

CHILDREN'S CAR USE: THE IMPLICATIONS FOR HEALTH AND SUSTAINABILITY

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1. INTRODUCTION

Car use is growing rapidly. Children use the car less than that the rest of the population, on average, but their use of it is growing at a similar rate. The implications of this growth are being explored in a project being carried out in the Centre for Transport Studies at University College London (UCL). One strand of the work involves surveys of school children and their parents, plus anthropometric measurements of the children's bodies. The preliminary results from these surveys provide the basis of a number of issues that are considered in this paper. It should be stressed that this is an exploratory analysis to identify issues for further investigation in later stages of the project.

2. THE GROWTH IN CHILDREN'S CAR USE IN GREAT BRITAIN

Table 1 shows how the percentage of trips and distance travelled by car in Britain has increased both for the total population and for children using figures from the National Travel Survey (NTS). It can be seen that in 1964, 32% of all trips were by car. By 1985/86, this had increased to 50%, and by 1997/99, this had increased further to 65%, implying that almost two-thirds of trips are by car. Children make fewer trips by car than the whole population, but it is clear that they are following the same trend: between 1964 and the present, car use by children increased from fewer than 20% of trips to almost half. When the distance travelled is considered, the dominance of the car is even clearer. Back in 1964, just under half the total distance travelled by the whole population was by car; by 1997/99 it was over three-quarters. Children have followed the same upward trend, with 70% of their current travel by car.

Table 1 Percentage of trips and distance travelled that are by car

	Trips			Distance		
	1964	1985/86	1997/99	1964	1985/86	1997/99
All	32	50	65	46	71	78
Children	19	31	47	37	64	70

Source: National Travel Survey, 1964, and special tabulations from the National Travel Survey for 1985/86 and 1997/99.

*Note: The data for 1964 are for stages, but 93% of trips were single stage;
For 1964 children are aged 3-15; for 1985/86 and 1997/99 they are aged 5-16.*

The focus of the research discussed in this paper is school children under the age of 13. Table 2 shows the national picture in terms of the average number of trips made by children aged 5 to 10 years. They made 869 trips a year on average in 1997/99. Of these, 57% were by car and 36% were walked. Back in 1985/86, only 41% of their trips were by car, and 49% were walked. This implies a significant modal shift over a period of about twelve years.

Table 2 Average annual number of trips by children aged 5-10 by trip purpose and mode

	1985/86			1997/99		
	Education	Other	All purposes	Education	Other	All purposes
Car	84	286	370	120	371	491
Walk	254	185	439	168	146	314
Other	43	44	87	28	36	64
All modes	380	515	895	316	553	869

Source: Special tabulations from the National Travel Survey, 1986/86 and 1997/99, Department of Transport, Local Government and the Regions.

It can be seen that education trips, that is, trips to and from school, are a minority of children's trips, at about 36% in 1997/99, a decrease from the 42% in 1985/86. In 1997/99, trips to school by car only represented about 14% of children's trips, an increase from the 1985/86 figure of 9%, but rather small compared with the 43% for trips for other purposes. This difference is reinforced by the fact that 67% of children's non-education trips were by car in 1997/99, an increase from the 1985/86 figure of 56%.

These national figures suggest that there is significant growth in car use by children, but most of it is for non-education trips. If the figures for the distance travelled are considered then the trends are even more dramatic. These trends are likely to continue, raising serious policy questions because of the high levels of children's car dependency that are likely to result (Mackett, 2002). There is certainly scope for investigation into the nature of travel by children and the reasons for it. A research project to do this is described in the next section.

3. THE CONTEXT OF THE RESEARCH

This work described in this paper is being carried out as part of a project entitled 'Reducing children's car use: the health and potential car dependency impacts' being carried out in the Centre for Transport Studies at University College London. It is being funded by the EPSRC (Engineering and Physical Sciences Research Council) under the Future Integrated Transport (FIT) programme for three years commencing January 2001. The objectives of the project are as follows:

- a) To examine the effects of car use on children's physical activity and health;

- b) To examine the effects of car use by children on their potential long-term car dependency;
- c) To develop a framework to evaluate the impacts of travel-to-school initiatives systematically.

