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Increasing the amount of walking by children

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Abstract

Children's car use is increasing. As a result of this, they are walking less. This has serious implications for their quantity of physical activity and consequently for their health. In this paper, findings are presented from a research project being carried out in the Centre for Transport Studies at University College London to examine these effects. A major element of the research involved fitting 200 children with portable motion sensors for a period of four days to measure their quantity of physical activity. In parallel with this, they kept travel and activity diaries, so that it was possible to establish how much energy they consumed in various activities, including walking. It is shown that walking to school for a week consumes more calories than one week's worth of physical education (PE) and games lessons, and that children who walk to events tend to use more energy in participating in them than children who are driven by car. The effectiveness of a specific initiative to encourage children to shift from the car to walking, namely the walking bus, is examined in detail, and found to be effective in helping to achieve this objective.

Keywords: children; walking; car use; health; physical activity; walking bus.

Topic area: A4 Non-motorized Transport

1 Introduction

In Britain, children are walking less than they used to. As Table 1 shows, the percentage of trips by children that were walked declined from 47% in 1985/86 to 32% in 2002, while the percentage of trips by children that are by car increased from 35% to 56%. Cycling has also shown a major decline, from 4% to 2% of children's trips.

Table 1 Percentage of children using various methods of travel

	1985/86	2002
Walk	47	32
Car	35	56
Bicycle	4	2
Other	14	11
Total	100	100

Source: National Travel Survey 2002 (Department for Transport, 2004)

For trips to school, as shown in Table 2, the percentage of young children walking decreased from 67% in 1985/86 to 51% in 2002 while, for older children, the percentage dropped from 52% to 48% over this period. The net transfer has all been to the car.

Table 2 Percentage of children using various methods of travel to school

	Age 5-10		Age 11-16	
	1985/86	**2002**	**1985/86**	**2002**
Walk	67	51	52	38
Car	22	41	10	24
Bicycle	1	1	6	2
Bus	9	7	29	33
Other	2	1	2	2
All	100	100	100	100

Source: *National Travel Survey 2002 (Department for Transport, 2004)*

The major factor causing the decrease in walking is the growth in car use. There are a number of causal factors including increasing car ownership, the general process of urban decentralisation, school admission policies, women's working and childcare arrangements, and concerns about children's safety. For example, the number of children in Britain aged 5-10 years travelling to school alone fell from 21% in 1985/86 to 10% in 2002 (Department for Transport, 2004). Much of the increasing car use is associated with meeting the needs of children, particularly for short trips (Mackett, 2001, 2003). It is likely that these trends will continue (Mackett, 2002).

Reduced amounts of walking and cycling by children is causing concern at Government level. This was reflected 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).

One of the consequences of reduced quantities of exercise is increasing obesity. The 2003 Annual Report of the UK Chief Medical Officer (Donaldson, 2003) states that the growth in the proportion of overweight and obese children is a major concern. Quoting the Health Survey for England in 2001 (Department of Health, 2003), the Report says 8.5% of 6 year olds and 15% of 15 year olds are obese. Between 1996 and 2001 the proportion of overweight children aged 6-15 years increased by 7% and obese children by 3.5%.

There is considerable evidence that lack of physical activity by adults can lead to a number of adverse health conditions (Department of Health, 2004), but for children, there is less evidence of the benefits and desirable amounts and type of physical activity (Riddoch, 1998). However, Biddle, Sallis and Cavill (1998) argue that there are three main rationales for young people to take part in regular physical activity:

- To optimise physical fitness, current health and well-being, and growth and development;

- To develop active lifestyles that can be maintained throughout adult life;
- To reduce the risk of chronic diseases of adulthood.

They acknowledge that neither the minimal nor the optimal amount of physical activity for children can be defined precisely. Notwithstanding this difficulty, they make the following recommendations:

- All young people should participate in physical activity of at least moderate intensity for one hour per day;
- Young people who currently do little activity should participate in physical activity of at least moderate intensity for at least half an hour per day.

Biddle, Sallis and Cavill (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 activities in which children participate, including travelling to and from school, can contribute to their daily quantum of physical activity, which in turn, should lead to healthier lives. This means that there is a sound reason why children should walk more.

The purpose of this paper is to demonstrate the contribution of walking by children to their quantity of physical activity and how it might be increased. Research addressing these issues is described in the rest of this paper, focusing particularly on the methodology used to collect data on children's travel and activity patterns and on a specific example of an initiative to reverse this shift from walking to the car, namely walking buses. After the results are presented, conclusions are drawn.

