE NATURE OF CHILDREN'S TRAVEL

Travel patterns of children and adults

In this section the nature of children's travel is examined, particularly in contrast to that of adults, to see where differences lie, since understanding the nature of their travel behaviour may be the key to introducing mechanisms to modify it, if that is appropriate.

Table 1 shows the purposes for which children and adults travel. The purpose for which children make most trips is education, that is, to and from school. The next most popular trip purposes are 'Visiting friends at private home' and 'Other escort'. The former of these reflects the fact that children spend much of their out-of-school time playing with friends at their homes, either to be sociable or because their parents wish their children to be cared for whilst they (the parents) are engaged in other activities that do not involve the children, such as employment or personal business. 'Other escort' refers to trips that children make for the benefit of others, for example, accompanying a parent to the shops. This again reflects the fact that children need to be looked after, because some parents do not wish to leave them alone (or with other children) in the home without adult supervision. These two trip purposes suggest that many of children's trips are made as a form of child care, reflecting parents' perceived needs to look after and monitor their children. The need to provide child care has been identified as one of the key factors in the growth in the number of short trips by car in recent years (Mackett, 2003).

Table 1 - Trips per person per year by purpose, 2008 (%)

	Children aged <17	All aged 17+
Commuting	1	20
Business	0	4
Education	27	0
Escort education	4	4
Shopping	7	24
Other escort	16	8
Personal business	8	11
Visit friends at private home	16	10
Visit friends elsewhere	3	6
Sport/entertainment	9	5
Holiday/day trip	5	4
Other including just walk	4	4
Total	100	100

Source: Department for Transport (2009)

In contrast the two largest trip purposes for adults are shopping and commuting. The next largest category of trips is 'Other escort', many of which will be taking children to various places, such as their friends. Given that most adults do not have children of an age which requires them to be escorted, those adults that do, must make many of these trips, since the 8% is an average over all adults. Similarly, the 4% of trips that are 'Education escort', that is taking children to and from school, will be an average of zero for most adults and a large number for some adults with child care responsibilities, mainly mothers of young children.

From this analysis some preliminary conclusions can be drawn:

- Adults and children have very different patterns of trips
- The trip patterns of children and their parents are strongly interlinked;
- Many of children's trips and those of their parents result from the need to provide care for children.

Shifting from why to how children travel, Table 2 shows the mode of travel for children and adults. It can be seen that the car is the dominant mode for both, with 55% of trips by children and 66% by adults. It is not surprising that adults make more trips by car since they actually own and drive the cars. What is, perhaps, surprising is that so many of children's trips are by car.

Table 2 - Trips per year by mode, 2008 (%)

	Children aged <17	All aged 17+
Walk	32	19
Bicycle	2	2
Car driver	-	52
Car passenger	55	14
Other private transport	2	1
Bus and coach	7	7
Rail	1	4
Taxi and minicab	1	1
Total	100	100

Source: Department for Transport (2009)

Children make more walking trips than adults and both children and adults only cycle about 2% of their trips on average. They also use bus and coach about the same amount at 7%, but adults use the train more.

Table 3 shows the modal split for children's trips, by trip purpose. It can be seen that walk is the most common mode of travel to school, but that car is dominant for other trips by children, with nearly half of all children's trips being by car for non-education purposes.

Table 3 - Children's mode and trip purpose, 2008 (%)

	Education	Other	Total
Walk	12	20	32
Car	9	46	55
Other	6	6	12
Total	27	62	100

Source: Calculated from Department for Transport (2009)

Interestingly, although children walk considerably more trips than adults, the frequency of long walks by children and adults are remarkably similar, as shown in Table 4, with 36% of both populations making long walks 3 or more times a week and about 25% of both walking for 20 minutes or more less than once a year or never. It may be than many of the long walks are families walking together, but given the different trip purposes and the different numbers of walk journeys, the similarities are quite striking.

Despite the apparent similarities of walking behaviour between adults and children in terms of frequency of long trips, there are considerable differences in cycling between children and adults, as shown in Table 5. Boys aged 11-16 make many more trips than adults: in fact they make many more cycling trips than any other age group, with males in the age groups from 17 to 49 all making about 27 trips a year. Girls aged 11-16, on the other hand, make similar numbers of bicycle trips to those aged 21 to 59 at about 10 trips a year. It is interesting to speculate about why boys, once they have the freedom to go out without adult supervision seem to take advantage of it much more than girls. Evidence of significant differences in boys and girls behaviour in the local environment was found in the CAPABLE project (Brown et al, 2008), which may explain some of the differences. The decrease for boys after they reach 16 may be because they switch to cars and motor cycles.