The Principal Investigator and Project Manager is Roger Mackett, Professor of Transport Studies at UCL. The research team at UCL consists of Lindsey Lucas, James Paskins and Dr Jill Turbin. Professor Neil Armstrong of the Children's Health and Exercise Research Centre at the University of Exeter and Dr Laurel Edmunds of the Department of Public Health at the University of Oxford are providing expertise on measuring children's physical activity patterns and relating these to health issues. Expertise on children's health and its relationship with transport is being provided by Professor Mark McCarthy of the Department of Epidemiology and Public Health Medicine at UCL. Information about the journey to school initiatives and their implementation and potential impacts is being provided by the Environment Department of Hertfordshire County Council. Dissemination of the research findings to health professionals and subsequent recommendations on how research in this area can inform evaluation of local healthy transport initiatives is being assisted by Adrian Coggins, a Health Promotion Adviser based in Hertfordshire. The fieldwork is all based in Hertfordshire, an area to the north of London. Further information about the project is available via the World Wide Web at www.ucl.ac.uk/transport-studies/chcaruse.htm .

In order to achieve these objectives, the project has been divided into a set of work packages, which are:

- a) Questionnaire surveys of children and their parents and anthropometric measurements of the children;
- b) Analysis of children's activity patterns using RT3 portable monitors and relating this to their lifestyles;
- c) Evaluation of travel-to-school initiatives, focusing initially on walking buses (Mackett et al, 2002b).;
- d) Analysis of the attitudes of teenagers to the car;
- e) Analysis of the effects of car use on children's cognitive and mental development;
- f) Analysis of the role of women in children's travel decisions.

The work being discussed here comes from Work Package (a).

4. THE SCHOOLS SURVEYS

Surveys have been carried out in ten schools in Hertfordshire. All the schools are involved in Hertfordshire County Council's Safer Routes to Schools initiative. For a number of years, the transport consultancy Mouchel has carried out questionnaire surveys of children in schools and their parents on behalf of the County Council. It was agreed that there would be active co-operation between that work and the research on the project described in the previous section. This meant increasing the range of topics covered to include questions on children's physical activity, and parents' use of the car and their attitudes about their children's travel behaviour. Staff from the UCL project put effort into increasing the response rates, and ensuring that the questionnaires completed by the children could be linked with those from the parents at the individual level. Also, measurements were made of the children's weight, height and body-fat content. This means that there are now available the results from a questionnaire survey of the children about their travel and physical activity patterns, a questionnaire survey of their parents covering issues such as household characteristics and use of the car, and anthropometric measurements of the children from which their body composition can be calculated.

A total of 849 pupils in three year-group cohorts were covered by the surveys. As shown in Table 3, the children are in Years 4, 5 and 7, with typical ages of 9, 10 and 12 respectively. Response rates of 95% were obtained in the pupil survey, 70% in the parent survey, and 88% for the anthropometric data exercise. Complete data from all three surveys were obtained for 65% of the children. The data have been checked for inconsistencies and missing values. All the data in this paper are based on the 549 pupils who were covered by all three surveys, in order to ensure consistency between the tables.

Table 3 The schools survey

Cohort	Typical age	Children's questionnaire		Parents' questionnaire		Anthropometric measurements		All surveys	
		No	Response rate	No	Response rate	No	Response rate	No	Response rate
A (Y4)	9	321	98	229	70	297	91	213	65
B (Y5)	10	324	96	241	72	304	90	227	68
C (Y7)	12	162	87	123	66	148	79	109	58
Total		807	95	593	70	749	88	549	65

Source: The schools survey in the project on children's car use

These data are used as the basis of the analysis in the rest of this paper. In the next section, the use of the car by children identified in the surveys is discussed.