2 The research project

This work described in this paper was 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 was 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 were 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 was Roger Mackett, Professor of Transport Studies at UCL. The research team at UCL consisted 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 Division of Child Health at the University of Bristol who provided expertise on measuring children's physical activity patterns and relating these to health issues. Expertise on children's health and its

relationship with transport was 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 was 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 has been assisted by Adrian Coggins, a Health Promotion Adviser based in Hertfordshire. The fieldwork was all based in Hertfordshire, an area to the north of London. Further information about the project is available via the World Wide Web at http://www.cts.ucl.ac.uk/research/chcaruse/.

In order to achieve these objectives, the project was 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 portable motion sensors and relating this to their lifestyles;

c) Evaluation of travel-to-school initiatives;

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;

The work being discussed here comes mainly from Work Packages (b) and (c).

3 Methodology

A major main strand of the project was the assessment of the travel and activity patterns using the portable motion sensors. The equipment used is the RT3 tri-axial accelerometer, manufactured by Stayhealthy, USA. It measures movement in three directions and is worn in a belt around the waist. An example is shown in Figure 1.

The RT3s combine the movements in three directions to produce total activity counts in units of vector magnitude (VM). These were converted to activity calories using formulae programmed into the equipment using data on the age, gender, weight and height of the child. (Activity calories are calories used in undertaking physical activity. The RT3s can also convert activity calories to total calories, i.e. including the calories that are used by the body to function and develop even when the person is passive, by adding on a constant based on the physical characteristics of the person. Activity calories are used in this work).

The RT3s are the size of a small pager and are worn around the waist in a purpose-made holster on a belt. It can be worn for all activities except those which would make it wet. They were set to record movements on a minute-by-minute basis. An example of the output is shown in Figure 2. In this study, the volunteers were asked to wear the monitor from a Wednesday to a Monday, with data being collected for the four days Thursday, Friday, Saturday and Sunday. These days were chosen so that both school days and weekend days were included.

Figure 1 The RT3 motion sensor

The children were asked to keep a travel and activity diary for the four days. An example extract from the diary is shown in Figure 3. The events from the diary have been mapped on the output traces from the RT3s so that the activity levels associated with each event or trip can be identified. (This was done in consultation with the children in order to reduce the number of possible miscodings).