Table 4 - Walks of 20 minutes or more by age, 2008 (%)

Frequency of walking	Children aged 2-16	All aged 16+
3 or more times a week	36	36
Once of twice a week	23	22
Less than once a week, more than twice a month	5	5
Once or twice a month	7	7
Less than once a month, more than twice a year	3	3
Once or twice a year	2	2
Less than once a year or never	24	25
All	100	100

Source: Department for Transport (2009)

Table 5 – number of bicycle trips per person per year, 2008

Age	Males	Females
5-10	14	11
11-16	47	11
All 5+	24	9

Source: Department for Transport (2009)

Despite the fact that children aged 11-16 make many more cycling trips than younger children, this is not because they own more bicycles. As can be seen in Table 6, bicycle ownership is higher amongst younger children. This apparent anomaly may reflect the twin functions of bicycles: for recreation and for travel. Many young children have bicycles as a form of toy for use in the garden or other space away from the road. Almost certainly, many of them do not take them onto the road and so do not use them to make trips of the type recorded in NTS. Children of all ages are more likely to own bicycles than adults, which suggests that most adults have cycled but have -chosen to give it up.

Table 6 - Bicycle ownership, 2008

Age	% who own a bicycle
5-10	87
11-16	76
All 5+	42

Source: Department for Transport (2009)

Changes in children's travel patterns over time

Having established that children's travel differs from that of adults in various ways, it is interesting to consider how children's travel patterns have changed over time. Table 7 shows the purposes of children's trips in 1996/68 and 2008. Whilst education trips have retained their share at 27%, there have been some shifts in the other trips, from shopping and personal business and visiting friends at home to escort and other leisure trips. The biggest shift has been the growth in escort trips, suggesting that children are spending more of their time being looked after by parents by being taken on trips rather than being left at home without adult supervision.

Table 7 - The purpose of trips by children (under 17) (%)

	1996/98	2008
Education	27	27
Shopping and personal business	21	15
Escort	17	20
Visit friends at home	17	16
Other leisure	14	17
Other	5	5
Total	100	100

Source: Department for Transport (2009), Department of the Environment, Transport and the Regions (1999)

The change in children's trip purposes with more escort trips, may partly explain the growth in car use by children, as shown in Table 8, from 35% of trips in 1985/86 to 55% in 2008, with an equivalent decrease in walking from 47% to 32% over the same period. This is because they appear to be making more trips with adults, in order for parents to know where their children are, and adults make most of their trips by car. The shift from walk to car was greater over the period from 1985/86 to 1996/98 than in the following period. There was a large fall in the number of cycling trips from 4% to 2% between 1985/86 and 1996/98 and has then stayed at that low level through to 2008.

Table 8 - Trips per year by children under 17 (%)

	1985/86	1996/98	2006	2008
Walk	47	38	34	32
Bicycle	4	2	2	2
Car	35	49	53	55
Other	14	12	11	11
Total	100	100	100	100

Source: Department for Transport (2009), Department of the Environment, Transport and the Regions (1999)

Tables 9 and 10 show the changes in modal split to school for two age groups. For younger children, there has been a steady shift from walk to car with the former dropping from 67% of trips to fewer than half over a 23 year period, with car use almost doubling. Bicycle use has remained low over the period. It can be seen that much of the decrease in walking was in the earlier part of the period. This effect is even more noticeable for older children (Table 10) with car use doubling from 1895/86 to 1995/97 and then almost levelling off, and walking showing a similar levelling off after 1995/97. Cycling showed a similar trend, declining fast in the earlier period and then levelling off. Bus use remained fairly constant over the period.

Table 9 - Mode of travel to school for children aged 5-10 (%)

	1985/86	1995/97	2006	2008
Walk	67	53	52	48
Bicycle	1	0	1	2
Car/van	22	38	41	43
Bus	9	7	5	7
Other	2	2	1	0
Total	100	100	100	100

Source: Department for Transport (2009), Department of the Environment, Transport and the Regions (1999)

Table 10 - Mode of travel to school for children aged 11-16 (%)

	1985/86	1995/97	2006	2008
Walk	52	42	41	40
Bicycle	6	2	3	2
Car/van	10	20	20	21
Bus	29	33	31	33
Other	2	3	4	3
Total	100	100	100	100

Source: Department for Transport (2009), Department of the Environment, Transport and the Regions (1999)

Another way to look at children's change of mode of travel over time is to compare the current situation with that of their parents. This information was collected in the CAPABLE project and is shown in Table 11. It can be seen that 43% of the current children walk to school compared with 70% of their parents, while car use is 32% now compared with 7% a generation ago. Another way to look at children's change of mode of travel over time is to compare the current situation with that of their parents. It can be seen that 23% of the children go to school by car while their parents walked to school. 3% of the children walk but their parents travelled to school by car. These figures reflect the net trend from walk to car.