5. CHILDREN'S CAR USE IN HERTFORDSHIRE

Table 4 shows the modal choice by children to school and to after-school activities. The mode shown is for trips to the latter not held at the children's schools. For the journey to school, the percentage by car is identical, at 38%, to

the national figure for 1997/99 implied by the figures in Table 2 (for a slightly different age group). The figure for walking at 50% is slightly below the national figure of 53%. It can be seen that car use is higher to after-school activities (62%) than to school, with relatively little walking (20%). The equivalent figures for all non-education trips by children from the NTS are 67% and 26% respectively. If the non-responses from the Hertfordshire figures are excluded, because these children probably do not attend such activities, the figures are 72% and 23% respectively. This all suggests that the Hertfordshire figures are in reasonable agreement with the national figures from NTS. It should be borne in mind that the NTS figures for all non-education trips are being compared with trips to after-school activities for Hertfordshire.

Table 4 Modal choice for trips by children

	Trips to school		Trips to after-school activities	
	Number	%	Number	%
Car	210	38	340	62
Walk	272	50	110	20
Cycle	4	1	18	3
Bus	63	12	7	1
No response	-	-	74	13
Total	549	100	549	100

Source: The schools survey in the project on children's car use.

One obvious reason for the high levels of car use by children is car availability. Table 5 shows the percentage of trips to school and after-school activities by household car ownership level. It can be seen that for trips to school, 39% of children in households with a car are taken in it, and that having more than one car does not seem to affect this significantly. 8% of children from households with no car are taken by car, presumably, by parents of other children at the same school. For after-school activities, 31% of these children are taken by car, suggesting that for children, having no car in the household is not necessarily a bar to car use for some trip purposes. Having more than one car does increase the likelihood of a child being taken by car to after-school activities to some extent.

Table 5 Percentage of trips by car by children by household car ownership

	Trips to school	Trips to after-school activities
0 cars	8	31
1 car	39	57
2+ cars	39	66
No response	-	2
Overall	39	62

Source: The schools survey in the project on children's car use.

It is clear that there are high levels of car use by children in the Hertfordshire sample. Table 6 compares the level of car ownership for the Hertfordshire sample with national figures. It can be seen in Table 6 that only 2% of the children in the sample live in households without a car, and that 66% live in households with two or more cars. This is very high car ownership compared with the national average, where 28% of households own no car and only 26% have two or more cars. An interesting question is whether the difference is due to it being Hertfordshire, which is relatively wealthy, or is it because the households all contain children, or is the sample biased towards children from households with particularly high car ownership? Table 6 shows the car ownership levels for all households in Britain consisting of two adults plus children, and for the whole population of South-East England, which is where Hertfordshire is located. It looks to a combination of these factors. The national sample of households with children has much higher car ownership than the whole population, with only 9% having no car and 44% with two or more. South-East England also has a higher car ownership level than the rest of the country. Putting these two facts together, it is not surprising that the sample lives in households with very high car ownership. Given that, as has already been shown, car use by the sample is consistent with that for children nationally, the sample does not seem to have higher car ownership than would be expected given the type of area they live in. What this does suggest is that households with children tend to have high car ownership. This will be partly due to the fact that most of the households will contain two people who can drive, but suggests that having children may be a causal factor in the decision to own more than one car.

Table 6 Percentage household car ownership

	0 cars	1 car	2+ car	Total
Sample of children in Hertfordshire	2	29	66	100
Great Britain – whole population	28	45	26	100
Great Britain – households with two adults plus children	9	47	44	100
South-East England – whole population	20	48	32	100

Sources: Schools survey of children in Hertfordshire, 1998/2000 National Travel Survey, and Focus on Personal Travel, Department of Transport, Local Government and the Regions, 2001 (The Stationery Office, London).