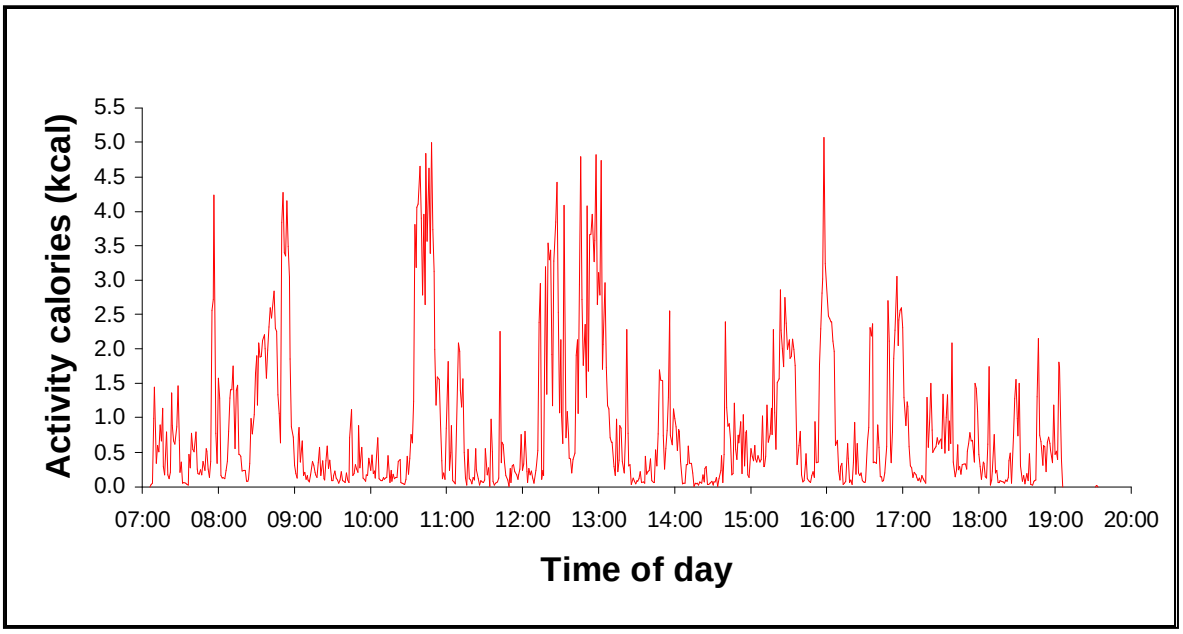

Figure 2 An example of the output from an RT3 motion sensor

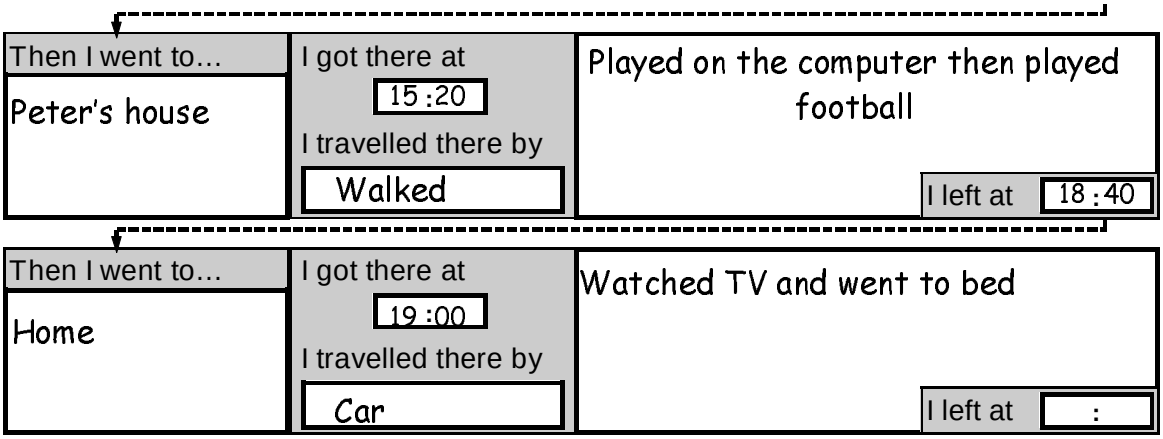

Figure 3 An example extract from a travel and activity diary

Table 3 The classification system for events recorded in the children's diaries

Broad level	Middle level	Narrow level
Travel	Travel to school	Walk, car, bicycle, bus, and other
	Travel from school	Walk, car, bicycle, bus, and other
	Other travel	Walk, car, bicycle, bus, and other
School	PE or games lessons	PE or games lessons
	Other lessons	Other lessons
	Break	Break
Structured out-of-home activities	Structured ball games	Badminton, basketball, cricket, football, golf, netball, squash, and tennis club or lesson
	Other structured sport	Athletics, cycling, dance, gymnastics, horse riding, martial arts, and skating club or lesson
	Organisations	After-school clubs, Air Training Corps, Crusaders, Scouts/Guides, and youth club
	Tuition	Choir, drama, extra tuition, and music lesson
Unstructured out-of-home activities	Unstructured ball games	Badminton, basketball, cricket, football, rounders, tennis, and unclassified ball games
	Other unstructured activities	Cycling, disco, dog walking, jogging, scootering, skateboarding, and walking
	Other outdoor play	Active play and general play
Out-of-home activities shared with parents	Out-of-home activities shared with parents	Appointment, event, fair/fete, meal out, and shopping
In home	At own home	At own home
	At other people's homes	At other people's homes
Other	Physical work	Physical work
	Waiting	Waiting
Not monitored	Not monitored	Not monitored

The events recorded in the children's activity and travel diaries have been classified, using the typology shown in Table 3. There are three levels so that analysis can be carried out using whichever level is most appropriate in terms of the trade-off between the number of cases and having sufficient detail to illustrate the point. It can be seen that five modes of travel have been represented including 'other'. For the school day, the only type of lesson that is differentiated is physical education (PE) or games lessons, since these are likely to be significantly more active than other lessons. Periods not in class have been classified as 'break', including the period before entering school, lunch time and morning break.

Outside school hours, a major area of interest is the distinction between structured and unstructured activities. A structured activity is a collective event where the child's detailed activity is determined by an adult and the nature of the event. A football lesson would be included here, but not a group of friends kicking a football around in the park. An unstructured activity means one where the child determines the level of activity, possibly under the supervision of an adult. In general, there has been a shift from unstructured to structured activities for children, partly because of parental concern about allowing children to be out without adult supervision. It means that children's time out-of-school tends to be more structured with the timetable dictated by the outside agency providing the activity. It also means that parents' lives, particularly mothers', become more complicated and car-oriented, since many such activities are likely to be some distance from home, and within quite narrow time windows, particularly if there is more than one child in the household.

