Physical activity and children

Review 5:

INTERVENTION REVIEW:

CHILDREN AND ACTIVE TRAVEL

NICE Public Health Collaborating Centre – Physical activity
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Executive Summary

Introduction

This is the fifth review in a series of reviews commissioned to provide background evidence for the development of public health guidance for promoting physical activity in children. It is the second review in this series to deal with the effectiveness of physical activity interventions,

This review examines the evidence for the effectiveness of active travel interventions in increasing use of active travel modes (i.e. walking and/or cycling). We included studies in the review if they assessed the effect of an intervention related to active travel interventions within transport (systems concerned with the movement of people from origin to destination) that do not involve a permanent change to the environment (as this was covered in a previous NICE review – Physical activity and the environment (NICE, 2007)). The outcome of the intervention had to include at least one measure of active travel behaviour.

Objective

This review addressed the following questions:

- Which active travel interventions (that do not involve a permanent change to the environment) are effective in increasing total physical activity levels in children and young people under the age of 18?
- Which interventions or programmes (that do not involve a permanent change to the environment) effectively promote (i.e. improve knowledge and attitudes towards), increase or sustain active travel by all children and young people under the age of 18?

Methods

All intervention study designs were included except studies that examined correlates of transport behaviour. Literature searches were conducted using the terms and databases agreed by the collaborating centre and NICE. Tailored search terms were used appropriate to a particular database. Search terms followed the same order (1) active travel terms and (2) physical activity terms. Searches were limited to articles published in the English language from 1990 to April 2007. The agreed search strategy resulted in 5,771 titles. 95 titles were assessed to be relevant and full papers retrieved and independently checked by two people against in-out criteria.

Results

Seventeen studies were included: one with a randomised controlled trial (RCT) design, two which used controlled before and after (CBA) designs (using a comparison or control area) and fourteen using uncontrolled before and after (UBA) designs.

Included studies were categorised into four types of approaches:

- cycling promotion
- safe routes to school/school travel plans
- walking buses
- walking promotion

All studies were located in a school setting, mostly among primary school children. One RCT reported no increase in use of active travel modes at schools with School Travel Plans compared to schools without such Plans. One CBA study reported no increase in walking at schools involved in a Walk to School Week compared with non participating schools. One CBA study reported substantial increases in walking among primary school pupils who had been provided with incentives to increase the amount of walking. In total, fourteen of

the studies reported increases in the active travel modes. Fifteen of the studies were conducted in the UK, one in the USA and one in Australia.

Evidence statements

1. Cycling promotion

There is evidence from five UK studies (all UBA [+]) that cycling promotion projects, targeting primary and secondary school children can lead to large self-reported increases in cycling both at 9-11 months and over 20-23 months. Characteristics of successful interventions included the involvement of external agencies to facilitate schools to promote and maintain cycling, with the support of parents and the local community.

There is evidence from two of the studies (UBA [+]), where cycling infrastructure was commonly part of the local transport infrastructure or children were encouraged to cycle to curriculum related events or sports fixtures, that self reported levels of walking declined over 20 and 23 months, implying that some of the increase in cycling may have been offset by a decrease in walking.

The evidence is applicable to the UK.

2. Safe Routes to Schools/School Travel Plans

There is evidence from one UK study (RCT [++]) to suggest that introduction of school travel plans and direct support from a school travel plan advisor at primary schools did not lead to increases in self reported levels of walking and cycling at 12 months.

There is evidence from one US and one UK study (UBA [+]) to suggest that a mix of promotional measures including curriculum, parental and community promotions (e.g. mapping safe routes to school, walk and bike

to school days) can increase self reported walking and cycling at 24 months. In the UK study this activity was in support of a travel plan.

The evidence is applicable to the UK.

3. Walking Buses

There is evidence from three UK (UBA [+]) studies to suggest that Walking Buses, (volunteer-led walking groups supported by parents and teachers plus the involvement of the local highways or transport authority), led to increases in self reported walking among 5-11 year olds, and reduced car use for children's' journeys to and from school at 10 weeks and 14 to 30 months.

There is evidence from one (UBA [-]) study to suggest that the provision of a walking bus may in itself not be sufficient to stem a more general decline in walking to and from school. Retaining volunteers to act as coordinators for these schemes appears to be a key factor in the sustainability of walking buses.

Currently walking buses are found to be commonly delivered in the UK, however evidence for their applicability remains uncertain (as they may be applicable only to the specific populations or settings included in the studies).

4. Walking promotion

There is evidence from one UK (CBA [+]) study, and two UK (UBA [+]) and one Australian (UBA [+]) studies to suggest that walking promotion schemes, involving promotional materials, incentives and rewards, travel diaries for children and parents and provision of "park and walk" parking areas close to school and restriction of parking outside of schools, can lead to increases in self reported walking to school among 4 to 11 year

olds, and reduced car use for children's' journeys to and from school at 4 to 10 weeks and 41 to 48 months.

There is evidence from one UK (CBA [+]) study to suggest that walking campaign packs alone, including promotion materials for children and parents, did not lead to increases in walking among 4 to 11 year olds at 4 weeks.

There is evidence from two UK and one Australia study (UBA [+]) to suggest that targeting children and parents who live a short distance to school (one mile or less) may support interventions to encourage increase walking levels for the school journey.

The evidence mainly comes from UK studies and so is directly applicable only to populations or settings included in the studies (primary school settings). The success of broader application is uncertain.

Included studies

Bickerstaff, K., Shaw, S., 2000 An evaluation of the Walking Bus at Pirehill First School. CAST: Staffordshire University.

Cairns, S., (2006a) Making School Travel Plans Work (Holmer Green First School), in Marsden, G.R. (ed) *Wasted Miles, Wasted Money: A less congested, more energy efficient future*, London: CICC Publications.

Cairns, S., (2006b) Making School Travel Plans Work (St Michael's Primary School), in Marsden, G.R. (ed) *Wasted Miles, Wasted Money: A less congested, more energy efficient future*, London: CICC Publications.

Cairns, S., (2006c) Making School Travel Plans Work (St Sebastian's Primary School and Nursery), in Marsden, G.R. (ed) *Wasted Miles, Wasted Money: A less congested, more energy efficient future*, London: CICC Publications.

DETR, 1999 School travel strategies and plans, London: DETR. A) Burnholme Community College.

DETR, 1999 School travel strategies and plans, London: DETR. B Horndean Community School.

DETR, 1999 School travel strategies and plans, London: DETR. C) Sandringham School.

DETR, 1999 School travel strategies and plans, London: DETR. D Wheatfields Junior School.

DETR, 1999 School travel strategies and plans, London: DETR. E Kesgrave High School.

Mackett, R., Lucas, L., Paskins, J., Turbin, J. (2005) Walking Buses in Hertfordshire: Impacts and lessons. UCL: Transport Studies Centre. http://www.cts.ucl.ac.uk/research/chcaruse/Walking%20bus%20report%20-%20UCL.pdf accessed 3rd September 2007.

McKee, R., Mutrie, N., Crawford, F., Green, B. 2007 Promoting walking to school: results of a quasi-experimental trial, Journal of Epidemiology and Community Health, 61: 818-823.

Osborne, P., (2006) Bike It, in WHO, Collaboration between health and transport sectors in promoting physical activity: examples from European countries (CD Rom). Copenhagen: WHO http://www.euro.who.int/InformationSources/Publications/Catalogue/20070503_2 accessed 22nd November 2007.

Rowland, D., DiGuiseppi, C., Gross, M., Afolabi, E., Roberts I. (2003) Randomised controlled trial of site specific advice on school travel patterns, Archive of Disease in Childhood, 88: 8-11.

Staunton, C., Hubsmith, D., Kallins, W. 2003 Promoting Safe Walking and Biking to School: The Marin County Success Story, American Journal of Public Health, 93(9): 1431-1434.

Sustrans, 2007 Bike It Case Study – Cinnamon Brow Primary School.

TAPESTRY, 2003 Walking to School campaign case study, Hertfordshire. (CD ROM).

Zaccari, V., Dirkis H. 2003 Walking to school in inner Sydney, Health Promotion Journal of Australia, 14(2): 137-140.

1. Introduction

1.1. Background to this review

The National Institute for Health and Clinical Excellence ('NICE' or 'the Institute') has been asked by the Department of Health (DH) to develop guidance on a public health programme aimed at promoting physical activity, play and sport for pre-school and school age children in family, pre-school, school and community settings.

Increasing activity levels have the potential to contribute to the prevention and management of over 20 conditions and diseases including coronary heart disease, diabetes, cancer, obesity and to improve mental health.

In 2004 the DH estimated the cost of inactivity in England to be £8.2 billion annually – including the rising costs of treating chronic diseases such as coronary heart disease and diabetes. The contribution of inactivity to obesity is estimated to cost a further £2.5 billion each year.

Around 35% of men and 24% of women (aged 16 plus) are physically active enough to meet the current national recommendations (achieving at least 30 minutes of at least moderate activity on 5 or more days a week). Seventy per cent of boys and sixty-one percent of girls aged 2-15 years achieve the recommended physical activity levels (at least 60 minutes of at least moderate intensity physical activity each day). Physical activity varies according to age, gender, class and ethnicity.

1.1.1. Physical activity and active travel

Active travel has become increasingly recognised as an important focus for interventions to promote physical activity. Transport-related physical activity contributes to overall physical activity levels, via walking and cycling and has the potential to be increased via targeted interventions (Ogilvie et al., 2004).

Active travel is concerned with walking and cycling for a functional purpose such as travelling to school, to visit friends or to go to the shops, so that physical activity is an incidental outcome and not the primary objective. The review of quantitative correlates (Biddle et al., 2007) identified a number of correlates associated with children's and adolescents physical activity. These included:

- access to facilities (+)
- time outdoors (+)
- opportunities to exercise (+)
- school physical activity policy (+)
- distance to school (-)
- parental support (+)

The review of qualitative studies (Foster et al., 2007) identified other possible barriers to active travel including:

- children and parents' fear of traffic
- parental restrictions on independent movement
- school influence over cycling policy and storage facilities
- limited play destinations locally
- adult disapproval of children playing outside.

1.1.2. Trends in physical activity and active travel

Different waves of the Health Survey for England (1997, 1998, 2003 and 2004) report small increases in physical activity levels between 1997 and 2004 (Department of Health., 2006) However data from national travel surveys show

that the distance adults walk and cycle has declined significantly in the last three decades (Department of Transport., 1995; Department for Transport., 2007). The average distance walked per person per year has fallen from 255 miles in 1975/6 to 201 miles in 2006. Bicycle mileage for the same years fell from 51 to 39 miles per person per year.