There may be variation in the level of car use by age and gender which may help to explain why it is so high. Table 7 shows the percentage car use for the three school years covered in the survey. For trips to school there is a significant decline in car use with age, as children become more confident about travelling without an adult, or, perhaps, more significantly, their parents are prepared to allow them out without adult supervision. However, there is

not such a strong decline for travel to after-school activities. It may be that, as children become older, they are more likely to go to activities further away and later into the evening, so parents feel a greater obligation to take them by car. For trips to school, the picture is complicated by the fact that the children will have transferred schools whilst in this age range. This means that it may be further to school. In some cases this will have led to free bus travel.

Table 7 Percentage of trips by car by children by age cohort

	Typical age	Trips to school	Trips to after-school activities
Year 4	9	52	63
Year 5	10	35	65
Year 7	12	19	53
Overall		39	62

Source: The schools survey in the project on children's car use.

Girls seem to be taken by car more than boys, for both trips to school and to after-school activities, as shown in Table 8. It will be shown later that parental peace-of-mind is one of the reasons that so many parents take their children to school by car, and it may be that parents perceive that girls are more vulnerable to dangers posed by hostile adults than boys. If this is the case, it may be more true in Britain than elsewhere: in Britain, widespread publicity has been given to the tragic, but rare, cases of children being attacked by strangers, and the victims have usually been female. In Norway, Ryeng and Rostoft (2002) found more boys being taken to school by car than girls.

Table 8 Percentage of trips by car by children by gender

	Trips to school	Trips to after-school activities
Male	36	60
Female	41	64
Overall	39	62

Source: The schools survey in the project on children's car use.

6. THE ROLE OF EDUCATION AND TRAINING

One of the objectives of the project on children's car use is to establish the effects of interventions on children's car use, and to develop a methodology for the systematic evaluation of such interventions. As a preliminary approach to this topic, the 192 children who had transferred from a primary or first school were asked about five different interventions which they might have had at that school. The five interventions were:

- Class activities about how much exercise and activity people need
- Class activities about how people travel
- Road safety or pedestrian skills training
- Attendance at a cycle training course

- Use of a walking bus

The present mode used to school is shown in Table 9 for those children who were subject to such interventions. Of the 192 children, 92 had class activities about exercise and activity, 90 had class activities about how people travel, 63 had a course on road safety or pedestrian training, 46 went on a cycle training course, and 15 used a walking bus to travel to school. Some of the children had been subject to more than one intervention, and some may have been subject to none.

Table 9 Education and experience at a previous school about travelling and mode choice to school

	Car		Walk		Cycle		Bus		Total	
	No	%	N	%	No	%	No	%	No	%
Class activities about exercise and activity	15	16	46	50	0	0	31	34	92	100
Class activities about how people travel	15	17	44	49	0	0	31	34	90	100
Road safety or pedestrian skills course	10	16	33	52	0	0	20	32	63	100
Cycle training course	6	13	23	50	1	2	16	35	46	100
Used a walking bus	0	0	11	73	0	0	4	27	15	100
Total	32	17	98	51	1	1	61	32	192	100

Source: The schools survey in the project on children's car use.

Note: This question was only asked of the 192 children who now attend middle schools and so could provide information about their previous school.

The first four interventions listed seem to have had little impact on the choice of mode to school, in that the proportions walking and using car do not vary much from the mean for all 192 children. Only one child cycles to school, and he or she did attend a cycle training course, so that might be a small, but useful, successful outcome. The most interesting result is for the 15 children who previously travelled to school by walking bus. None of them now travel to school by car and 11 of them walk, with the other four going by bus. There is anecdotal evidence from the part of the project on the evaluation of walking buses (Mackett et al, 2002b) that some parents whose children have grown out of using the walking bus, are willing to let them walk, with confidence that the children are trained in pedestrian skills. Of the five interventions cited, the walking bus is unique in that it is the only one in which parents are actively involved, and it is the parents who largely decide how the children travel to school. This suggests that active involvement of parents in interventions, rather than just educating the children, is required for them to have an impact.