'Active play' describes play where a specific energetic activity, such as 'On the swings' was mentioned. 'Out-of-home activities shared with parents' includes events that parents take children on, but may include similar events which where the child was not accompanied by an adult such as some shopping trips, because the diary did not ask questions about who accompanied the child on a trip.

The category of 'Not monitored' covers the period when the RT3 was not worn, which is mainly when the children were in bed. One important activity that is missing is swimming. This is because the RT3 monitors cannot function if they are wet, so there may be some under-recording of physical activity, but this is likely to be small.

It is recognised that the terminology used in the typology is not perfect. For example, badminton uses a shuttlecock not a ball, but it has been grouped with similar activities. The purpose of the typology is to group activities which require similar levels of calorie consumption. The slightly curious headings reflect a lack of appropriate words to describe the event rather than a misclassification. This is not helped by the ambiguity of the word 'activity', which can mean either any event that a person carries out or imply the level of energy consumed in carrying out an event (that is, there can be active activities and inactive activities, which is rather confusing).

One of the overall objectives of the project is to develop a framework for the systematic evaluation of interventions to improve children's welfare in the fields of travel and physical activity. To do this, a specific case has to be used so that the ideas can be tested in a practical context. The chosen case study is the 'walking bus'. A walking bus is a group of children who walk to school along a set route, collecting other children along the way at 'bus stops', escorted by several adult volunteers, one of whom is at the front (the 'driver') and one is at the back (the 'conductor'). All the children using the walking bus are

registered with it and all the volunteers have undergone training and police checks (or Criminal Record Disclosures which replaced police checks in Britain in April 2002).

In 1993 the concept of walking buses was proposed in a book by David Engwicht (1993). Now there are walking buses in the USA, Canada, Great Britain, Australia, New Zealand, and Denmark. According to CAST (2000), the walking bus set up early in 1998 at Wheatfields Junior School in St Albans was the first in Britain. By 2001, 50 out of 102 local authorities surveyed for the Department for Transport (2001) had implemented one or more walking buses, and a further 31 planned to do so. It was the most common planned initiative. This implies a very rapid rate of growth from the initial one in 1998.

Five walking buses in Hertfordshire have been studied in depth over a year in order to collect data to incorporate into the evaluation framework (Mackett et al 2003a). Use of the evaluation framework involves the identification of all the parties that are active participants and then the collection of data from each of them about the their role and what they see as the outcomes, both positive and negative. The participants involved are the headteacher, the walking bus co-ordinator, the parents, the children and the volunteers (who are usually parents of children using the walking bus). Children who have ceased to use the walking bus (and their parents) were interviewed as well as those still using it. Information was also collected about the walking bus route and where the children live to see how far they walk. This can be compared with their previous journeys in terms of mode used and distance travelled. This is summarised in a table from which a judgement can be made about the success, or otherwise, of a walking bus.

To complement that work by providing evidence across a wider spectrum of situations, and to find out about schools which have not set up walking buses, a postal survey has been conducted. This has covered all the schools in Hertfordshire which have or could have set up a walking bus (Mackett et al, 2003c). Questionnaires were sent to the 41 schools that had asked Hertfordshire County Council (HCC) to check potential walking bus routes for suitability and safety, as at January 2002. The questionnaires sent to the headteachers were in two parts: Part A to be completed by him or her, and Part B to be passed on to the co-ordinator of each walking bus. Twenty-six completed Part A's were received back, and Part B's for 26 walking buses at 23 schools (some schools have more than one walking bus). Of the 26 walking buses, 14 were still active at the time of the survey (May 2002). Of the 26 schools taking part in the postal survey, four were included in the in-depth study (the walking bus at the fifth school was set up later than the others and was not included on the list of 41 schools provided by HCC).

4 Walking as physical activity

The reasons why children should walk more were discussed above: it is a form of physical activity that children already undertake as part of their everyday lives, which can contribute to their health. In the project being described in this paper, data have been collected about children's activities over four days, including the intensity of the activity. From this the contribution of walking can be calculated.

A total of 200 children at eight schools in Hertfordshire were involved in this part of the study. Five children provided inadequate data for analysis, leaving a sample of 195. These are split fairly evenly between boys and girls. They were in two year groups: Year 6

(aged 10-11) and Year 8 (aged 12-13), with rather more in the former than the latter, as shown in Table 4.

Table 4 The number of children providing data for analysis

	Boys	Girls	Total
Year 6 (age 10-11)	54	58	112
Year 8 (age 12-13)	42	41	83
Total	96	99	195

Source: RT3 activity and travel monitoring exercise.