Table 11 - Mode of travel to school by children compared with that used by their parents at the same age (%)

		Mode used by child now			
		Walk	Car	Other	All
Mode used by parent when a child	Walk	31	23	16	70
	Car	3	2	2	7
	Other	9	7	7	23
	All	43	32	25	100

Source: CAPABLE project parents' questionnaires

The figures shown in Table 7 can be split between modes as shown in Table 12, by grouping all non-education trips. It can be seen how car use has grown, particularly for non-education trips, and how more of the decline in walking has been to and from places other than school. This suggests that concern about the growth in car use to school may be rather misplaced if, for example, the concern is about the reduction in physical activity from walking, because much more of the modal shift has been for non-education trips.

Table 12 - Changes in children's mode and trip purposes (%)

	1996/98		2008	
	Education	Other	Education	Other
Walk	13	25	12	20
Car	8	41	9	46
Other	6	7	6	6
Total	100		100	

Source: Department for Transport (2004, 2009)

The growth in children's car use is partly due to the general increase in car use resulting from increased car ownership: as more people buy cars, they tend to use them because much of the cost of car travel is in the sunk costs of purchase, insurance and road tax. Once these have been paid, the marginal costs of travel by car is often cheaper than the equivalent public transport journey, particularly for a group travelling together, such as a family. The convenience of the car can be very apparent when taking a family with children plus all their requirements which can include in-car entertainment, toys, pushchairs and so on. It is this convenience factor plus the complexity of modern life that makes it so difficult to reduce car

use (Mackett, 2009). In fact, having children is one of the reasons for car ownership, as shown in Table 13, which shows that households with dependent children are more likely than average to have one or more cars.

Table 13 - Car ownership, 2001, England

	All households with dependent children	All households
0 cars	10	27
1 car	40	44
2 cars	42	24
3 cars	6	5
4+ cars	2	1

Source: Office for National Statistics (2010)

The impact of increasing separation of home and school

It has been shown that children are shifting from walking to car for the journey to school and several underlying factors discussed, such as increasing car ownership and increasing perception by parents that children need to be with an adult in order to be safe. Another factor could be that children are travelling further to school. Table 14 shows how the average trip length to school has grown over the years, increasing by about 50% over twenty years or so, which implies a large increase in travel. This is true of children at both primary and secondary school.

Table 14 - Mean distance to school (km)

	1985/86	1995/97	2006	2008
Aged 5-10	1.8	2.1	2.4	2.6
Aged 11-16	3.7	4.6	5.4	5.4

Source: Department for Transport (2009), Department of the Environment, Transport and the Regions (1999)

If the relationship between trip length and mode is considered, as shown in Tables 15 and 16, it can be seen that short trips tend to be walked. For younger children, for trips over 1.6 km the majority are by car. For older children longer trips tend to be by bus (included under 'other'), but quite a large number are by car. It seems very likely that as trips to school have become longer, they have shifted from walk to car (and possibly bus for older children). But, why have trips to school become longer? At least two reasons can be identified: firstly, as car ownership has increased, more parents have had the opportunity to take their children by car, and so it is easier to travel further. As long as children are constrained to walking there is a maximum distance that they can travel, but once parents decide to take their children by car, that constraint disappears. This may be partly associated with the perceived need to escort children to school rather than letting them walk alone or with friends. The second reason for the increase is that of parental choice of school. In England, parents have the right to choose a school for their child. Many choose not to send their child to the nearest school, partly because of the growth in concern about the perceived quality of schools which has been fuelled by the issuing of league tables of examination performance of schools. This has led to longer trips to school than would occur if all children went to their local school. Longer trips to school are more likely to be by car. This process is facilitated by the greater availability of cars, as discussed above. Once the choice of school has been made, if it is at some distance from the home, it will be impractical for many children to travel by any mode other than the car.