7. THE EFFECTS OF PARENTAL ATTITUDES AND BEHAVIOUR

Of the 549 children in the sample, 208 travel to school by car. Table 10 shows the reasons given by their parents for driving them to school. The main reason

given is that the school is on the route to work. That is, 39% of the children are dropped off at school by a parent who then travels on to work. The implications of this are discussed below. The second reason given is, that it is too far to walk. This implies that the parents do not regard cycling or the bus as feasible options, so the only way for the child to travel is to go by car. Safety and security factors were each mentioned by 31% of the parents: 66 of them want the peace of mind of know that their child has arrived safely, while 64 gave road safety as a reason. The former was included as a euphemism for safety from hostile strangers, with the wording chosen to avoid raising unnecessary concern. Saving time was cited by 28% of the parents, reflecting a finding from previous research on why people use cars for short trips (Mackett, 2000) which found that shortage of time in the morning was a significant factor in using the car to take children to school. Other reasons given were the convenience of using the car when taking children to more than one school, and the lack of a suitable bus route. The 'Other' reasons given were mainly concerned with bad weather and the need to carry heavy bags and other items.

Table 10 Reasons given by parents for driving their child to school

	Number	%
School is on route to work	82	39
Too far to walk	79	38
Peace of mind – to know they have arrived safely	66	31
Roads are too dangerous to walk or cycle	64	31
Time – it is quicker by car	59	28
Convenience when taking children to different schools	33	16
Lack of a suitable bus route	19	9
Other	14	7
Total	206	100

Source: The schools survey in the project on children's car use.

Note: These responses are for the 208 children who travel to school by car; respondents were not restricted to only one answer.

The nature of the car trips to school is shown in Table 11. It can be seen that only 28% of the 208 trips were being made to especially to take children to school. The majority were made as part of a longer trip: 47% of the parents were going on to work, 15% were involved in a complex trip taking two or more children to school or nursery, and 7% were going on to other destinations. These figures are reasonably consistent with those cited by Bradshaw and Jones (2000), which showed that significant proportions of trips by car to school, are part of longer trips, usually to work. This has very important policy implications because even if many children are encouraged to switch from the car to other means of travel, most of those car trips will continue to be made. NTS for 1998/2000 (Department of Transport, Local Government and the Regions, 2001) shows that 10% of the traffic in the period 0800 to 0859 in urban areas in term time is cars taking children to school. The evidence from these surveys suggests that many of the drivers are going on to other destinations, so getting the children to switch to

alternatives may reduce localised congestion around the school entrance, but it will not do much for overall traffic levels. Anecdotally, it is sometimes observed that there is less traffic on the roads during school holidays, and that the difference from term time may be attributed to the use of the car to take children to school. Bradshaw and Jones (2000) analysed NTS data and showed that most (69%) of the difference in car mileage between school term and school holiday was due to commuting, business and work-related trips, and only 28% was due to the reduction in education escort trips. It is likely that the extra commuting, business and work-related trips during term time were being made by parents who use some or all of the school holidays to go away for holidays or to look after the children at home.

Table 11 The nature of school trips by car

	%
Trip made solely to take child to school	28
Trip to school made in the course of a trip to work	47
Trip to school made in the course of a trip to another school or nursery	15
Trip to school made in the course of a trip to another destination	7
Not answered	4
Total	100

Source: The schools survey in the project on children's car use.

Some aspects of the effects of parental behaviour on the choice of mode for children have been discussed above. One issue that is being explored in the project is whether children are being brought up with little experience of modes other than the car which may mean that when they become adults they will have difficulty in using other modes and so will resist policies to reduce car use. It has been shown elsewhere (Mackett et al, 2002a) that some of the children hardly ever use any form of travel other than the car, and that this is probably related to a very high level of car usage by their parents. In order to try to establish this, the parents were asked whether or not the car was usually used to go to five activities: the main grocery shopping for the household, going swimming at the nearest pool, visiting the nearest town centre, visiting the nearest post office, and visiting the public library. The households were then classified into categories according to how many of the activities they used the car for. Table 12 shows the percentage of children in households where the answer was zero, where the car was used for some but not all the activities, and where it was used for all five activities. It can be seen that children from households where the parents do not use the car for travelling to any of these activities are much less likely to travel to school and after-school activities by car than other children, whereas those children whose parents use the car to go to all five activities are much more likely to go to school and after-school activities by car. Of course, this may be partly related to the location of the home relative to the various destinations, with some of the households living in relatively isolated rural locations which make it rather impractical to travel other by car, but for many of them, the choice of location would have been an explicit decision which made the household become car dependent. In other cases, the