Most of the results are shown for these four age and gender groups, plus overall values. The reason for showing the figures for the individual groups is to avoid cohort effects. For example one type of activity may appear to use more energy than another for the whole population, but if the former one is only done by, say, the older children, who are also more energetic overall, then the overall result alone may be misleading. Similarly there may be activities that are predominantly carried out by one gender group, and that gender may be more active overall, so this would bias the overall picture. The overall figures provide a useful summary, providing care is taken to avoid such cohort effects.

A major theme of the project is to examine the effects of car use on children's health in terms of physical activity. One way to do this is to compare the number of activity calories consumed by the various modes of travel, as shown in Table 5, which shows the 'intensity' of the activity, measured in activity calories consumed each minute, travelling by the various modes.

Table 5 shows that the children, spend over twice as many activity calories per minute walking than going in the car. It should be noted that, as Table 6 shows, few of the children cycled, so the figures for bicycle have to be treated with caution. Only 11% of the younger boys travelled by bus, and none of the younger girls, but many more of the older ones do so, mainly to school.

Table 5 Intensity (activity calories consumed per minute) of travelling by various modes of transport

	Year 6		Year 8		Overall
	Boys	Girls	Boys	Girls	
Walking	2.1	1.9	2.6	3.2	2.5
Car	0.8	0.8	1.0	1.1	0.9
Bicycle	2.0	0.9	1.9	2.4	1.9
Bus	-	1.2	1.5	1.6	1.5
Overall	1.3	1.1	1.7	2.0	1.5

Source: RT3 activity and travel monitoring exercise.

As Table 6 shows, over the four days of the survey, 14% of the children did no walking, while 95% of them made a trip by car. More of the older children walked at least once than the younger children, probably reflecting greater parental willingness to allow the older children out without parental supervision.

Table 6 Percentage of children who used each mode at least once during the survey period

	Year 6		Year 8		Overall
	Boys	Girls	Boys	Girls	
Walk	76	85	90	98	86
Car	88	100	100	93	95
Bicycle	26	13	22	17	19
Bus	11	0	37	36	18
Other	14	15	12	19	15

Source: RT3 activity and travel monitoring exercise.

Another way to look at the use of the various modes it to see the percentage of trips made by each. As Table 7 shows, 51% of the trips were by car and only 39% were walked, with 4% by bicycle and 4% by bus. These figures compare well with those in the National Travel Survey for 2002 which showed 56% of trips by car, 32% walked and 2% cycled. In fact, the figures collected in the study on children's car use show more walking and cycling and less car use than the national figures, despite living in a fairly affluent part of the country with high levels of car ownership. However, the figures here are for two weekdays and two weekend days and so are biased towards the modes used at the weekend.

Table 7 Percentage of trips by each mode during the survey period

	Year 6		Year 8		Overall
	Boys	Girls	Boys	Girls	
Walk	38	34	46	40	39
Car	52	61	39	48	51
Bicycle	8	2	5	2	4
Bus	0	1	8	8	4
Other	2	2	1	3	2
Total	100	100	100	100	100

Source: RT3 activity and travel monitoring exercise.

Having seen that walking is better than other modes of travel in terms of activity calorie use, it is pertinent to compare walking with other activities, as shown in Table 8. The activities were described by the children in their own language. These have been coded using the hierarchical system discussed in Section 4. Table 8 shows results at the middle level, with the higher level also shown because the number of cases at the narrowest level of classification is very small in some instances.

Walking has been included for comparison. It can be seen that, overall, walking is second only to PE or games lessons in intensity, equal with unstructured ball games and higher than all the structured out-of-home activities. In the age-gender groups it not lower than fourth. This suggests that walking offers great potential as a way for children to consume calories, being as good as ball games, whether in an organised class or self-organised. It has the advantage that it requires no preparation, special equipment or expenditure of money.

Table 8 Intensity of various activities undertaken by children

		Year 6		Year 8		Overall
		Boys	**Girls**	**Boys**	**Girls**	
Walking		2.1	1.9	2.6	3.2	2.5
At school	PE or games lesson	2.7	2.6	3.2	4.1	3.1
	Other lessons	0.6	0.5	0.7	0.7	0.6
	Break	1.9	1.5	2.3	2.0	1.9
Structured out-of-home activities	Structured ball games	2.0	2.3	2.4	1.9	2.2
	Other structured sport	1.9	1.4	3.6	1.9	2.2
	Organisations	1.8	1.2	1.7	0.8	1.3
	Tuition	0.7	0.9	0.3	0.5	0.7
Unstructured out-of-home activities	Unstructured ball games	1.9	0.9	3.1	2.7	2.5
	Other unstructured activities	1.7	1.4	1.9	2.9	1.8
	Other outdoor play	1.5	1.6	1.6	1.4	1.5
Out-of-home activity shared with parents		1.0	1.0	1.4	1.4	1.1
In home	At own home	0.5	0.5	0.6	0.6	0.5
	At other people's homes	0.9	0.8	0.9	0.7	0.8
Other	Physical work	1.1	1.7	0.7	1.0	1.1
	Waiting	1.0	0.9	1.2	0.7	1.0
Overall		0.8	0.7	1.1	1.0	0.9