Table 15 - School trips by mode and length for children aged 5-10, 2007-08

	Under 1.6 km	1.6 to 3.2 km	3.2 to 8.0 km	8.0 km and over	Total
Walk	80	31	3	0	49
Bicycle	1	2	1	0	1
Car/van	18	61	76	70	42
Other	1	6	20	30	8
Total	100	100	100	100	0

Source: Department for Transport (2009)

Table 16 - School trips by mode and length for children aged 11-16, 2007-08

	Under 1.6 km	1.6 to 3.2 km	3.2 to 8.0 km	8.0 km and over	Total
Walk	91	65	10	0	41
Bicycle	1	4	3	0	2
Car/van	6	21	34	22	22
Other	2	12	53	78	35
Total	100	100	100	100	0

Source: Department for Transport (2009)

Children's independent mobility

Another trend in recent years has been the loss of independence mobility of children. This is illustrated by Table 17 which shows that the percentage of children aged 5-10 travelling to school alone has decreased from 21% in 1985/86 to 6% in 2008, with a smaller decrease for older children from 46% to 36%.

Table 17 - Percentage of children travelling to school alone

	1985/86	1995/97	2006	2008
Aged 5-10	21	9	5	6
Aged 11-16	46	41	43	36

Source: Department for Transport (2009), Department of the Environment, Transport and the Regions (1999)

In recent years, NTS has asked parents why they accompany children to school. If a child under 17 is travelling to school by car they have to be accompanied by an adult who is driving the car. However, there is no such necessity for a child who is walking to be accompanied by an adult. Tables 18 and 19 show the reasons that parents give for accompanying their children walking to school for the period 2002 to 2008. It can be seen that for younger children, the top reason is traffic danger and this has increased from 45% of parents citing this reason in 2002 to 54% in 2008. The second most popular reason is fear of assault/molestation which has decreased over this period from 2002 to 2008. It is interesting that there appears to have been a shift in the area of concern from assault or molestation to traffic danger. However, there has been growth in other concerns such as the child getting lost or not arriving. The latter in particular might be a euphemism for concern about assault or molestation, with the parent worrying that their child might be abducted. Another fear is that of bullying, which has stayed fairly constant over time. It can be seen that many parents have concerns about letting their children out without an adult. It should also be recognised that one factor underlying the growth in the concern about traffic danger may be the growth in car use. Of course, if this leads to more parents driving their children to school, that exacerbates the problem. Some parents accompany their children for other reasons. The most popular is convenience: the parent may be travelling in the same direction, to work for example. The school being too far a way may simply be a way of summarising some of the concerns mentioned above, possibly being unwilling to articulate their fears.

Table 18 - Reasons why children aged 5-10 who walk to school are accompanied by an adult (%)

	2002	2004	2006	2008
Traffic danger	45	48	54	54
Child might get lost	6	8	9	15
Child might not arrive	8	12	13	16
Fear of assault/molestation	37	33	33	30
Fear of bullying	6	8	9	6
School too far away	6	4	4	2
Convenient to accompany child	-	-	15	17
Other	13	15	9	9

Source: Special tabulations from Department for Transport (2009)
Note: Percentages are the percentages of all children of that age group
Percentages may sum to more than 100 as more than one reason could be given
'Convenient to accompany child' was not an option for respondents before 2005

Table 19 - Reasons why children aged 11-16 who walk to school are accompanied by an adult (%)

	2002	2004	2006	2008
Traffic danger	5	5	6	5
Child might get lost	1	1	-	0
Child might not arrive	1	2	1	2
Fear of assault/molestation	5	6	4	4
Fear of bullying	1	1	2	1
School too far away	1	-	1	1
Convenient to accompany child	-	-	4	4
Other	2	1	2	1

Source: Special tabulations from Department for Transport (2009)
Note: Percentages are the percentages of all children of that age group
Percentages may sum to more than 100 as more than one reason could be given
'Convenient to accompany child' was not an option for respondents before 2005

The concerns that cause parents to accompany their older children (Table 19) are similar, but the smaller numbers make it more difficult to discern trends.

Pooley et al (2005) found similar evidence over a longer period from interviews carried out in Manchester and Lancaster. They found that about 40% of people born in 1932-41 travelled to school alone at the age of 10-11, whereas about 9% of those born in 1990-91 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%. Hillman et al (1990) also looked at various other measures of the freedom allowed to children by letting them undertake various activities unaccompanied: for example, crossing the road, using buses, cycling on roads and going out after dark. In all cases where the equivalent data were collected in 1971 and 1990, the children had less freedom to go out alone in 1990. They carried out comparable surveys in Germany in 1990, and found that German children were allowed much greater freedom to go out alone than their English counterparts.