Declines in children's active travel patterns are similar to adult trends and levels. Among 5-10 year old children in 1975/76, 72% of school journeys were on foot and 1% by bicycle whereas in 2006 this had declined to 52% of school journeys being made on foot. Bicycle journeys to school remained static at 1% over the period. Among 11-16 year olds walking comprised 49% and cycling 7% of school journey modes in 1975/76. Walking had declined to 41% and cycling to 3% by 2006. These declines in walking and cycling largely come from their substitution to travelling by car, which has increased in use from 16 to 41% among 5-10 year olds and from 7 to 20% among 11-16 year olds across this thirty year time period. These observations may be valid but other explanations for their findings have been suggested (1) active travel has been measured in the different ways between surveys (the use of different physical activity questionnaires in the Health Surveys for England), (2) the sample sizes are too small for robust estimates of the data at a population level (the absence of published confidence intervals), and (3) the travel survey measurement only records some types of active travel journeys and not others (the failure of many transport surveys to capture off-road travel).

1.2. The nature of evidence on active travel

The evidence base for transport interventions and active travel studies has been taken mainly from published road transport literature, rather than medical or public health literature. Evidence on active travel is at an early stage of development and few studies have focused on public health related outcomes like walking and cycling. Reporting levels of walking and cycling as a study outcome is a relatively recent phenomenon in the transport literature (Ogilvie et al., 2004). Transport studies have focused on measures to do with the car not

active travel, reflecting transport planners' focus on the car as the dominant and normative mode of travel. Typical measures would include surveys of motorised vehicle use using through cordon counts or monitoring road traffic casualties.

In addition, the evidence hierarchy practised within public health is not reflected within transport research. For example, use of controlled research designs is rare, and issues such as data capture, contamination and bias make some public health study designs inappropriate. Without particular study designs (i.e. RCTs) it is impossible to demonstrate any causality. Consequently, research of 'natural experiments' occurring within road transport often apply less rigorous study designs, for example favouring uncontrolled before and after designs over controlled experimental studies.

There are also a number of significant challenges associated with undertaking a review of the evidence of active travel interventions. These challenges fall into two categories (1) finding the evidence and (2) the quality of the evidence found.

Finding evidence of the effectiveness of active travel interventions is challenging. Searches must examine both databases of traditional public health literature and transport. Any search strategy needs to be broad enough to capture studies from non-traditional sources. Many active travel studies are published in journals that are not indexed in public health databases, or are in the 'grey' literature (such as government reports or case studies). Systematically searching grey literature remains problematic as it involves a mixture of electronic searches (e.g. web-based reports, and contacting key agencies for reports or study details).

The quality of the active travel evidence tends to be lower in terms of reporting issues related to measurement or sampling. For example, the primary outcomes of active travel have tended to focus on accident reduction and safety. Few studies report levels of walking and cycling as a study outcome, or present unvalidated measures that are difficult to equate to established measures of physical activity. A wider range of study types tends to be used in the transport field, with more of a focus on case studies or uncontrolled pre and post studies.

The evidence base for active travel interventions has been developed from innovative practice rather than research. Recent developments in the UK have been progressed by independent charities or committed local schools to implementing active travel interventions (e.g. walking buses, individualised marketing). These initiatives were conceived by practitioners rather than researchers; hence their evaluation or research base has lagged behind their popularity with practice and of course their evidence base. This phenomenon is not new in physical activity research as can be seen in other areas of physical activity promotion, e.g. exercise on prescription schemes. This place of development also results in the lower quality evidence base for active travel interventions lying within grey rather than published literature.

1.3.1 Policies and initiatives relevant to active travel

National policies on active travel and children are focused predominantly on the school journey. Since the late 1990s the Department for Transport has been promoting active travel for the journey to school. *Safe routes to schools* was one of the policy initiatives promoted in the Government's White Paper in 1998 (DETR, 1998). In November 1998 a School Travel Advisory Group was established representing a wide range of organisations with an interest in school travel, including three government departments (Education and Employment; Environment, Transport and the Regions; Health). This set a target to return levels of walking, cycling and bus use to that of the mid 1980s by 2010 (STAG., 2000) and the emphasis was shifting from *safe routes to schools* to *school travel plans* (STP).

In 2003 a joint initiative of the DfES and DfT led to the establishment of a national target for all schools to have approved STPs by March 2010 (DfES/DfT., 2003). Schools which develop and have STPs approved by their local authority have also been entitled to a one-off grant which can only be spent on on-site school travel initiatives. There is a range of active travel initiatives currently under way in

the UK some of which have been established through non-governmental organisations, particularly by the sustainable transport charity, Sustrans, and this is reflected in the studies found.

One policy driver which may be acting as a barrier to active travel among those under age 18 is the Education Reform Act, 1988. Parental choice has been a subject of increasing importance in party political debates from the 1980s. The 1988 Act established the concept of Grant Maintained schools and endorsed parental choice. It also gave schools some freedom from Local Education Authority policy and a degree of autonomy over budgets and admissions. The emphasis on parental choice provided by the 1998 Education Reform Act was reinforced by a 1989 High Court judgement (Regina v. Greenwich, London), which ruled that it was unlawful for a local authority to view potential pupils living some distance away from a school less favourably than potential pupils living close by. Importantly, the Act and this judgement is likely to have added to the increase in journey distance to school, reported each year through the National Travel Survey, and thus reduced opportunities for walking and cycling the school journey.

Examples of current UK active travel initiatives include:

1. Cycle promotion
2. Safe routes to school and School Travel Plans
3. Walking Buses
4. Walking promotion

Cycling promotion

This comprises a range of measures to encourage the target audience to take up cycling. These measures could be information campaigns to promote cycling, supported by classroom activities, games and raffles. Cycling promotion programmes for children can also address the safety concerns of parents and carers, by providing cycling proficiency schemes for children and meetings with parents to tackle their worries about children cycling to school. Cycle promotion programmes are most often set within schools and focus on the school journey as one where children can be encouraged to travel by bicycle.

Safe routes to school and School Travel Plan

These measures aim to increase walking and cycle use through the implementation of a range of individual promotion activities. These are sometimes supported by physical infrastructure measures, typically paths for walking and cycling, away from motor traffic. They will often focus on the promotion of a range of alternatives to single family car use including walking, cycling, scooting, public transport, and car sharing. All schools in England are expected to have School Travel Plans by March 2010 and since 2003 a one-off grant payment has been made to all state schools with an approved Travel Plan (DfES/DfT, 2003).

Walking Buses

These are initiatives where parents and carers arrange for their children to walk to school as part of a pre-arranged group along a set route, usually with a ‘timetable’ for what time pupils will be collected or dropped off from the Walking Bus to and from school. Volunteer parents/carers lead the Walking Buses. ‘Drivers’ lead along a set route to and from school with other parents/volunteers at the rear of the group as ‘conductors’ to ensure safety. Sometimes Walking Buses are set up informally by parents/carers and sometimes the local authority highways department is involved. Involvement with the local authority requires all routes are risk assessed and parents receive training, often in return for limited liability insurance from the local authority. In November 2006 the Department for

Transport announced a grant scheme to help fund Walking Bus schemes where schools could bid for a £500 or £1,000 grant. (Department for Transport, 2006)

Walking promotion

Walking promotion in the school setting is often based on incentive schemes. These include competitions between classes to encourage walking, or agreeing that certain days may be made key days for walking to school each week, such as WOW days (Walk on Wednesdays). Walking promotion is particularly focused on primary schools where distances are often short i.e. under 1 mile.

1.4 Scope of the reviews

1.4.1 Aspects of the physical activity and children that will be covered

NICE guidance will be based on the findings from five reviews on specific aspects of physical activity and children:

- Under 8s
- Active Travel
- Adolescent girls (11-18)
- Families and communities
- Economics.

This report presents the findings from the Active Travel review.

1.4.2 Population groups that will be covered

The age group is all children of up to 18 years of age. The guidance will investigate the effectiveness of interventions across the broad social gradient, rather than focusing on those in the poorest circumstances and those in the poorest health. It will look for any differential response to active travel initiatives between social groups and area deprivation.

1.4.3 Areas that will not be covered

The influence of national fiscal policy on active travel levels.

1.4.4 Outcomes

The primary aim has been to assess active travel interventions that do not involve a permanent change to the environment but are effective in increasing total physical activity in children and young people under the age of 18. The outcome of the intervention had to include at least one measure of physical activity behaviour including;

- walking (e.g. change in proportion walking, minutes walking per week)
- cycling (e.g. change in proportion reporting cycling, minutes cycling per week)
- modal shift (e.g. change in proportion reporting walking as part of their journey or main part of their journey)
- physical literacy (e.g. cycle skills - improvement in cycle skill level)

Secondary, outcomes were also considered if there were possible consequences of behavioural interventions aimed at increasing active travel. These could include:

- Self-efficacy (e.g. a change in reported levels of confidence to undertake an active travel journey independently)
- Parental willingness to allow children to travel independently

1.4.5 Review team[1]

This review has been carried out by a team from the Public Health Collaborating Centre (CC) for Physical Activity. The Collaborating Centre is an alliance between the British Heart Foundation Health Promotion Research Group (University of Oxford) and the British Heart Foundation National Centre for Physical Activity and Health (Loughborough University).

[1] Lead author: Dr Adrian Davis: adrian.davis@phonecoop.coop . The systematic review was conducted by Dr Adrian Davis, Dr Charlie Foster, and Ashur Kaur, with assistance of the SURE Information Centre (University of Cardiff) and their contribution is gratefully acknowledged.

2. Methodology

2.1. Literature Search

The following search terms and databases were used. References were downloaded into a Reference Manager database and de-duplicated resulting in 5,771 references. Key international and national experts and lead organisations were contacted in order to source any potential references and the CC drew on any possible references from personal libraries (20 references). References of included studies were also checked which resulted in no additional records.

2.1.1. Search terms

We developed a pilot electronic search strategy to identify relevant published research. Final searching was undertaken by Cardiff University. Searches were limited to articles published in the English language from 1990 to April 2007. All search strategies were designed by the CC and NICE. Tailored search terms were used appropriate to a particular database. Search terms followed the same order (1) active travel terms and (2) physical activity terms.

A full search for MEDLINE is presented in Appendix C.

2.1.2. Databases searched

Medline; Embase; Cinahl; PsychInfo; SPORTDiscus; TRIS on line; Global Health; Geobase; Cochrane Library; ISI Science Citation Index and Social Science Citation Index; Sociological Abstracts; Cambridge Scientific Abstracts (CSA) ERIC, CSA Environmental Sciences, ASSIA, SIGLE, Current Contents, ERIC, TRANSPORT, Environline, EPPI Centre Databases and NRR.