household may simply have got into the habit of using the car whatever the trip. Either way, the children may be growing up with little or no experience of the alternatives.

Table12 Parental car use for trips to all five activities disaggregated by children's car use to school and after-school activities

	Trips to school	Trips to after-school activities
Car not used by parents	22	39
Car used to some activities by parents	34	60
Car used to all activities by parents	49	69
Overall	39	62

Source: The schools survey in the project on children's car use.

Note: the five activities are: main grocery shopping, going swimming at the nearest pool, visiting the nearest town centre, visiting the post office, and visiting the library.

8. THE RELATIONSHIP OF CAR USE TO ACTIVITY AND HEALTH

The final theme to be explored in this paper is the relationship between car use by children and their health and activity. Increased physical activity by children can bring various health benefits either in childhood or in later life, including reduced risk of heart disease, stroke, obesity and osteoporosis, and enhanced mental health and quality of life (Health Education Authority, 1997, Sustrans, undated). One way to increase the amount of physical activity by children is for those who travel by car to switch to walking or cycling. This view was expressed in the White Paper on Transport, issued in the Summer of 1998, which stated: "Not walking or cycling to school means that children get much less exercise and builds in car dependency at an early age" (Department of the Environment, Transport and the Regions, 1998, paragraph 5.29). It may be more complicated than this, because it is possible that some children who are walking to school are then so exhausted that they cannot take part in voluntary physical activity, while those who car by car arrive rested and so can run round at school break times. Similarly, many of the after-school activities are physical activities, so it is conceivable that there are children being taken by car to activities that are far more physically demanding than a short walk. Whilst both these scenarios are possible, they seem to be unlikely in most cases. What is clear, is that there is a complex relationship between physical activity, health and travel patterns which will be explored in the project. At this stage, some of the possible linkages will be identified for deeper analysis later in the project.

The 549 children were all weighed and measured. From these data, their Body Mass Index (BMI) can be calculated as the ratio of their weight in kilograms to the square of their height in metres. For adults, being overweight is defined as having a BMI of over 25, and being obese is having a BMI of over 30. For children the picture is more complex because children's bodies go through significant changes as they mature. Values which vary by the age

and gender of children have been used to determine which children are overweight (Cole et al, 2000).

Table 13 shows the mode of transport used to school and after-school activities for children classified by whether they were of normal weight or overweight. (The overweight category includes the 4% who were classified as obese, but the numbers were too small to be analysed separately). From an analytical point of view, one would like to see a clear picture that shows that those who go by car tend to be more overweight than those who do not. The evidence here does not seem to support this hypothesis. There appears to be more children of normal weight going by car than overweight ones. This issue may be very complex, for example, by being related to changing patterns of development in children. One way to look at this is to consider the pattern of change of body composition with age, as shown in Table 14. The children in the middle age group have the highest proportion who are overweight. This may be consistent with how children develop, and needs to be disaggregated by gender for further analysis.

Table 13 Percentage of children by body composition who use each mode of travel

	Trips to school			Trips to after-school activities		
	Normal weight	Overweight	All	Normal weight	Overweight	All
Car	39	37	38	63	58	62
Walk	50	50	50	20	22	20
Cycle	1	1	1	3	4	3
Bus	11	12	11	2	0	1
No response	0	0	0	13	16	13
Total	100	100	100	100	100	100

Source: The schools survey in the project on children's car use.