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 are allowed to go out alone is about eight, with boys being allowed out about 6 months younger than girls (Mackett, Brown and Paskins, 2005a). However, children's independence is a complex subject, which is partly influenced by the children's perceptions and behaviour. As Table 20 shows, more boys than

girls aged 8 to 11 in Cheshunt were allowed out alone. But when being allowed out with older siblings and friends is taken into account, the difference between the genders partly disappears, 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, 2009).

Table 20 - Percentage of children allowed out independently by gender

	Allowed out alone	Allowed out with older siblings and friends but not allowed out alone	Only allowed out with an adult	Total	Allowed out without an adult
Boy	63	22	15	100	85
Girl	48	33	19	100	81
All	56	27	17	100	83

Source: CAPABLE children's questionnaires.

Not surprisingly, children are given greater independence as they grow up, as shown in Table 21. By the time they reach 10 or 11, nearly all the children in Cheshunt are allowed out without an adult.

Table 21 - Percentage of children allowed out independently by year group and gender

	Allowed out alone		Allowed out with older siblings and friends but not allowed out alone		Only allowed out with an adult	
	Boy	Girl	Boy	Girl	Boy	Girl
Year 4 (age 8-9)	52	33	32	44	16	23
Year 5 (age 9-10)	50	44	26	27	24	29
Year 6 (age 10-11)	86	69	7	29	7	2

Source: CAPABLE children's questionnaires.

In the CAPABLE study it was found that independence has some important effects on how children behave. As Table 22 shows, 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 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 be indoors if they did go out.

Table 22 - Percentage of children with different degrees of independence carrying out activities after school often.

	Boys				Girls			
	Allowed out alone?		Allowed out without an adult?		Allowed out alone?		Allowed out without an adult?	
	Yes	No	Yes	No	Yes	No	Yes	No
Stay at home often	50	69	74	54	56	74	66	65
Go to a friend's home often	77	58	74	48	76	73	79	57
Go somewhere outdoors often	77	60	75	48	76	68	73	67
Go somewhere indoors often	54	72	60	63	52	48	80	70

Source: CAPABLE children's questionnaires.

THE IMPACTS OF CHILDREN'S TRAVEL PATTERNS

The impacts on traffic

One aspect of children's travel to school that is recognised by many others is the effect on traffic near schools. Table 23 shows the percentages of traffic in urban areas during term time during the morning peak. Over the hour 0800 to 0859, the percentage of traffic that is taking children to school has grown from 7% in 1985/86 to 14% in 2008. Children are usually required to be at school shortly before 9.00 am, so the peak is higher than this, and had reached 20% by 2008, up from 14% in 1985/86. The peak to school is slightly later than the overall peak, at which time it is 19% of the traffic, an increase from 8% in 1985/86.

Table 23 - Cars taking children to school in urban areas during term time (percentage of car trips)

	1985/86	1995/97	2006	2008
0800 to 0859	7	9	12	14
Peak time	8	13	16	19
Peak percentage	14	18	18	20

Source: Department for Transport (2009), Department of the Environment, Transport and the Regions (1999)

This issue of the effect of trips to school on traffic levels is a topic of popular debate in Britain. During the school holidays, traffic is much less, and the difference is often interpreted as being due to children not being taken to school, and so, if children walked to school rather than being taken by car, there would be a similar reduction in traffic during term time. In fact, the reduction in traffic levels would be much less than this for three reasons: firstly, many parents stay at home rather than being at work during the school holidays; secondly, many of the trips to school by car are by teachers and other staff; and thirdly, many of the trips to school by car are part of longer trips, for example by parents going to work, and the work journeys would continue even if the child walked. This last point is illustrated in Table 24, from the CAPABLE project, in which it can be seen that 50% of the trips by car to school were part of a trip to work and only 32% were solely to take a child to school. In the afternoon, more trips are made by car especially to collect children to school, probably because the end of school and the end of work times tend to coincide less than the beginning of these activities in the morning. Only the trips by car being specially made to take children to school would disappear if the children switched to walking.

Table 24 - The purpose of car journeys that take children to or from school

	To school	From school
Part of a journey to or from work	50	35
Combined with another school/nursery trip	8	10
Combined with a trip to or from somewhere else	10	10
School journey sole purpose of trip	32	44
Total	100	100

Source: CAPABLE project parents' questionnaires

The impacts on children's volumes of physical activity

As indicated above, measurements of children's physical activity was carried out in the Children's Car Use and CAPABLE projects. By linking the times of the activities from the travel and activity diaries with the records from the accelerometers, it was possible to establish the intensity of the activity: 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 25 shows the results at the top level of the hierarchy. It can be seen that playing is the most intensive activity, followed by clubs (football clubs, tennis clubs and so on), and then travel, with being at home the least active. If, as discussed above, children are being required to be guarded by their parents, 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.