2.1.3. Selection of studies for inclusion

The agreed search strategy resulted in 5,771 titles, plus an additional 20 studies from personal files. All were screened for relevance by one person. A pilot screening was performed independently by two researchers on 15% of the total hits from the electronic databases in order to assess sensitivity of screening. This pilot assessed titles and abstracts for their relevance relating to both a transport intervention and assessing physical activity outcomes.

95 titles were assessed to be relevant and the full papers were retrieved, and were independently checked by two people against in-out criteria:

1. Was the study an active travel promotion intervention study or review of intervention studies?

2. Was the age group studied aged 18 or under?

3. Was an outcome reported on physical activity, travel mode, or travel behaviour or physical literacy?

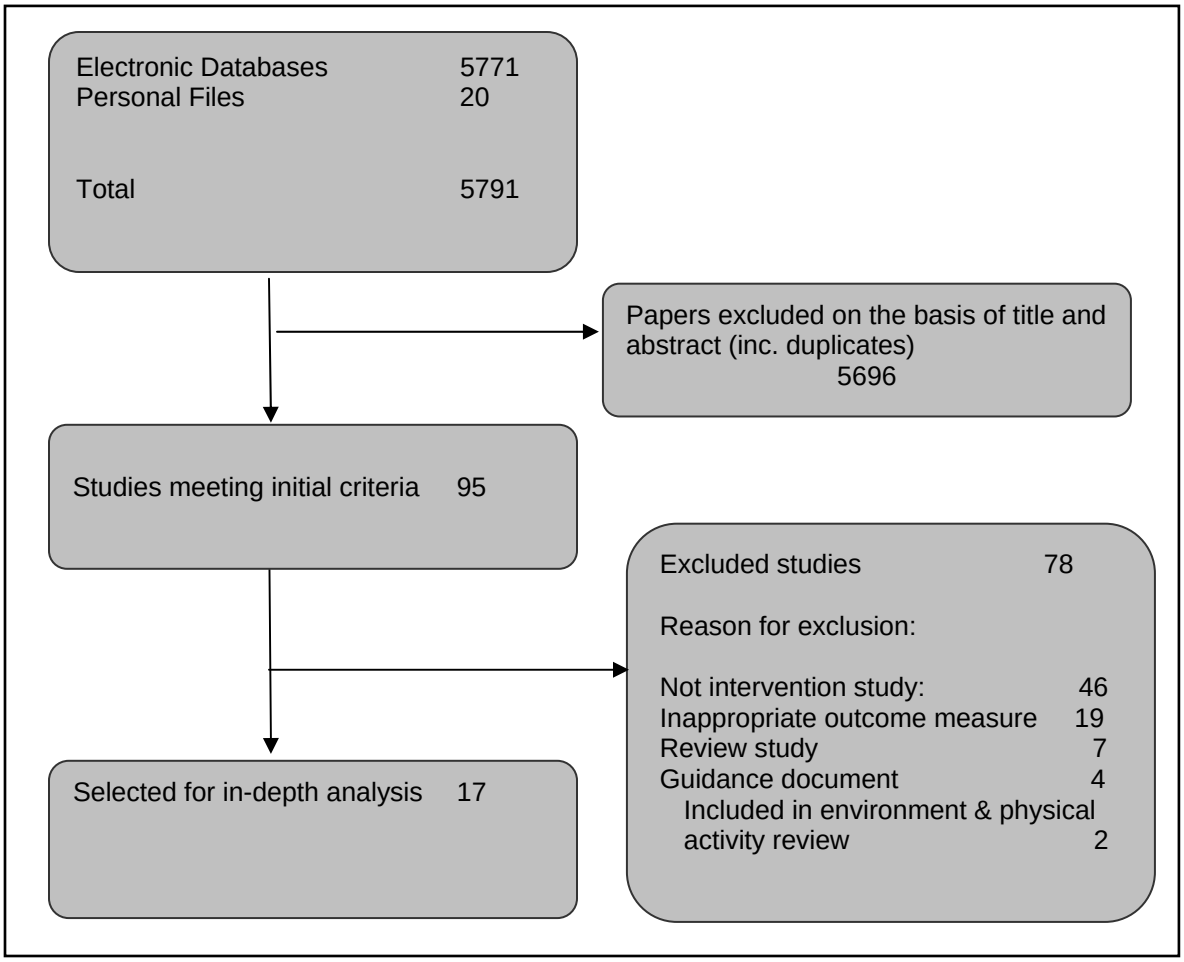
Of these all were subjected to independent full paper assessment by two reviewers using the appropriate (by study design) methodology checklists (see NICE., 2007, p 65-104). Figure 1 shows the process of review screening leaving 17 studies accepted for full data extraction (5774 were rejected).

Studies were included if they assessed the effect of an intervention related to promoting, increasing or sustaining active travel by children and young people. The outcome of the intervention had to include at least one measure of physical activity behaviour (including walking/cycling/modal shift) or physical literacy. Other outcomes were also considered including self-efficacy and parental willingness to allow children to travel independently, if there were possible consequences of behavioural interventions aimed at increasing active travel.

The main reason for exclusion of studies was that they were not intervention studies or did not measure physical activity as an outcome. One study was found

that reported the impact of cycling training programmes on the frequency of cycling among children and young people (Cycle Training UK., 2004). This study was excluded because it did not disaggregate the data between adults and children.

Figure 1 Flow diagram of article selection process



2.2. *Study Type and Quality Appraisal*

Each study was categorised by research design (Randomised Control Trial [RCT], Controlled Before and After [CBA], Uncontrolled Before and After [UBA]. Studies were classified into one of three categories (++, + or -) based on the responses to the criteria set out below (see NICE., 2007, p 65-104).

++	All or most of the criteria have been fulfilled. Where they have not been fulfilled the conclusions of the study or review are thought **very unlikely** to alter.
+	Some of the criteria have been fulfilled. Those criteria that have not been fulfilled or not adequately described are thought **unlikely** to alter the conclusions.
–	Few or no criteria fulfilled. The conclusions of the study are thought **likely or very likely** to alter.

The final "grade" of each paper reflects "how well the study was conducted" (NICE, 2006, p 90). The appropriate methodology checklist was used, appropriate for the study design.

One ++ study was found. Fifteen studies were categorised as + with the remaining 1 as -. Table 1 lists which studies met the three quality types. The main reasons for a study being assessed as (-) quality was its failure to describe methods adequately and to take into account any potential confounders.

Table 1 Study quality

Study quality	Authors
++	Rowland et al., 2003
+	DETR., 1999a; DETR., 1999b; DETR., 1999c; DETR., 1999d; DETR., 1999e; Cairns, 2006a; Cairns, 2006b; Cairns, 2006c; Mackett et al., 2005; McKee et al., 2007 Osborne, 2006; Staunton et al., 2003; Sustrans., 2007; Tapestry 2003; Zaccari & Dirkis, 2003
-	Bickerstaff & Shaw, 2000

2.3. Study categorisation

2.3.1. Description of studies

The 17 studies are described in Section 4 and presented in the Evidence Table. They included:

- 1 Randomised Controlled Trial (Rowland et al., 2003)
- 2 controlled before and after studies (i.e. with a comparison area) (McKee et al., 2007; Tapestry,. 2003),
- 14 uncontrolled before and after measures studies (ie no comparison area) (Bickerstaff, Shaw., 2000; Cairns, 2006a; Cairns, 2006b; Cairns, 2006c DETR., 1999a; DETR., 1999b; ; DETR., 1999c; DETR., 1999d; DETR., 1999e; Mackett et al., 2005; Osborne, 2006; Sustrans., 2007; Staunton et al., 2003; Zaccari & Dirkis, 2003)

These studies tested a range of different active travel related interventions and fell into four different approaches (see section 3 for full definitions):

- cycling promotion
- safe routes to school/school travel plans
- walking buses
- walking promotion

All interventions included some behaviour intervention(s) that did not involve a permanent change to environment, and were effective in changing total physical activity levels in children and young people.

2.3.2 Country of studies

Fifteen of the 17 studies were conducted in the UK. Table 2 presents the studies by country and lead author.

Table 2 Country of origin

Country of origin	Authors
UK	Bickerstaff, Shaw., 2000; DETR., 1999a; DETR., 1999b; Cairns, 2006a; Cairns, 2006b; Cairns, 2006c; DETR., 1999c; DETR., 1999d; DETR., 1999e; Mackett et al., 2005; McKee et al., 2007 Osborne, 2006; Rowland et al., 2003; Sustrans., 2007; Tapestry 2003;
USA	Staunton et al., 2003
Australia	Zaccari & Dirkis, 2003

All interventions were delivered at the level of a local road, community, school or geographical area.

2.3.3 Length of outcome measures

Six studies measured short term outcomes (up to and including 12 months follow up) only: (Bickerstaff, Shaw., 2000; McKee et al., 2007; Osborne., 2006; Sustrans., 2007; Tapestry., 2003; Zaccari & Dirkis, 2003). Seven studies measured longer term outcomes (over 12 months follow up) only (DETR., 1999a; DETR., 1999b; DETR., 1999c; DETR., 1999d; DETR., 1999e; Cairns, 2006a; Cairns, 2006b). Four studies measured both short and longer term outcomes (under 12 months and over 12 months follow up) only (Cairns, 2006c; Mackett et al., 2005; Rowland et al., 2003; Staunton et al., 2003).

2.4. Assessing applicability

Each study was assessed on its external validity: that is, whether or not it was directly applicable to the target population(s) and setting(s) in the scope. This

assessment took into account whether the study was conducted in the UK, any barriers identified by studies or the review team, with references as appropriate, to implementing each intervention in the UK, (NICE, 2006). For each of the approaches one of the following phrases has been used to describe the body of evidence in relation to each question:

- likely to be applicable across a broad range of populations and settings
- likely to be applicable across a broad range of populations and settings, assuming it is appropriately adapted
- applicable only to populations or settings included in the studies – the success of broader application is uncertain
- applicable only to settings or populations included in the studies.

2.5. Synthesis

It was not appropriate to use meta-analysis to synthesise the outcome data as interventions, methods and outcomes were heterogeneous. This review is restricted to a narrative overview of all studies that met the inclusion criteria and contained sufficient data for data extraction and quality assessment. The effects of physical activity studies and core physical skills studies were examined by setting of the intervention, stratified by study quality. The evidence statements were developed using NICE criteria (NICE., 2007) outlined below:

- The best available evidence
- The strength (quality and quantity) of supporting evidence and its applicability to the populations and settings in question
- The consistency and direction of the evidence.