Source: RT3 activity and travel monitoring exercise.

Some other points come out of this table. Being at home does not consume many activity calories per minute, nor does sitting in class. This suggests that children should be encouraged to go out of the house, because whatever they do, they will be more active than being at home. It also shows that break times at school are very important for children's energy consumption, and that reducing their length to provide more time for lessons has implications for their health.

Two overall findings are that boys seem to be more energetic than girls, but the effect of being two years older is much greater.

It has been shown that walking is second to PE and games lessons in intensity, but the durations are likely to be different. One way to make a comparison is to see how many calories would be consumed over a week. Table 9 shows the number of calories that would be spent in five journeys to and from school and in two hours of PE or games lessons. The travel to school is classified by the mode used for the greatest duration. For example, most bus trips include a element of walking to and from the bus stop. The calories spent in this walking is included in the bus trips. None of the younger children travel to school by bus, and no older girls cycle. The numbers cycling are very small and need to be treated with caution than the other figures. Two hours of PE or games lessons has been used because the National Healthy School Standard Guidance (Department of Health, Department for Education and Employment, 2000) includes Standard 3.5 which says that schools can meet the requirements of the standard by offering all pupils, whatever their age and ability, two hours of physical activity a week within and outside the national curriculum.

It can be seen that walking to school consumes many more activity calories than two hours of PE or games for older children. Younger children who walk to school use

about 65% of the calories that they use in PE or games lessons in a week. This difference occurs for two reasons: the older children walk more intensively than the younger ones (see Table 8) and they have longer journeys on average because most of them are at secondary schools of which there are fewer than primary schools, so they are located further from homes, on average.

Table 9 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		Year 8		Overall
	Boys	**Girls**	**Boys**	**Girls**	
Walk to and from school	211	206	530	658	388
Car to and from school	149	159	191	225	164
Bicycle to and from school	450	365	370	-	404
Bus to and from school	-	-	439	373	403
Overall travel to and from school	192	186	475	509	317
PE or games lessons for two hours	327	311	378	495	376

Source: RT3 activity and travel monitoring exercise.
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.

It may be noticed that cycling and bus both use more calories even than walking. However, the number of cycling trips are very small and so need to be treated with caution, and only the older children use the bus (this is a good example of a 'cohort effect', as discussed above, because for the older children a bus journey uses fewer calories than walking all the way, but because only these children use the bus, the overall mean is high). Children who travel by car to school consume quite a few calories, but many fewer than in two hours of PE or games. Calories are consumed travelling by car partly because many car trips involve some walking, either to and from the car, and partly because some journeys are in two stages, for example a child might be dropped off at the childminder's home by a parent who is driving to work, and then the childminder walks the child to school later. It should also be noted that, in the case of trips by car and bus, acceleration of the vehicle may have an effect on the RT3 reading, but experiments with the equipment suggested that this effect is very small.

It is possible to examine the relationship between the intensity of various activities and the mode of travel used to travel there, as shown in Table 10. It can be seen that, overall, the children who walk use 1.1 activity calories per minute and those who go by car use 1.0. This is an interesting but small difference. When the figures are compared before rounding the former is 16% higher. When individual activities are examined, there are some much larger differences. For example, for PE and games lessons, the walkers use 3.5 activity calories a minute, compared to 2.4 for car users. At break times the values are 2.0 and 1.7 respectively. Similarly, for unstructured out-of-home activities, the equivalent values are 2.2 and 1.8, and for out-of-home activities shared with parents, the values are 1.3 and 0.9. For structured out-of-home activities, the values are 1.9 and 1.7 respectively. The difference is the same way round, but perhaps smaller than one might expect. This may be because the car has to be used to reach some specific, very energetic, specialist activities. It is quite clear that for most activities, those who walk to them are more energetic when there than those who travel by car. The only group for whom the converse is sometimes true is the Year 6 girls, and this may reflect greater use of the car to escort

them to some very energetic events, and parental reluctance to allow them out to walk much.