Table 25 - Intensity of various events undertaken by children in activity calories per minute

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

Source: RT3 accelerometers and activity and travel diaries in Children's Car Use study.

Travel is shown to be fairly active in Table 25. However, it is obvious that the different modes require different amounts of effort by the user. Table 26 shows the intensities for the different modes. 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 underestimate 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.

Table 26 - Intensities of children's travel in activity calories per minute

Walking	2.3
Car	1.0
Bicycle	1.7
Bus	1.5
All travel	1.6

Source: RT3 accelerometers and activity and travel diaries in Children's Car Use study

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 it was decided to compare the calories consumed walking to and from school for a week with two hours of physical education (PE) and games lessons which is the recommended standard. As Table 27 shows, for the older children, aged 12-13, walking to and from school for a week uses 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', and the national press (for example, The Times on 22 September 2003).

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, as shown in Table 28.

Table 27 - A comparison of the number of activity calories consumed in a week travelling to and from school with two hours of PE or games lessons

	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 two hours	326	307	388	499	371

Source: RT3 accelerometers and activity and travel diaries in Children's Car Use study
Note: the journeys to and from school have been classified by the mode used for the greatest duration where more than one mode was used.

Table 28 - Intensity of various events in activity calories per minute, classified by the mode of travel used to arrive

	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

Source: RT3s and activity and travel diaries in Children's Car Use study

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 29.

Table 29 - Intensity of various events in activity calories per minute, classified by whether they travel more by walking or by car

	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

Source: RT3s and activity and travel diaries in Children's Car Use study

Another interesting finding about the effects of adult accompaniment on children's travel behaviour comes from the use of GPS monitors along with the accelerometers and diaries in the CAPABLE study. As well as using the intensity of children's activities from the accelerometers, the children's speed of movement over the ground and the sinuosity of their movement measured as the average change of direction in degrees per minute were examined (see Mackett et al (2007) for more detailed information about the methodology). Table 30 shows that children walk faster and straighter when with an adult than when

without. Whilst they are slightly more active when with an adult, the difference is not statistically significant (Mackett et al, 2007). Table 31 shows the differences between boys and girls when walking without an adult, with boys being more active and faster. These can be interpreted in terms of gender differences of behaviour, with boys more inclined to run around, possibly kicking a football around, while girls tend to chat to their friends, meandering along, perhaps looking in the shops (Brown et al, 2009). Whilst we do not fully understand the difference in children's behaviour when an adult is present compared to when there is not, it is clear that there are differences, suggesting that some of children's natural behaviour in using the local environment is inhibited when adults are present. If this is so, then the increase in parental supervision of children when making a journey, as identified above, means that children are losing out on the opportunity to use the local environment as they wish. This may be in terms of social networking or exploring and learning about the environment. Either way it is a loss caused by increasing parental desire to monitor children's activities because of perceived risks to children.

Table 30 - Effects of adult accompaniment on children's walking patterns

	Accompanied by an adult?	
	No	Yes
Speed in metres/second	0.7	0.9
Intensity in 10^{-2} activity calories/second	6.2	6.5
Angle in degrees	52	39

Source: CAPABLE surveys using GPS monitors and RT3 accelerometers and diaries.

Table 31 - Gender differences in children's unaccompanied walking patterns

	Boy	Girl
Speed in metres/second	0.8	0.6
Intensity in 10^{-2} activity calories/second	7.5	5.9
Angle in degrees	52	52

Source: CAPABLE surveys using GPS monitors and RT3 accelerometers and diaries.

Whilst it should be acknowledged that the relationships are not fully understood it 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 affects 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 shown in Table 25, 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).

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.

MEASURES FOR INCREASING CHILDREN'S WALKING AND CYCLING

Physical measures

Some examples of physical measures in the local environment that have been introduced in Great Britain are discussed below (Department for Transport and Department for Education and Skills, 2003a).

- **Traffic calming**, which can make the area around a school safer, such as the example of Lancashire County Council which has introduced over 100 20 mph zones (20 mph is 32 km/hour: the normal speed limit in urban areas is 30 mph, that is 48 km/hour).
- **Safer routes** which means making routes that many children use to walk or cycle safer. This is done by carrying out a 'Child safety audit', to identify child road safety problems and then carrying out appropriate remedial measures. Child pedestrian training and cycling training are seen to be part of such programmes.
- **School infrastructure.** This includes providing secure cycle parking and lockers. The provision of lockers can enable children to carry the minimum amount of equipment each day.
- **School crossing patrols.** These involve a person stopping the traffic to enable children to cross the road safely.