This review did not produce any evidence statements based upon any cost-effectiveness data which will be considered in the economic review.

3. Cycling promotion: Summary of Findings

3.1. The studies

5 UK based studies (all UBA design) provide evidence for the effectiveness of cycling promotion on levels of cycling. All address the school setting.

DETR., (1999a) sought to increase use of cycling to a York secondary school through a range of promotional work such as a bicycle maintenance class a cycle, a cycle promotion group (Cycle 2000) and a cycle raffle each term with the prize being a new bicycle, and an exchange visit to Odense, Denmark, (which had the highest levels of cycling to school in Europe during the 1980s and 1990s) (Nielsen., 1990), supported by some infrastructure measures largely on the school site including a new cycle shed and segregated cycle route through the school grounds. The school was a Sustrans demonstration project school to show that increases in cycling to school are possible.

DETR., (1999b) was a Sustrans Demonstration project school in Horndean, a small town in Hampshire, to increase walking and cycle use to school but where significant promotional work was focused on cycling to school including a school travel plan and classroom work for Year 7s on safe routes and other school travel issues. New cycle parking facilities were provided and some highways measures were planned including traffic calming on the approach roads to the school, and a new raised crossing outside the school gate. Promotional work also included an exchange visit to Odense, Denmark and a eight week module for Year 9 pupils on the journey to school as part of geography lessons.

DETR., (1999e) sought to assess the effectiveness of cycling promotion to encourage cycling at an school on the eastern fringe of Ipswich, Suffolk, with a pre-existing high level of cycle use. The area has rural characteristics having low density settlement patterns. Cycle promotion was largely ingrained in school life. School plans lessons were organised so that pupils did not need to carry too

many books back and forth, and the school newsletter always stressed to parents the need to encourage cycling and the benefits it brings to the school.

Osborne., (2006) addressed the issue of encouraging more children and their parents to cycle to school. The 40 pilot schools for a 'Bike It' programme in England, located in four urban areas (York, Manchester, Bristol, Derby) were evaluated in terms of the success or otherwise in increasing cycling to school through an intensive programme of visits and support by Bike It officers who ran events such as cycling breakfasts, bicycle maintenance, and cycle rides. Staff largely focused their attention to years 5 and 6 in primary school and year 7 in secondary schools.

Sustrans., (2007) assessed the effectiveness of a bicycle promotion intervention in increasing bicycle use to a primary school in Warrington, Cheshire. The Bike It project aimed to show that with support to schools it was possible through behavioural interventions to increase cycle use. The school adopted a policy of enabling every child with the school to benefit from the Bike It programme throughout the school year. For example in a primary school all children (aged 5-11 years) would participate in Bike It.

3.2. Evidence of efficacy

If statistical data were reported in the original studies, these have been included in all sections headed 'evidence of efficacy' and tables. If no data are reported in these sections it means that no data were provided by the author(s). One (+) quality study (DETR., 1999a) showed that cycling levels to school rose from 13 to 25% between January 1996 to November 1998 as measured by single day self-report pre- and post intervention surveys. At the same time walking declined from 81% of school journeys to 69% so the overall active travel percentage share for the school journey remained at 94% and car use remained at 5%. It is not, however, possible to assess any effect of the intervention on total physical activity. One (+) quality study (DETR., 1999b) showed that between January 1996 to November 1998 that the percentage of pupils walking the school journey had increased by 4%, from 38% to 42%, and cycling for the school journey had

increased by 3%, from 4% to 7%. Car use had declined from 43% to 37% while bus use remained stable at 15%. One (+) quality study (DETR., 1999e) reported that walking for the school journey declined from 35% in October 1995 to 15% in summer 1998 while bicycle use increased from 45% to 61%. Bus use increased from 12% to 16%. Car use remained stable at 8% pre and post intervention. However, the study reported considerable use of bicycles during the school day for curriculum related events and sports fixtures away from school. This includes visits to the local BT laboratories, religious institutions, the tennis club, squash courts and playing fields which would otherwise have been inaccessible because of high transport costs. All three studies reported changes over 12 months.

Two (+) quality studies reported short-term increases in cycling (Osborne., 2006; Sustrans., 2007) (self reported in autumn term 2004 and summer term 2005 and counts of bicycles parked at schools, and self reported and counts of bicycles parked at the school, evaluated over eleven months, respectively). In both studies cycle use rose so that those cycling to school daily increased from 3.9% to 11.3% and from 5% to 25% respectively. The difference between the figures for these two Bike It case studies reflects a lower average cycle use for the school journey pre intervention for the 40 Bike It schools than at the one primary school in Warrington in the second study. Less frequent cycle use also increased. Cycling to school once a week increased with 19% cycling on average once a week across the 40 Bike It schools post intervention (pre-intervention figure not stated) (Osborne., 2006). Cycling to school once or twice a week increased at the Warrington primary school from 12% pre intervention to 27.5% post intervention (Sustrans., 2007).

The quality of the studies are summarised in Table 3.

Table 3 Summary of studies by quality and outcome

	Quality		
Outcome	++	+ UBA	-
positive effect		DETR., 1999a DETR., 1999b DETR., 1999e Osborne., 2006 Sustrans., 2007	
no effect			
negative			

3.3. Key questions

3.3.1. Which interventions are effective in promoting, increasing or sustaining cycling by children and young people with their families?

The risk of some active travel interventions may be that they do not increase active travel overall but rather change modes from walking to cycling or vice-versa. This was the case in two studies (DETR., 1999a; 1999e) although in the second of these two studies where cycling was already the dominant mode of travel to school it was reported that cycling during the day may have increased overall active travel levels beyond what would have been possible through walking or otherwise inaccessible due to cost. No data was reported to support this claim.

Two studies of a relatively intensive supported behavioural intervention (Bike It) reported very substantial increases in cycling among primary school pupils over the short-term (Osborne., 2006; Sustrans., 2007). In both studies it is reported that there is an important link to families and that parents/carers were involved and encouraged to support and cycle with their children.

3.3.2. What mass media and/or information campaigns or strategies are effective in promoting, increasing or sustaining cycling levels in children and young people under the age of 18?

Two of the five studies were Sustrans Demonstration project schools as part of a Safe Routes to Schools programme (DETR., 1999a; DETR., 1999b). One of these provided a range of intervention measures including enhanced cycle parking, bicycle maintenance one evening per week and a once a term raffle with a new bike as a prize (DETR., 1999a). The other provided a range of intervention measures including cycle lockers and secure cycle parking as well as a small element of curriculum work in Years 7 and 9 (DETR., 1999b). Both involved an exchange visit to Odense, Denmark. One of the other studies reported on a pilot study for the Bike It programme (Osborne., 2006) while another was a study of a subsequent Bike It intervention in one primary school (Sustrans., 2007). Both reported on a range of initiatives as part of a strategy to encourage cycling including a small element of curriculum work, Bike to School events, cycle incentive schemes, and engaging with parents/carers as well as school staff.

The fifth study had one of the highest levels of cycling to a secondary school in England prior to the intervention (DETR., 1999e). The schools' positive attitude towards cycling is a main driver for cycle promotion although money is spent on lockers and improvements to cycle parking facilities. There were many active role models for pupils including 15 teachers and senior staff who regularly walked or cycled to school.

3.3.3. In which situations/settings are interventions to promote, increase or sustain children and young people's cycling levels effective?

The five studies were all in a school setting where the journey to and from school was the focus. This setting has particular advantages in that there is a daily routine which can be established towards active travel and at primary school level considerable enthusiasm among the target group for these travel modes. Behavioural interventions at school can often be supported with limited infrastructure provision for cycling through secure and weather protected cycle parking.

3.3.4. Which interventions that do not involve a permanent change to the environment are effective in promoting, increasing or sustaining active travel to school by children and young people of different age and gender groups?

School-based interventions appeared to increase cycling in both primary and secondary schools when they built on an existing positive cycling culture. None of the studies reported travel mode change by gender.

3.3.5. Are there aspects/ components that are consistent between interventions which are effective in promoting, increasing or sustaining children and young people's cycling levels?

Four of the five studies reported interventions where a dedicated officer had regular contact with the school (DETR., 1999a; DETR., 1999b; Osborne., 2006; Sustrans., 2007). For Bike It schools this contact might be as much as weekly. Such intense external support is likely to be an important aspect of gaining school support for an intervention offered from outside rather than developed within the school.

3.3.6. Which aspects/ components of interventions and their delivery contribute to the effectiveness of interventions to promote, increase or sustain cycling?

Positive approaches towards cycling among a schools' management appears to help promote cycling among pupils (DETR., 1999a; DETR., 1999e). However, the other interventions were successful with less supportive cycling cultures at the start of the intervention. This may be because of the relationship which develops between the officer and the school community, as per Bike It. In one study the school set up a Cycle 2000 group to help promote cycling to school with student, teachers, and Sustrans representatives (DETR., 1999a).

3.3.7. What are the characteristics of study populations and settings that may contribute to the effectiveness of the successful cycling interventions and programmes?

The characteristics of the study population that may contribute to successful interventions are again a cycle-friendly culture (supportive parents) and infrastructure. In addition, distance to school appears to be critical. For example, Bike It is predominantly focused on primary schools where distances are often relatively short (although no data on distances to school were provided) (Osborne., 2006; Sustrans., 2007).

3.4. Applicability (of evidence from efficacy studies) to UK population/setting

All five of the studies were conducted in schools in the UK. They are applicable only to populations or settings included in the studies. The success of broader application is uncertain.

3.5. Implementability of intervention.

All of the studies can be implemented across the UK but may be more suited to locations where distances to school are often relatively short – as is more often the case with primary schools (1.5 miles average trip length in 2006).

Cycling promotion summary evidence statement:

There is evidence from five UK studies (all UBA [+])* that cycling promotion projects, targeting primary and secondary school children can lead to large self-reported increases in cycling both at 9-11 months and over 20-23 months. Characteristics of successful interventions included the involvement of external agencies to facilitate schools to promote and maintain cycling, with the support of parents and the local community.

There is evidence from two of the studies (UBA [+]), where cycling infrastructure was commonly part of the local transport infrastructure or children were encouraged to cycle to curriculum related events or sports fixtures, that self reported levels of walking declined over 20 and 23 months, implying that some of the increase in cycling may have been offset by a decrease in walking.**

The evidence is applicable to the UK.