Table 14 Percentage of children by body composition by age cohort

	Normal weight	Overweight	All
Year 4	81	19	100
Year 5	77	23	100
Year 7	82	18	100
All	79	21	100

Source: The schools survey in the project on children's car use.

An alternative approach to considering body composition is to look at the quantity of physical activity. This was covered in the surveys by asking the children about what they do during their morning break and lunch break in terms of degree of physical activity. The responses have been classified into 'active' and 'not active'. Not surprisingly, there was a high correlation between the answers for the two break periods. In this paper, the answers for the lunch

break have been used because it is the longer period, with greater scope for a range of activities to be pursued. Table 15 shows the percentage of children who are active or non-active, by mode of travel. These figures suggest that the children who are active during break time are more likely to be active in terms of walking to school rather than going by car. There is not such a well-defined relationship for after-school activities. The survey questions about the after-school activities included disaggregation by the intensity of these activities, so that needs to be considered in the further analysis.

Table 15 Percentage of children by activity level and mode of travel

	Trips to school			Trips to after-school activities		
	Active	Not active	All	Active	Not active	All
Car	37	41	38	62	63	62
Walk	52	45	50	21	18	20
Cycle	1	1	1	3	4	3
Bus	10	12	11	1	2	1
No response	0	1	0	12	13	13
Total	100	100	100	100	100	100

Source: The schools survey in the project on children's car use.

The information in Table 15 suggests that there may be a relationship between the mode of travel to school and level of physical activity at school, but this needs systematic analysis in order to substantiate it. The figures in Table 13 showed no evidence of a relationship between mode of travel to school and body composition. However, when the level of activity and body composition are compared, as in Table 16, there does seem to be a relationship: the overweight children appear to be less active. Even if there is a relationship, the direction of causality is not clear: are the children overweight because they are less active, or are they less active because they are overweight? Clearly, there needs to be more research on this, which is the subject of Work Package (b) on the analysis of children's activity patterns using RT3 portable monitors and relating this to their lifestyles. On the basis of the evidence here, the relationship between children's car use and health seems to be from mode of travel to level of physical activity to body composition to health. The key question is: do interventions that encourage children to walk (or cycle) rather than use the car work through this chain of relationships to better health? That is one of the major issues to be addressed in this research project.

Table 16 Percentage of children by body composition by activity level

	Normal weight	Overweight	All
Not active	30	37	32
Active	70	63	68
All	100	100	100

Source: The schools survey in the project on children's car use.

9. CONCLUSIONS

This paper contains a preliminary analysis of survey data relating children's car use to a variety of factors. It has raised many issues for further analysis, and so any conclusions must be regarded as tentative at this stage.

Children have high levels of car use, and it is growing. Most of children's travel is not to school, and car use is higher on non-education trips than on education trips. This means that attention needs to be paid to non-education trips, although it is recognised that it may be easier to change education trips. These trends are likely to continue, raising serious policy questions because of the high levels of children's car dependency that are likely to result. There is scope for further investigation. A research project to do this is being carried out in the Centre for Transport Studies at UCL. As part of this project, questionnaire surveys have been carried out of children and their parents, and the children have been weighed and measured, and their body-fat content measured. These surveys provide the data which has been analysed in this paper.

The children in the sample have high levels of car use, broadly in line with national figures. They live in households with very high levels of car ownership, with 66% owning two or more cars and only 2% living in households without a car. The high levels of car ownership reflect the relatively high levels in the South-East Region which is a wealthy part of Britain, but it also suggests that children may be a causal factor in the high levels of car ownership. Even children who live in households without a car make many trips to after-school activities by car, presumably travelling with their friends.

Car use to school declines with age, but it does not seem to do so for after-school activities which may reflect the changing nature and location of such activities with age. Girls are more likely to be taken by car than boys.

The effects of five interventions related to travel on children's modal usage have been examined. Four of the five seem to have had little effect, but many children who previously used a walking bus to travel to school seem to continue to walk, suggesting that this may be a successful intervention.