Table 10 Intensity of various activities, classified by the mode of travel used to arrive

	Year 6				Year 8				Overall	
	Boys		Girls		Boys		Girls			
	walk	car	walk	car	walk	car	walk	car	walk	car
PE or games lesson	3.2	2.1	2.7	2.4	3.5	2.9	4.7	2.4	3.5	2.4
Other school lesson	0.6	0.6	0.5	0.5	0.6	0.7	0.8	0.5	0.6	0.5
School break	1.9	1.8	1.6	1.5	2.3	2.2	2.2	1.2	2.0	1.7
Structured out-of-home activities	1.8	1.5	1.3	1.6	2.5	1.9	-	1.7	1.9	1.7
Unstructured out-of-home activities	1.5	1.5	1.2	1.6	3.2	2.5	2.5	2.1	2.2	1.8
Out-of-home activity with parents	1.0	0.8	1.3	0.8	1.7	1.1	1.0	1.1	1.3	0.9
At another home	0.9	0.7	0.9	0.8	1.3	0.9	0.8	0.7	1.0	0.8
Overall	1.0	0.9	0.9	0.9	1.4	1.3	1.3	0.9	1.1	1.0

Source: RT3 activity and travel monitoring exercise.

The most likely explanation for these differences is that there are some children who are more energetic than others and so they are keener to walk than others, and keener to participate in their various activities. It is not being suggested that a child who is usually taken by car to an event would perform more actively at the event if he or she were made to walk there.

It certainly seems that children who walk more will consume more calories not only in travelling, but also when they arrive. There is evidence (California Department of Education, 2002) that children who are physically fitter perform better academically. If this is true, put together with the evidence here, it seems that children who walk to school will perform better academically than their colleagues who travel by car. This provides a very powerful message to parents – not only will walking more improve their health, it will also improve them academically.

5 Encouraging children to walk more

Having demonstrated that walking is good for children in terms in increasing their physical activity, this raises the question of how this can be done. One way is to introduce specific initiatives that encourage children to walk rather than using the car, in order to help overcome some of the barriers to walking, such as parental concerns about road safety and the child becoming lost. An initiative that has been studied in this research is the walking bus, using the methodology described in Section 3.

A significant issue about walking buses is the extent to which they encourage a shift from car to walking (Mackett et al, 2003b,c). Table 11 shows the reduction in car use for 11 of the walking buses in the postal survey. According to the walking bus co-ordinators 62% of the children using the walking buses used to travel by car, with a range

from 32% to 100%. It should be recognised that the children who travelled by car previously may not have used the car everyday. Also, the car may not have been used solely to take the child to school. A parent may have previously dropped a child at school and now drops the child at the start of the walking bus and then travels onto work.

There is some evidence on car use by those using the walking bus from the interviews about the five walking buses. Table 12 shows the mode used before they started using the walking bus by the 73 children interviewed. It also shows the mode used on days when the walking bus is not used. This suggests that about 26% (17 out of 66 for whom information is available) of the children previously used the car every day. If those using a mixture of car and walk are counted as 0.5 this increases to 36% (24 out of 66). This is lower than the figure of 62% in Table 11. However, if the schools in both surveys are examined, and the children who previously used a mix of walk and car are counted as 0.5, the mean from the postal survey is 42.4% (14 children out of 33) and the mean from the interviews is 42.5% (17 out of 40). (One of the four schools that was interviewed and responded to the postal survey, did not answer this question in the latter survey, so the comparison here is based on three schools). The surveys were done at different times, which may explain the difference between the total numbers. This comparison suggests that the differences between the two data collection exercises reflects the different sets of schools covered rather that a difference arising from the methods used. This partly arises from the small numbers providing this information, namely 172 children in this part of the postal survey and 66 in the interviews. It is recognised that these are small numbers, but walking buses are small-scale initiatives, and it is unusual to obtain data about the dynamics of modal shift from any sector of the population, let alone for young children.

Table 11 Estimated shift from the car in the schools with active walking buses in the walking bus postal survey

Walking bus number	Number of children registered	Number of children who used to travel by car	Percentage of children who used to travel by car
1	12	7	58
2	5	2	40
3	15	7	47
4	5	3	60
5	13	4	31
6	13	6	46
7	14	7	50
8	28	9	32
9	18	18	100
10	41	39	95
11	8	5	63
Total (for schools providing data)	172	107	62

Source: The walking bus postal survey

Table 12 Number of children using modes of travel other than the walking bus in the walking bus interviews

	Walk	Car	Mixture of walk and car	Not known or not applicable	Total
Mode of travel used before walking bus was set up	35	17	14	7	73
Mode of travel used on days that the walking bus is not used	20	13	9	31	73

Source : The walking bus interviews

As shown in Table 12, quite a few children do not use the walking bus every day, and some use car on other days. This means that even if a child has switched from car to using the walking bus, they may not be making five fewer car trips to school each week. (It is worth noting that most walking buses only operate in the morning. This is usually because of the variation in the times that children leave school because of after-school activities).