Funding measures

On 2 February 2001 the government made available bursaries for 111 posts across the country to enable 84 local authorities to employ travel plan co-ordinators at a cost of up to £30,000 (about €34,000) a year per post. Later this was increased so that the government was funding 250 school travel advisers out of a fund that was planned to reach £7.5 million (about €8.6 million) by 2004-05. According to the Good Practice Guide (Department for Transport and Department for Education and Skills, 2003a) 2000 school travel plans had been produced since 1999, covering 10% of all schools with a target of all schools having one by 2010.

In order to encourage schools to produce travel plans, the Government provides additional capital grant to schools to spend on measures identified in their travel plans. The amounts depend on pupil numbers but are typically £5,000 (about €5,700) for a primary school and £10,000 (about €11,400) for a secondary school (Department for Transport and Department for Education and Skills, 2003b).

In late 2006, the Department for Transport and the Department for Education and Skills announced a new scheme to encourage the setting up of walking buses by providing grants of £1000 (about €1140) a year for three years to state-funded primary schools in England (Department for Transport, 2007). To be awarded the funding the school's headteacher had to have a reasonable expectation that a 'walking bus' would save an extra 5 return car trips per day, on average over the whole year. Smaller grants of £500 (about €570) were made available for other walking initiatives such as 'Walk on Wednesday' and 'Go for Gold'.

Organizing school trips

Various initiatives to organise trips to school have been implemented in Great Britain, one of which is walking buses, in which a group of children walking to school is escorted by a small number of adult volunteers, stopping on the way to pick up more children.

The first walking bus in Great Britain was set up at Wheatfields School in St Albans in early 1998. Further walking buses have been set up in many schools since then. Children who live too far from the school to walk all the way can be dropped off at a convenient meeting point and then be escorted the rest of the way. 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 were analysed 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) whilst acknowledging that caution was required in assessing the evidence.

Cycle trains are similar to walking buses but involve a group of parents and children cycling together. Woodford Halse Church of England Primary School in Northampton has set one up, involving 14 children and three or four adults (Department for Transport and Department for Education and Skills, 2003a).

Campaigns

'Are you doing your bit?' was a national campaign launched in 1998 by the Department of the Environment, Transport and the Regions (now the Department for Transport) about sustainable development. It focused on several messages including encouraging people to change their travel habits, including children travelling to school. The campaign included national advertising, media relations and sponsorship to communicate campaign messages (Davis, 1999).

The Healthy Schools Programme was set up by the Department of Health and the Department for Education and Employment (now the Department for Children, Families and Schools (2008)). It was based on a whole-school approach to physical and emotional well-being focused on four core themes:

- Personal, social and health education;
- Healthy eating;
- Physical activity;
- Emotional health and wellbeing.

Encouraging a healthy form of travel to school was seen as a useful contribution to the programme.

The Safe and Sound Challenge was launched in January 1999 as part of the Healthy Schools Programme (Department for Transport, 2002). The aim was to increase the number of children and young people who walked or cycled to school safely through innovative travel schemes. In the first stage of the Challenge, winning schools were awarded prizes of up to £6,000 (about €6,800) for their proposals. Part II extended the challenge to schools that were unable to take part in the first stage, inviting them to develop innovative and healthy schemes to promote healthy and safe travel to school. Successful entries included:

- Pedestrian training;
- Cyclist training;
- Walking bus schemes;
- Installation of secure cycle parking;
- Education programmes aimed at parents, teachers and pupils;
- Training of volunteers to provide safety advice.

'Bike it' is a programme launched by Sustrans (2008a) to increase levels of cycling by encouraging schools to make the case for cycling in their school travel plans. Sustrans is a charity committed to encouraging the use of sustainable forms of travel. Sustrans (2008b) has also issued the report 'Cycling with children' to identify ways in which parents can encourage their children to cycle.

Local authorities sometimes set up their own local campaigns, for example, Buckinghamshire County Council's 'Go for Gold' park and stride incentive scheme under which children who walk to school are rewarded with coloured stickers which can be exchanged for prizes.

Educational programmes

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

Information

In 1998 the 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.