***DETR., 1999a; DETR., 1999b; DETR., 1999e; Osborne., 2006; Sustrans., 2007 (all UBA [+])**

****DETR., 1999a; DETR., 1999e (both UBA [+])**

4. Safe Routes to Schools/School Travel Plans: Summary of Findings

4.1. The studies

Three studies, two UK based, and one US based (one RCT and two UBA studies) provide evidence for the effectiveness of Safe Routes to Schools/School Travel Plans in increasing walking and cycling (Rowland et al., 2003; DETR., 1999c; Staunton et al., 2003).

Rowland et al., (2003) evaluated the effect of site specific advice from school travel coordinators on school travel patterns in Camden and Islington, London. Site specific advice was provided on the development of a school travel plan through visits and contact from a school travel coordinator.

DETR., (1999c) sought to promote walking, cycling and bus use among 11-18 year olds. Promotional measures focused on a 'Safe routes to school' module within the curriculum and promotional work to keep parents and the community informed. Other elements included new cycle storage for 80-100 bikes, and preparation of a School Travel Plan.

Staunton et al., (2003) evaluated the impact of a programme to increase walking and biking to school and decrease car use in Marin County, California, US. The programme included: mapping safe routes to school; walk and bike to school days; frequent ride miles contest; classroom education; walking school buses and bike trains; newsletter and promotions. The programme relied heavily on parents, teachers and volunteer helpers to carry out the broad range of activities.

Evidence of efficacy of Safe routes to schools/School Travel Plans

The (++) quality randomised controlled trial study was conducted in the UK (Rowland et al., 2003) and showed no difference in active travel modes used between schools that developed school travel plans and a control group of schools. In the intervention schools the intervention was up to 16 hours of expert

assistance, across one school year, in supporting the development of a Travel Plan. The proportion of children walking in the intervention schools was 70%, cycling or using public transport was 6% while 24% travelled by car. In the control school 71% walked, 7% cycled or used public transport, and 23% travelled by car. For the journey to school, the adjusted odds of walking, cycling, or using public transport in intervention schools were almost identical to that in control schools (OR 0.98, 95% CI 0.61 to 1.59). School Travel Plans require schools to set themselves targets for achieving modal shift away from car use. However, the other two studies reported increases in walking and cycling: one US based (+) quality study (Staunton et al., 2003) reported increases in self-reported walking of 64% and a 114% in biking and a 39% decrease in children arriving by private car carrying only one student, over the long-term. One UK (+) quality study (DETR., 1999c), showed increases in self-reported walking and cycling. Both walking and cycling increased between early summer 1996 and early summer 1998 from 35% to 47% and 2% to 5% respectively. Bus users declined from 23% to 20% and car use dropped from 40% to 28%. The quality and main outcomes of the studies are summarised in Table 4.

Table 4 Summary of studies by quality and outcome

	Quality		
Outcome	++ RCT	+ UBA	-
positive effect		DETR., 1999c Staunton et al., 2003	
no effect	Rowland et al., 2003		
negative			

Key Questions

4.3.1 Which interventions are effective in promoting, increasing or sustaining active travel by children and young people with their families?

Each study directly sought to increase walking and cycling use. Two studies demonstrated a positive effect on walking and/or cycling levels in children travelling to school (DETR., 1999c; Staunton et al., 2003). These two interventions were part of Safe routes to schools programmes which used multi-pronged approaches to promote walking and cycling to school.

One of these studies, in the UK at a suburban secondary school in Hertfordshire with 1062 pupils aged 11-18, involved some highway improvements and cycle parking, alongside a promotional project including public meetings, school newsletters, a module on school travel to help change pupil travel behaviour (DETR., 1999c). A US study, based in suburban Marin County, California, among elementary and middle school pupils, was purely promotion based and included walk and ride days, classroom education, a frequent ride miles contest for those cycling; walking school buses and bike trains (where pupils cycle in a group with adults) (Staunton et al., 2003). Both studies reported substantial increases walking and cycling although the latter were from a very low base in both studies.

One UK study which focused on the drafting of School Travel Plans among primary schools in inner London reported no increase in either walking or cycling in the 9 intervention schools completing the study (Rowland et al., 2003). Control schools indicated that at the intervention schools the support of a school travel adviser in helping develop a Travel Plan had no effect on pupil travel behaviour even though the intervention schools implemented some form of Safe routes to schools activities compared to four of the control schools. Secondary data indicated that there was no evidence that the intervention had any substantial effect on parental fears about safety on the journey to school.

4.3.2 What mass media and/or information campaigns or strategies are effective in promoting, increasing or sustaining active travel in children and young people under the age of 18?

No evidence was found to specifically answer this question. The two studies which were effective in increasing levels of walking and cycling were each located in residential areas of cities. One UK (+) intervention included promotional work with slogans about using alternatives to car use as well as through public meetings and exhibitions (DETR., 1999c). The US (+) study (Staunton et al., 2003) included newsletters and promotions. Volunteer leaders at the schools were supplied with template flyers, fact sheets, posters, newsletters, and e-mails.

In one UK (++) quality study (Rowland et al., 2003), which showed no effect, additional incentives may have been needed beyond the assistance provided by the travel plan coordinators to address safety concerns and advice on developing a Travel Plan. However, it is likely that such coordinators would have promoted behavioural change interventions – although these are not reported on.

In summary, the evidence would suggest that introduction of Safe Routes to schools behavioural interventions can lead to increases in walking and cycling in the short and long term.

4.3.3 In which situations/settings are interventions to promote, increase or sustain children and young people's active travel effective?

All three studies were located in a school setting and there is a lack of evidence with which to assess the effectiveness of interventions in other settings. The two studies which reported increases in walking and cycling were located in affluent suburban areas (DETR., 1999c; Staunton et al., 2003). With regard to the studies which reported no increase in walking and cycling there is insufficient evidence to suggest whether or not advice from a School Travel adviser is sufficient to lead to increases in walking and cycling (Rowland et al., 2003) It is possible that the traffic environment in inner London makes parents too fearful for their children's safety to let them walk or cycle without environmental changes to reduce the

dangers posed by motorised traffic. It is notable that for one study which included private schools the modal shift away from car use at these schools was reported to have been substantially smaller. This was attributed partly to distance between home and school (Staunton et al., 2003).

4.3.4 Which interventions that do not involve a permanent change to the environment are effective in promoting, increasing or sustaining active travel to school by children and young people of different age and gender groups?

None of the studies provided data addressing gender. Therefore, there is insufficient evidence to make an assessment about the impact of gender. The age of children and young people ranged age 5-11 (Rowland et al., 2003), elementary and elementary and middle schools (Staunton et al., 2003) and age 11-18 (DETR., 1999c). Safe routes to schools programme appear to be effective, across a broad age range, in increasing walking and cycling for the school journey.

4.3.5 Are there aspects/ components that are consistent between interventions which are effective in promoting, increasing or sustaining children and young people's active travel?

A small element of curriculum work and some promotional work including information targeted at parents and the local community appears to be a common aspect to the two interventions which reported increases in active travel mode use. Safe routes to schools programmes which have some specific behaviour change promotions such as walking and cycling days and educational work with pupils to consider their travel behaviour appear to lead to increases in the use of these modes.

4.3.6 Which aspects/ components of interventions and their delivery contribute to the effectiveness of interventions to promote, increase or sustain active travel?

A wide range of measures to promote walking and cycling was reported by one of the schools as the most important factor through giving local people ownership of the project (DETR., 1999c). Staunton and colleagues similarly reported that much of the programme's success could be "attributed" to the contributions made by parents, teachers, and community volunteers (Staunton et al., 2003) although no data was presented to support this observation.

4.3.7 What are the characteristics of study populations and settings that may contribute to the effectiveness of the successful active travel interventions and programmes?

The two studies reporting increased walking and cycling were relatively wealthy and suburban in location (DETR., 1999c; Staunton et al., 2003). Neither provided further details about the localities. The location of schools in suburban areas may influence the potential for travel behaviour change more favourably than more intensely motor trafficked streets in inner London and thus influence parents and pupils likelihood to change travel behaviour to walking and cycling. The third study which reported no increase active travel modes to school comprised 45% of its schools from the private school sector in the intervention and 50% in the control group (Rowland et al, 2003). It is of note that children attending private schools are likely to travel further to school than those attending state school and more likely to travel by car. This relationship was identified among children in the US study who attended private schools - where changes way from car use to walking and cycling where smaller than for public (state maintained) schools (Staunton et al., 2003).

4.4 Applicability (of evidence from efficacy studies) to UK population/setting.

Two of the studies were from the UK and thus provide directly applicable evidence. The evidence from the US Safe routes to schools project is likely to be

applicable in similar settings in the UK.. The study addressing School Travel Plans is directly applicable although a study addressing a sample of inner London primary schools may not be so replicable elsewhere in the UK.

In summary, the evidence is applicable only to populations and settings included in the studies – the success of broader application is uncertain.

4.5 Implementability of intervention

The two UK studies show that Safe routes to schools and School Travel Plan intervention are highly implementable in the UK. In addition, the US intervention is similar (so long as there are pavements) to many safe routes to schools that are implemented in the UK.

Safe routes to schools/School Travel Plan summary evidence statement

There is evidence from one UK study (RCT [++])* to suggest that introduction of school travel plans and direct support from a school travel plan advisor at primary schools did not lead to increases in self reported levels of walking and cycling at 12 months.

There is evidence from one US and one UK study (UBA [+]) to suggest that a mix of promotional measures including curriculum, parental and community promotions (e.g. mapping safe routes to school, walk and bike to school days) can increase self reported walking and cycling at 24 months. In the UK study this activity was in support of a travel plan.**

The evidence is applicable to the UK.

***Rowland et al., 2003 (RCT [++])**

****DETR., 1999c; Staunton et al., 2003 (both UBA [+])**

5. Walking Buses: Summary of Findings

5.1 The studies

Four studies, all UK based, (all UBA studies) provide evidence for the effect of Walking Buses (Appendix D) in encouraging active travel.

Bickerstaff & Shaw, (2000) evaluated the effectiveness of a Walking Bus in reducing car use for the school journey at a First school in Stone, Staffordshire. Pirehill School set up a walking bus initiative targeted to increasing walking to school among its 4-9 aged pupils. Parents meetings to recruit volunteers, and publicity was issued to all parents by the school. Parents volunteers were engaged to run the walking bus scheme which started operating in November 1999 on two days per week with 12 children. By January 2000 it was operating five days per week with 24 children.