Because of the relatively small numbers involved, and because some children did not previously go to school by car on five days a week, and because some do not use the walking bus every day, it is difficult to reach a firm estimate of the reduction in the number of car trips to school by children. (It is worth bearing in mind that the figures presented here are based on a survey of the whole of Hertfordshire, which is wider than many other travel surveys. Potentially, every child on a walking bus in the county was covered and the response rate in the postal survey was well over 50%, which is very high for this type of survey sent out 'cold'). Given these caveats, the reduction in the number of children travelling by car seems to be about 50% of the number of children on the walking bus. A walking bus typically has 10 children using it and at January 2003 there were 26 active walking buses in Hertfordshire (Mackett et al, 2003c). Putting these figures together suggests that there are about 130 children on walking buses rather than using the car each day in Hertfordshire. This is not a huge reduction in the number of car trips in a county with a population of just over one million.

Just because a child has switched from using the car to going by walking bus, it does not mean that the car is not being used for a trip. For example, if a parent previously dropped a child off outside the school on the way to work and now drops the child off at the beginning of the walking bus, then there will not be a significant reduction in the number of cars on the road, but there could be a reduction in the amount of parking near the school entrance, which would be a small benefit on road safety grounds. The figures from the five interviews, shown in Table 13, confirm that the cars used to bring the children to school previously are still being used for a trip at about the same time. It seems likely that the car is being used to go to work by a parent even though the child is using the walking bus. In other words, even though the child has started using the walking bus, there is not a reduction in the number of car trips. More generally, in the questionnaire surveys undertaken in another part of this project (Mackett et al, 2002), it was found that 28% of the trips to school by car were made solely to take a child to school. The rest were made in the course of trips to other destinations, mainly workplaces. This confirms the limited scope for walking buses to reduce the number of cars on the road.

Table 13 Use of the car at the time of the journey to school in terms of the mode used prior to use of the walking bus

Mode of travel before using the walking bus	Use of the car at the time of the journey to school			Total
	Car used every day	Car used on some days	Car not used	
Car	11	1	0	12
Mixture of car and walk	0	10	0	10
Walk	0	0	16	16
Total	11	11	16	38

Source: The walking bus interviews

There is another possible effect of walking buses, namely that children who used the walking bus at their first school get into the habit of walking and so continue to use the walking bus when they move onto their next school. In the surveys in schools in the project (Mackett et al, 2002), of the 192 children who had moved on to another school, none of the class activities or training exercises related to physical activity and travel choices seemed to reduce the use of the car whereas of the 15 children who had used a walking bus at their previous school, 11 now walked and four went by bus, and none went by car. These are very small numbers, but they suggest that going on a walking bus may give children the confidence to walk unescorted, or more likely, give their parents the confidence to let them walk.

6 Conclusions

Children are shifting from walking to the car. Walking consumes more calories than travelling by car with important implications for their quantity of physical activity and so for their health. In fact, walking compares very favourably with most activities in terms of energy consumption. Walking to and from school for a week is much better than a week's worth of PE and games lessons for many children. The worst thing that children can do in terms of physical activity is stay at home. The car can be useful to take them to some activities, but the evidence from the surveys carried out in this research is that children who walk to events not only use more calories in travelling, but use more when they arrive. Evidence from elsewhere suggests that there may be a relationship between physical fitness and academic achievement. If this is so, then walking more will not only make them healthier, it may make them achieve more at school.

It is necessary to remove barriers to encourage children to walk more, by using targeted initiatives. A good example is the walking bus. It has been shown here that about 50% of the trips made on walking buses were previously made by car. Hence such initiatives can help to shift children from cars to walking, both directly, and, in the longer run, by building up children's and parents' confidence to allow children to walk unescorted by an adult. There may not be much reduction in traffic on the road because, in many cases, the car was still be used by the parent for other trips, usually to work.

To sum up, this paper has shown that children who walk are much better off in terms of physical activity than those who travel by car. Given the level of parental concern

about the increasing obesity in children, this research helps to provide a powerful argument to help convince parents of the need to increase the amount of walking by children.

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