In 1999 the Department of the Environment, Transport and Regions (1999a) issued a best practice guide for local authorities, documenting case studies for 30 schools, including evidence from the students about what they felt about transport issues and what the school was doing. The schools were arranged under three headings: urban schools, inner city schools and rural schools. The descriptions include background information, school travel initiatives, local authority initiatives, implementation, the future and contact details. This was complemented by 'A Safer Journey to School', a separate guide to school travel plans, specifically designed by Transport 2000 for schools (parents, teachers and governors) (Transport 2000 Trust, 1999). It also produced a database of classroom materials (which no longer seems to be available at www.databases.dft.gov.uk/schools). In addition the following were produced (Department for Transport, 2002):

- School travel resource pack for teachers, parents and governors provides information and materials for use in the development of a school travel plan;
- The school travel resource pack slide set;
- Travel to school survey questionnaire which was part of the school travel resource pack. It was in two parts: a tutor-led questionnaire and a pupil questionnaire.

The UK Government is keen to encourage the use of modes other than the car to travel to school. The Department for Transport published a number of documents jointly with the Department for Education and Skills (now the Department for Children, Families and Schools), a report on 'good practice' including descriptions of a number of schemes and an 'action plan' to suggest ways of encouraging more walking and cycling to school (Department for Transport and Department for Education and Skills, 2003a, b).

The Good Practice Guide (Department for Transport and Department for Education and Skills, 2003a) discusses how sustainable travel and road safety can be incorporated into the curriculum, how school travel plans can be developed, and sources of experience in developing them. Many examples are cited, covering a range of topics. These include the following measures to increasing the volumes of walking and cycling:

- Traffic calming;
- Safer;
- School infrastructure and policies;
- School crossing patrols;
- Walking buses;
- Cycle trains;
- Training;

- Personal security;
- Ethos - local authorities and schools can encourage an environment in walking and cycling are encouraged and car use discouraged.

The Department for Education and Skills has stated that it will revise its guidance on school uniform policy so that schools could take into account the needs of children who wished to walk or cycle.

One of the concerns of parents about children walking is personal security. This has been examined in a report covering wider aspects of the subject (Department for the Environment, Transport and the Regions, 1999b). One of the major concerns of parents is the perceived potential risk posed to their children by strangers. This can be addressed as part of local crime prevention strategies and through providing guidance to children through appropriate videos and other media tools.

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

Whilst it should be acknowledged that that a wide range of initiatives have been tried to increase children's volumes of walking and cycling, it should be 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.

It should be noted that the vast majority of schemes are targeted at the education trips, despite the evidence shown above that the growth in car use for children is mainly in trips not to or from school. The reasons for targeting education trips are that they are well defined and because schools can take the initiative. It is possible that some children who have switched from car to walking or cycling to school may consequently decide to walk or cycle more to other destinations. However, this does not seem likely to be a major effect because the number of children who can switch their mode of travel to school is probably fairly small because, for many children, once the choice of school has been made, they are locked into use of the car. Also, given that many parents accompany children on many of their trips to destinations other than school because of the perceived risks, and adults tend to use the car, it is likely that even if children have been encouraged to walk or cycle to school, their parents' concerns about the perceived risks may mean that they continue to use the car for other trips.

CONCLUSIONS

This paper has shown that children have different patterns of travel to adults, partly because they take part in different activities, but also because of the tendency for parents to wish 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, particularly after school and at weekends. Walking and cycling cause the consumption of more activity 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 more than they used to is because trips to school are longer than they used to be. This is, almost certainly, associated with the policy of giving parents the choice of school. 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 choice of 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. It is clear from the evidence presented here that this has implications for the children's volumes of physical activity and their social networking, 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, it is important to recognise that many children are being dropped at school by parents driving to work and elsewhere, which means that even if they children switched to walking or cycling, there would not be a huge reduction in traffic during the morning peak.

It has been shown that a variety of measures have been introduced to encourage children to walk or 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 that there are very many children who can switch from the car because of earlier decisions about the choice of school. It is also not clear that, even if more children are encouraged to walk and cycle to school, this will translate into many modal shifts for non-education trips because of parental involvement in children's travel decisions reflecting their concerns about the perceived risks.

Taking a more optimistic view, if children do walk to and from school they may well acquire the skills and confidence to go out alone, and, probably more crucially, their parents may develop the confidence to let them. Parents are recognising the risks to children of obesity and other health risks associated with sedentary lifestyles and so 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, so this may lead to children having greater independent mobility.

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 considerable determination and expenditure to tackle. However, the cost of not addressing them, in terms of both personal wellbeing and national expenditure is huge, for example because of the decrease in health resulting from conditions associated with reduced physical activity, which include strokes, heart disease and type 2 diabetes. This means that action is required now.

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