Most of the trips to school by car are part of more complex trips to other destinations, usually work, but sometimes to take other children to school or to other destinations. This has important implications for policies to reduce car use, because it suggests that encouraging children to switch from car use to other modes for trips to school will do relatively little to reduce the amount of traffic in the morning peak.

Parental concerns about safety and security are major reasons why children are taken to school by car. This, together with the finding on the impacts of walking buses, suggests that parents need to be actively involved in education and training about how children should travel rather than just the children. It

also suggests that action should be targeted at ways of overcoming parental concerns about safety and security.

Many of the children with high levels of car use live in households where the parents have high levels of car use. It is recognised that this may be because of the location of the home relative to various activity centres including schools, but if this is the case, it suggests that there is a need to encourage households to consider the long-term travel implications of decisions about where to live. Whatever the reason for the high use of the car by the household, there is a serious risk that the children will get into the habit of only using the car. This means that they will have no familiarity with how to use other forms of travel, and so may show significant resistance to policy initiatives to reduce car use in adult life.

The surveys show that the children who are active seem to be more likely to walk rather than use the car compared with other children, and the children who are not overweight are more likely to be active. This implies that there may be a relationship for children between mode of travel, level of activity, body composition and health, but it is complex, and needs further analysis. This analysis will be carried out in this project.

The results presented here are preliminary. They are interesting in their own right, More importantly, they suggest that further analysis will lead to some significant findings on the important issue of the effects of children's car use, particularly in terms of health and car dependency with its implications for sustainability.

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REFERENCES

Bradshaw, R. and Jones, P. (2000) *The Family and the School Run: What would make a real difference?* Scoping report to the AA Foundation for Road Safety Research, Transport Studies Group, University of Westminster.

Cole, T. J., Bellizzi, M. C., Flegal K. M., and Dietz, W. H. (2000) Establishing a standard definition for child overweight and obesity worldwide: international survey, **British Medical Journal**, **320**, 1–6.

Department of the Environment, Transport and the Regions (1998) *A New Deal for Transport: Better for Everyone: The Government's White Paper on the Future of Transport*.

Department of Transport, Local Government and the Regions (2001) *National Travel Survey, 1998-2000 Update*, Transport Statistics Bulletin.

Health Education Authority (1997) *Young People and Physical Activity: Promoting Better Practice*, HEA, London.

Mackett, R. L. (2000) Reports on the project 'Potential for mode transfer of short trips', carried out for the Department of the Environment, Transport and the Regions, available from the World Wide Web at www.ucl.ac.uk/transport-studies/shtrp.htm .

Mackett, R. L. (2002) Increasing car dependency of children: should we be worried? **Proceedings of the Institution of Civil Engineers: Municipal Engineer**, 151 (1) 29-38.

Mackett, R. L., Lucas, L., Paskins, J., and Turbin, J. (2002a) Understanding the car dependency impacts of children's car use, Proceedings of the Workshop on Children and Traffic, held in Copenhagen, May 2002, available from the World Wide Web at www.flux.teksam.ruc.dk/FLUX_UK/ChildrenMob/index_uk_ChildrenMob.htm .

Mackett, R. L., Lucas, L., Paskins, J., and Turbin, J. (2002b) A methodology for evaluating walking buses as an instrument of urban transport policy, paper written for presentation at the First Annual Conference of Special Interest Group 10 (Urban Transport Policy Instruments) of the World Conference on Transport Research Society, Leeds, July 2002.

Ryeng, E. O. and Rostoft, M. S. (2002) Mode choice among school children compared to their motor skills, as well as their freedom to stay and travel outdoors, Proceedings of the Workshop on Children and Traffic, held in Copenhagen, May 2002, available from the World Wide Web at www.flux.teksam.ruc.dk/FLUX_UK/ChildrenMob/index_uk_ChildrenMob.htm .

Sustrans (undated) *The Health Benefits of Safe Routes to School*, Information Sheet FS15, available by telephoning 0117 929 0888.