DETR., (1999d) assessed the effectiveness of a Walking Bus and other associated safe routes to school measures including a new bus route, and curriculum work and road safety training in reducing car travel to a Junior school in a suburban area of St. Albans, Hertfordshire. The School implemented the first known Walking Bus in the UK which was seen to the most effective element of a Safe route to school project for the school.

Mackett et al., (2005) assessed the effectiveness of five Walking Buses in Hertfordshire having noted that many had been set up at schools in Britain as a way of providing an alternative to the car as a means of travel to school but had then ceased. Walking bus route were promoted within the school and by meetings and information sent home. Sixty-two per cent of the children using walking buses had previously travelled to school by car. Some children used the walking bus fewer than five days a week.

Cairns, S.; (2006c) assessed the effectiveness of three Walking Buses, in Liverpool, established at one primary school. The school operated other initiatives as part of school travel plan work such as walk to school days and park

away days but the walking buses have been viewed as critical both in terms of the numbers of pupils using them and in encouraging other parents to re-think how their children get to school.

5.2 Evidence of efficacy

One UK (+) quality study (DETR., 1999d) reported increases in walking to school linked to a Walking Bus commencing. Between summer 1996 and December 1998 walking increased from 53% to 69%, cycle use increased from 0% to 2%, bus use from 3% to 8%, while car use declined from 44% to 21%. One UK (+) quality study (Mackett., 2005) reported some long-term increases in walking as a result of five Walking Buses. In most cases, one or two children on each walking bus switched from being driven to school. This figure is higher if children who sometimes used the car are included. Some children used the walking bus fewer than five days a week and in total this comprised approximately 50% of pupils in the walking buses at the five schools. Overall, the reduction in the number of children travelling by car was about 50% of the number of children on a walking bus. On average, each child who previously traveled by car who switched to walking, walked for 22 minutes on the walking bus each time it was used. For a child that uses the walking bus every day, this is nearly two hours of extra physical activity a week. This is a considerable increase in physical activity.

One UK (+) quality study (Cairns, S.; 2006c) reported long term increases in walking to which Walking Buses contributed. Walking increased from 60% to 68.3% in 14 months, and approximately 25% of all walking was with walking buses. Car use declined from 40% to 27% .One (-) UK study reported an overall decline in walking as well as among those using a Walking Bus (Bickerstaff & Shaw, 2000) although 10 (36%) of the Walking Bus users were previously driven to school. The decline in use of the walking bus was from 22 pupils using it at the outset and 14 using it four months later. No further details were available. The quality of the studies and main outcomes are summarised in Table 5.

Table 5 Summary of studies by quality and outcome

	Quality		
Outcome	++	+ UBA	- UBA
positive effect		DETR., 1999d Mackett et al., 2005 Cairns, S.; 2006c	
no effect			
negative			Bickerstaff., 2000

5.3 Key Questions

5.3.1 Are walking buses effective in promoting, increasing or sustaining active travel by children and young people with their families?

The interventions sought to increase the number of primary school pupils walking to and sometimes from school. Walking Buses sometimes operate on some days of the week and not others**.** One (+) quality study assessed the effects of Walking Buses across a range of primary schools (Mackett et al., 2005). At the first stage, all the Walking Buses were launched with some enthusiasm. The schools provided support and publicity, Road Safety Officers had been working with the school, and the coordinator and parent volunteers were keen. However, this study reported that 12 Walking Buses had ceased to operate in Hertfordshire from a list of 26. In nine cases this was because of a lack of volunteers to escort the walking buses (Mackett et al., 2005). The reliance on volunteers and the impact of the loss of one or two individuals may have to the sustainability of the

initiative often appears to be critical. Another Walking Bus was reported to be in decline (Bickerstaff & Shaw, 2000).

5.3.2 What mass media and/or information campaigns or strategies are effective in promoting, increasing or sustaining walking bus use in children and young people under the age of 18?

No evidence was found to specifically answer this question. Three of the studies addressed Walking Buses in single primary schools. In one (+) quality study the Head teacher was the champion for non-car use and messages were issued through governors meetings, public meetings, exhibitions, school newsletter, and press coverage (DETR., 1999d). Sponsorship for the Walking Bus was gained from a local supermarket and a television company. In one (+) quality study information and promotional work was largely that of an initial letter sent out from the school to gauge interest among parents (Cairns, S.; 2006c). In one (-) quality study a parents meeting was organised to recruit volunteers and publicity was issued to all parents but with little success (Bickerstaff & Shaw, 2000).

Several Walking Bus studies reported that children were rewarded for walking, such as with house-points, vouchers for the school bookshop and the chance to go to a ‘green’ disco (DETR., 1999d) or a small reward at the end of term (Cairns, S.; 2006c)**.**

5.3.3 In which situations/settings are interventions to promote, increase or sustain children and young people’s walking bus use effective?

As described in earlier sections, the school setting is a key setting for interventions to promote, increase or sustain children and young people’s active travel levels. Studies of interventions in other setting were not found. It is of note that Walking Buses are focused at primary schools and thus age may be a key determinant given that 5-11 years olds are more likely to be escorted to school than secondary aged pupils and the Walking Bus provides a guarantee that pupils are escorted by adults.

5.3.4 Which interventions that do not involve a permanent change to the environment are effective in promoting, increasing or sustaining walking bus use to school by children and young people of different age and gender groups?

There is insufficient data available to assess the impact of gender on the intervention. However, Walking Buses are targeted at primary school pupils (ages range from 5-11 years) and can be effective in increasing the numbers of children walking to school.

5.3.5 Are there aspects/ components that are consistent between interventions which are effective in promoting, increasing or sustaining children and young people's walking bus use?

There is some evidence to suggest that having a clear coordinator or champion for a Walking Bus may be an important component. This was identified in one study (DETR., 1999d) and was also raised in the review of a number of Walking Buses (Mackett et al., 2005). The latter noted that the contribution of the coordinator to the success of the Walking Bus should not be overlooked. The personality and organisational ability of the coordinator impacted on the operation and long-term future of the Walking Bus. The loss of an effective coordinator may well have an impact on the continuation of a Walking Bus.

It appears that having a coordinator or champion for a Walking Bus is important in promoting and sustaining children and young people's active travel.

5.3.6 Which aspects/ components of interventions and their delivery contribute to the effectiveness of interventions to promote, increase or sustain walking bus use?

Close liaison with the local highway or transport authority appears to be a common component in the effectiveness to promote, increase, or sustain Walking Buses. Local highways or transport authorities appear to be key promoters of the concept of Walking Buses. For example, nearly all schools replying to a survey in Hertfordshire had heard about them through the local

highway authority even if they were not intending to start Walking Buses (Mackett et al., 2005), while those in Staffordshire and Liverpool were supported by their respective transport authorities (Bickerstaff & Shaw, 2000; Cairns, S.; 2006c).

5.3.7 What are the characteristics of study populations and settings that may contribute to the effectiveness of the successful walking bus interventions and programmes?

Two studies were conducted in areas with different social class patterns, affluent residential communities in Hertfordshire (DETR., 1999c) and a school in Liverpool with 37.2% of pupils receiving free school meals (Cairns, S.; 2006c). With so few studies it is difficult to determine whether this is a significant factor contributing to the success or otherwise of Walking Buses. More important may be the distance to school and whether walking is seen as viable. One study reported that parents were not happy to trust the safety of their children to other parents (Bickerstaff & Shaw, 2000).

5.4 Applicability (of evidence from efficacy studies) to UK population/setting.

The evidence from Walking Buses are applicable only to populations or settings included in the studies – the success of broader application is uncertain. Distance from school may mean that Walking Buses are more likely to be effective in urban areas where population densities are relatively high and pavements are continuous. However, the evidence from the studies suggests that Walking Buses appear to cease to function over the longer term unless there is sufficient continuity of support from volunteers.

5.5 Implementability of intervention

In the opinion of the reviewers, the UK studies would be highly feasible to implement in other UK city and town settings.

Walking Buses: summary evidence statements

There is evidence from three UK (UBA [+])* studies to suggest that Walking Buses, (volunteer-led walking groups supported by parents and teachers plus the involvement of the local highways or transport authority), led to increases in self reported walking among 5-11 year olds, and reduced car use for children's' journeys to and from school at 10 weeks and 14 to 30 months.

There is evidence from one (UBA [-]) study to suggest that the provision of a walking bus may in itself not be sufficient to stem a more general decline in walking to and from school. Retaining volunteers to act as coordinators for these schemes appears to be a key factor in the sustainability of walking buses.

Currently Walking Buses are found to be commonly delivered in the UK, however evidence for their applicability remains uncertain (as they may be applicable only to the specific populations or settings included in the studies).

*** DETR., 1999d; Mackett et al., 2005; Cairns, S., 2006c (UBA [+])**

****Bickerstaff & Shaw, 2000 (UBA [-])**

6 Walking promotion: Summary of Findings

6.1 The studies

Five studies, four UK and one Australian based, (two CBA and three UBA studies) provide evidence for the effect of walking promotions in encouraging active travel.

McKee et al., (2007) assessed the impact of a combined intervention on a group of Year 5 pupils' travel behaviour in one school with a control school class in another school not receiving the intervention. The intervention involved curriculum materials to promote walking to school. This was a resource pack designed and adapted for schools in Scotland to reflect the linkages with the 5-14 year old curriculum which offered ideas for making an active travel project informative, interactive and appropriate for primary school children. This included a customised map of the school community and illustrated the core path networks linking the wider community to the school. Aspects of the pack were also designed for use by pupils and their families at home to engage them in the project outside the formal curriculum.

TAPESTRY (2003): this project was a school travel initiative linked to a national (UK) "Walk to School Week" campaign. Pupils (4-11) at 147 participating urban primary schools in Hertfordshire (UK) which therefore could have reached 60,000+ pupils, and their parents received a wide range of promotional materials including a pack to help with the planning of classroom activities focused on walking to school. Eleven schools receiving the intervention were assessed as were two control schools not participating in "Walk to School Week".

Cairns, S.; (2006a) sought to increase walking and other modes to school and reduce car use. One component was Go for Gold, which was a walking incentive scheme which sought to encourage walking among families where distances to school were often under 1 mile. There were a wide range of incentives available to those walking or otherwise not travelling to school by car.

Cairns, S.; (2006b) assessed a promotional campaign to encourage walking, with Park and Stride for those needing to use a car. A range of incentives were promoted to both children and adults. This included Walk On Tuesdays and Thursdays, where record cards are signed off by parents to confirm that children have walked and certificates & “Champion Walker” gold pencils awarded to everyone who maintained their walking record all term.

Zaccari & Dirkis, (2003) assessed the impact of a four week programme to raise awareness about the benefits of walking to school and any consequent changes in walking and car use in a primary school in Australia. Mapping of routes to schools, use of personal travel diaries and painting of banners for display around the school were used to engage pupils, as well as Newsletters and involvement of the local press in broadly promoting the benefits of walking to school to the local community.

6.2 Evidence of efficacy

One (+) quality UK study reported a significant increase in those walking to school in an intervention school Year 5 class with little change at a control school (McKee et al., 2007) following the introduction of a curriculum based intervention project and associated materials for pupils and parents to discuss together. Outcomes were measured in pre-intervention and then an after survey was conducted at 10 weeks. Twenty three intervention school pupils (out of a class of 30) positively changed their behaviour from baseline to follow-up by increasing the distance travelled to school by walking. Thus, over 75% of pupils increased the distance they walked each day by nearly four fold over ten weeks. Mean distance walked to school in the intervention group increased from 198 to 772 metres, an 389% increase while mean distance walked to school in the control group increased from 242m to 285m at follow up, an increase of 17% (mean difference between intervention and control schools 555m, t (38) =24.679, p,0.001 (95% CI 2315m to 2795m).. No reason was reported for this increase in walking. The authors also reported that 71% (n=20) of the intervention group progressed to a higher ‘‘stage of change’’ of behaviour change relating to active

commuting or remained in the ‘‘action’’ and maintenance’’ stages compared with 52% (n=14) of the control group in relation to making an active journey to school (OR 1.90, 95% CI 0.63 to 5.73 – this outcome was calculated by CC from raw data).

The Tapestry project was a controlled repeated cross-sectional (+) quality study whereby pupils in eleven UK primary schools received campaign packs and two control schools did not. After 4 weeks there was no significant difference in levels of walking to either sets of schools (Tapestry., 2003). The proportion walking to schools in the intervention increased from 75% to 76% and decreased from 78% to 77% in the control schools.

One (+) quality Australian study reported a modest increase in walking to school following a four week promotional programme during which pupils kept travel diaries and a promotional programme was initiated (Zaccari & Dirkis, 2003). They reported the percentage of car trips decreased by 3.4% and the percentage of walking trips increased by 3.4%. Bus use increased by 0.9%. Journey to school comparisons between the first week and the fourth week indicated an overall 6% increase in the number of children walking to school.

One (+) quality UK study reported a near doubling in walking to school and commencement of some cycling to school over 41 months with a corresponding decrease in car use to school of more than 50% (Cairns, S.; 2006a). In April 2000 62% of pupils travelled by car, 30% walked, 8% parked and walked, and 0 cycled. In October 2003 25% travelled by car, 58.5% walked, 12.5 parked and walked, and 4% cycled. One (+) quality UK study reported a modest increase in walking of 5.4% and a similar increase in park and walk of 5% over 48 months with a corresponding 9.9% decline in car travel to school (Cairns, S.; 2006b). The quality and outcomes of the studies are summarised in Table 6.

Table 6 Quality and outcomes of studies

	Quality			
Outcome	++	+ CBA	+ UBA	-
positive effect		McKee et al., 2007	Cairns, S.; 2006a Cairns, S.; 2006b Zaccari & Dirkis, 2003	
no effect		Tapestry., 2003		
negative				

6.3 Key Questions

6.3.1 Which interventions are effective in promoting, increasing or sustaining walking by children and young people with their families?

Interventions to promote walking are one of the most common measures to help reduce car use for the school journey in the UK, most notably at primary school level, where distances to school are often under 1 mile. Specific walking programmes such as Walk to School and Walk on Tuesdays and Thursdays (WOTT), including classroom based activities and incentive are effective in increasing walking for the school journey.

6.3.2 What mass media and/or information campaigns or strategies are effective in promoting, increasing or sustaining walking in children and young people under the age of 18?

No evidence was found to specifically answer this question. One (+) quality UK study was focused on a Travelling Green project using a resource pack for teachers which also included information for children to discuss with their parents/carers (McKee et al., 2007). In one (+) quality UK study Go for Gold was a walking incentive scheme where children had a card which was stamped every morning that they walk to school. Walking home was also later incorporated into the scheme with parents initialling the card which is then stamped again the next day. Assemblies, curriculum work, and newsletter also promoted walking to school. Walking nearly doubled from a pre-intervention baseline of 30% to 58.5% post intervention (Cairns, S.; 2006a).

One (+) quality UK study reported a Walk on Tuesdays and Walk on Tuesdays and Thursdays scheme. Those who used Park and Stride (a four minute walk from a pub car park) were also included. Information was also issued to parents on road safety, health, and environmental issues. Walking to school increased from 53.3% to 58.7% and park and walk from 9% to 14%. (Cairns, S.; 2006b). In one (+) quality Australian study a strategy was that pupils were given a four week travel diary to complete each day. Map work in class was used to locate homes, and 36 school banners were painted by pupils. Nine Newsletters were produced on a weekly basis during term 1 to raise the school community's awareness of the problems created by driving to school. There was involvement of the local press, plus a school assembly on Walk to School. Police enforcement against pavement parking was increased during the intervention period (Zaccari & Dirkis, 2003).

6.3.3 In which situations/settings are interventions to promote, increase or sustain children and young people's walking effective?

All four successful interventions were targeted at the school setting. No studies were found reporting on walking interventions among children and young people in other settings.

6.3.4 Which interventions that do not involve a permanent change to the environment are effective in promoting, increasing or sustaining walking to school by children and young people of different age and gender groups?

None of the studies provided data addressing gender. All four successful interventions were targeted at primary school pupils. One study reported walking interventions targeted at older primary school aged pupils rather than young children on the basis that Year 5 to primary 7 (Scotland) were already undertaking road safety education and likely to have greater independence and maturity to walk to school than pupils in lower primary school (McKee et al., 2007). However, one Australian study reported an intervention focused across the school years where the greatest increases in walking were reported to be among younger pupils in Years 2 and 3 simply because this, according to the study, was where the potential for change was greatest (Zaccari & Dirkis, 2003). Similarly, at a First School in the UK (Years 1-3), walking levels were reported to have nearly doubled (Cairns, S.; 2006a).

6.3.5 Are there aspects/ components that are consistent between interventions which are effective in promoting, increasing or sustaining children and young people's walking levels?

The engagement of primary school pupils through incentives, and communication to their parents/carers appears to be a common component of the school walking promotions reported.

6.3.6 Which aspects/ components of interventions and their delivery contribute to the effectiveness of interventions to promote, increase or sustain walking levels?

Two of the four studies reporting increases in walking placed significant emphasis on incentives for pupils (Cairns, S.; 2006a; Cairns, S.; 2006b). Personal travel diaries were used in one study as a way of engaging with pupils as well as painting banners which were displayed around the school (Zaccari & Dirkis, 2003). Two of the studies also provided incentives or sought parents' engagement with the programme (McKee et al., 2007; Cairns, S.; 2006b).

6.3.7 What are the characteristics of study populations and settings that may contribute to the effectiveness of the successful walking interventions and programmes?

All five studies addressed the primary school setting. In three of the four studies where walking to school was reported to have increased, distance to school appears to be an important determinant of the success. In one of the studies a specific reason for the emphasis on walking was that 86% of pupils lived within a mile and most of these within half a mile of the school (Cairns, S.; 2006a). In another study most pupils were reported to live within half a mile from school (Cairns, S.; 2006b). Similarly, in a third study 80% of pupils lived within one kilometre of the school (Zacarri, Dirkis., 2003).

In summary, schools are a key setting for increasing active travel through walking interventions and these appears to be focused on primary schools. Distance to school may be an important determinant. In the opinion of the reviewers, in locations where car ownership is high and distance to school is less than 1 mile there may be most potential for walking promotion interventions.

6.4 Applicability (of evidence from efficacy studies) to UK population/setting.

Four of the five studies came from the UK and so these are directly applicable to UK school settings. The Australian paper is likely to be applicable because of its

location in an urban settlement with similar population densities to UK cities. In summary, the evidence is applicable only to populations or settings included in the studies – the success of broader application is uncertain.

6.5 Implementability of intervention.

Walking promotion interventions are feasible to implement in UK primary school settings, especially where average distances to school are a mile or less. They are likely to be the most common behaviour interventions to increase active travel in school settings.

Walking promotion summary evidence statement

There is evidence from one UK (CBA [+]) study*, two UK (UBA [+]) and one Australian (UBA [+])*** studies to suggest that walking promotion schemes, involving promotional materials, incentives and rewards, travel diaries for children and parents and provision of "park and walk" parking areas close to school and restriction of parking outside of schools, can lead to increases in self reported walking to school among 4 to 11 year olds, and reduced car use for children's' journeys to and from school at 4 to 10 weeks and 41 to 48 months.**

There is evidence from one UK (CBA [+]) study** to suggest that walking campaign packs alone, including promotion materials for children and parents, did not lead to increases in walking among 4 to 11 year olds at 4 weeks.**

There is evidence from two UK and one Australia study (UBA [+])*** to suggest that targeting children and parents who live a short distance to school (one mile or less) may support interventions to encourage increase walking levels for the school journey.**

The evidence mainly comes from UK studies and so is directly applicable only to populations or settings included in the studies (primary school settings) – the success of broader application is uncertain.

*** McKee et al., 2007 (CBA [+])**

**** Cairns, S., 2006a; Cairns, S., 2006b (both UBA [+])**

***** Zaccari & Dirkis, 2003 (UBA [+])**

****** Tapestry., 2003 (CBA [+])**

******* Cairns, S., 2006a; Cairns, S., 2006b; Zaccari & Dirkis, 2003 (all UBA [+])**

7 Discussion

There is a small but growing body of literature about the efficacy of different approaches to promoting active travel with children. These approaches are consistently centred around travel to and from school and we found no examples of travel to and from other destinations. Only one school setting was in a rural settlement on the fringe of a town (DETR., 1999e). Initiatives that involved the school, parents and the local community, often supported by an external co-ordinator, and that engaged the children were most likely to demonstrate short and long term changes in active travel behaviour. These findings are consistent with the results of a recent systematic review which concluded that school-based interventions including family or community involvement (van Sluijs et al., 2007) were more likely to increase adolescent physical activity, rather than activity in younger children.

There are also likely to be some similarities between interventions targeted at adults and those targeted at children. A systematic review which assessed whether interventions were effective in improving population health and encouraging people to walk and cycle as an alternative to using cars found that interventions have not been effective unless they target motivated sub-groups of the population (Ogilvie et al., 2004). A difference between adults and children will be that there is evidence that children, particularly at primary school level, are generally motivated towards active travel modes. Their motivation may be tempered by distance to school, and parental habits and safety concerns.

As previous reviews have found there is a lack of well-designed studies to establish the effectiveness of these initiatives (Foster & Hillsdon., 2004). The review found evidence of efficacy; ‘efficacy’ is defined as whether the intervention works in different settings and for different groups. The studies show consistent, short and long term effects of active travel initiatives to increase active travel related physical activity. What remains unknown is the effectiveness of such initiatives. ‘Effectiveness’ is defined as how well an intervention works compared with a similar non-intervention condition. Without the benefit of a sufficient

number of comparison or control group studies, no conclusions can be reached as to the effectiveness of such interventions (Grey, 1997).

The explanations for this may lie in the complete focus on school-related active travel. The lack of studies in other settings may reflect that research on physical activity and learning physical activity skills largely does not take place outside of the curriculum for this age group. Alternatively, it may reflect a paradigm issue as highlighted by the finding of the NICE Under Eights review (Gorely et al., 2007). For example, it was anticipated that there might have been relevant studies investigating the effectiveness of methods to teach children ride a bike. The lack of these studies may in part demonstrate that those involved in cycling training do not come from a research paradigm where conducting intervention studies are a normal part of their mode of working.

There are important limitations with the standard approaches to the measurement of how children travel to school. These range from hands-up surveys, paper travel survey questionnaires, and also counts of bicycles parked at schools, and often undertaken on single days and thus potentially affected by weather. The former can be at significant risk of bias. However, this may be recompensed in part, at least, through many school travel surveys consistently reporting increases in the active travel modes post intervention. The Bike It programme from Sustrans is a case in point where cycle use has been reported to have increased between 300-400% at nearly all participating schools, and where occasional bike counts provided some triangulation and confidence in the self-report data.

One limitation of this review is potential publication bias. The review was limited to English language. We anticipated a large number of similar schemes from continental Europe. For example, the Traffic Snake Game, popular in Flanders is reported to have achieved increases in active travel on the school journey. However, a detailed evaluation of the programme was not available (Bossaert., (2007) Personal communication). The European Local Transport Information Service provides some limited information about a variety of active travel

interventions targeted at children and young people under age 18 (www.eltis.org) but further detailed information is not available in English.

Other types of interventions may exist but have not been submitted or accepted for publication, or only those with positive results have been published. Other reviews have commented on the lack of research in this area (Sallis et al., 1998). Only three studies had comparison or control groups using an experimental design, leaving the other studies unable to attribute changes to their intervention alone. All the studies were conducted within field settings and therefore are subject to systematic error, including selection bias and measurement bias (Beaglehole et al., 1993).

As a result of the DfES/DfT initiative and target for all schools in England to have travel plans by 2010 there is likely to be considerable 'grey' data from work many schools have undertaken as part of their STP. However, the quality of the data is very likely to remain poor without greater resource and engagement of external researchers who are able to design for more rigorous data capture and analysis. Moreover, many schools have little time available to enable robust data capture, often having already invested time in developing a school travel plan. However, greater researcher involvement is likely to give greater confidence to the efficacy and effectiveness of the interventions.

Recently the Research Councils' Energy programme with the EPSRC's Life Sciences Interface and Economy, Environment and Crime programmes has identified the area of walking and cycling as an area it would like to develop in its transport portfolio in order to study environmental interventions. A similar UK programme focused on interventions that do not involve a permanent change to the environment and which address active travel among children and young people under the age of 18 would help provide evidence which addresses the issues of efficacy and effectiveness.

Conclusion

This review has resulted in some evidence statements that can form the basis of recommendations for practice. However, further evidence for the efficacy and sustainability of interventions promoting active travel to children is needed.

In addition, as no studies were found which reported on settings other than the school there is a need for action to address the paucity of evidence and potentially the paucity of research given that children make other journeys through which active travel modes are possible options for a least local travel.

8 Evidence Tables

Evidence Table 1; Cycling promotion

First Author and date	Study design & research type/quality	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/potential sources of bias	Applicability to the UK
DETR 1999a	Uncontrolled before and after [+]	Small secondary school	To assess impact of a Demonstration Project in increasing levels of cycling for the school journey	450 mixed gender pupils, 11-16, in York in primarily residential area with significant proportion in local authority housing. 25% receive free school meals	Combination of promotion of cycling through work with pupils, plus exchange trip to Odense. Plus, bicycle maintenance provided one evening per week, and a once a term raffle with a prize of a new bike for good school attendance. New segregated cycle route through the school, enhanced cycle parking on site, and some traffic management on approaches to the school.	January 1996 before intervention implementation and again in November 1998	Before and after travel surveys in class	A near doubling of cycling from 13 to 25% between January 1996 to November 1998. Walking declined from 81% to 69% so overall active percentage share remained at 94% and car use remained at 5% Some focus on walking and public transport		Self-report data	Yes –UK

First Author and date	Study design & research type/quality	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/potential sources of bias	Applicability to the UK
DETR 1999b	Uncontrolled before and after [+]	Large secondary school	To assess impact of a Demonstration Project in increasing levels of cycling for the school journey	1867 mixed gender pupils, 11-18, in small Hampshire town location near an extensive area of suburban housing. 5.3% receive free school meals	Exchange trip to Odense, 8 week model introducing concept of sustainable transport for Year 9 pupils, and classroom work on school travel issues in Year 7, secure cycle parking compound, installed cycle lockers, a separate entrance for pedestrians and cyclists, included better and safer access to school by foot, bicycle, and public transport' within the school.	January 1996 before intervention implementation and again in November 1998	Before and after travel surveys in class	By the after survey in November 1998 the modal share for walking had risen from 38% to 42% and cycling had increased from 4% to 7%. Car use had declined from 43% to 37% while bus use remained stable at 15%	Decline in car use to school from 43 to 37%	Self report data	Yes - UK

First Author and date	Study design & research type/quality	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/potential sources of bias	Applicability to the UK
DETR 1999e	Uncontrolled before and after [+]	Large Secondary school	To assess the effectiveness of cycling promotion to school at a school with a pre-existing high level of cycle use	970 mixed gender pupils, 11-16on the eastern fringe of Ipswich alongside a busy main road into the town serving two large suburban villages with 10% of pupils travelling from smaller rural settlements within an 8 mile radius. 8% receive free school meals	Pupils are taught basic safety rules and responsibilities, but the school does not want to be heavy handed with regulations and so discourage cycling. The school itself has created the high levels of cycling by its positive attitudes, active promotion and its spending on infrastructure such as lockers and secure parking. Its enthusiasm has spread to its feeder schools too.	October 1995 survey and then again in early summer 1998	Before and after travel surveys in class	Walking has declined from 35% in October 1995 to 15% in summer 1998 while bicycle use has increased from 45% to 61%. Bus use has increased from 12% to 16%. Car use has remained stable at 8% pre and post intervention. However, considerable use of bicycles during the school day may result in a total increase in physical activity levels than would not be achieved through lower levels of cycle use		Self-report data	Yes – UK

First Author and date	Study design & research type/quality	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/potential sources of bias	Applicability to the UK
Osborne 2006	Uncontrolled before and after [+]	Range of primary and secondary schools	To encourage more children and their parents to cycle to school and to increase the number of young people who cycle to school and on other journeys	School children in Years 5-6 in primary and Year 7 in secondary in 40 urban schools in York, Derby, Manchester, Bristol areas	To encourage more children and their parents to cycle to school and to increase the number of young people who cycle to school and on other journeys	9 months	Before and after travel surveys in class	3.9% of pupils usually cycled in 2004 and 11.3% usually cycle to school in 2005. One in 3 new cyclists previously travelled by car. 71% of pupils were cycling once a week (in addition to the school journey) up from 65%. In total an additional 2500-3500 parents and pupils were cycling to school. 20% of all pupils participate in Bike to School events	Before surveys with parents, after surveys with school champions and local highway authorities. One third of new cyclists had previously traveled by car	Self report data although some bike counts	Yes - UK

First Author and date	Study design & research type/quality	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/potential sources of bias	Applicability to the UK
Sustrans 2007	Uncontrolled before and after [+]	Primary school	Bike It officer visiting school to provide a range of cycling promotional events: Activities have included cycle rides, maintenance classes, cycle themed science lessons, cycle training and skills sessions, fun days, Bike fair, cycle to school days and a regular cycle on Wednesdays, and many children have taken part in a large number of these. The frequency of events varied but as a general rule six days per term	Primary school, with 291 pupils, in a moderately deprived ward in Warrington, UK, but has a number of successful projects (eg Healthy Schools)..	To assess the effectiveness of a bicycle promotion in increasing bicycle use to schools	10 months	Before and after travel surveys in class	Change in numbers of children cycling every day, once or twice a week, once or twice a term, once or twice a year. Every day cycling increases from 5% (n=15) to 72 (n=75). Car use declined from 51% to 41% (see table). Reported that up to 100 children cycled each Wednesday throughout the summer term. Many parents also reported as cycling with their children.	There was a reduction from 51% to 41% of journeys to school by car between September 2006 and July 2007	Self report data although some bike counts	Yes - UK

Evidence Table 1; Safe routes to schools/school travel plans

First Author and date	Study design and research type	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
DETR 1999c	Uncontrolled before and after [+]	Secondary school	One of two pilot schools in Hertfordshire for a safe routes to schools project seeking to increase levels of walking, cycling, and public transport use	Much of the catchment is made up of affluent suburbs and surrounding villages (5% free school meals). 64% of pupils live within 2 miles of the school. 1062 mixed gender pupils.	Curriculum work – school developed a safe routes to school module – optional course for Year 9 taken by roughly 45 pupils per year. External contributors to module. Project promotional work to keep parents and community informed. Also new cycle storage for 80-100 bikes, and preparation of a School Travel Plan. Some traffic engineering measures, new crossing, new footways, bus shelter and lay-by and school safety zone	2 years	Before and after travel surveys in class	Both walking and cycling increased between early summer 1996 and early summer 1998 from 35% to 47% and 2% to 5% respectively. Bus use declined from 23% to 20% and	Decline in car use from 40 to 28% over period	self report data	Yes - UK

First Author and date	Study design and research type	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
Rowland 2003	RCT [++]	Primary schools	To evaluate the effect of site specific advice from a school travel coordinator on school travel patterns	41 primary schools across Camden and Islington invited to participate. 21 agreed	Site specific advice on developing a school travel plan through visits and contact from a school travel coordinator – up to 16 hours over an academic year	12 months	Proportion of children walking, cycling, public transport, or car use on day of survey	70% of children walked to school, 24% travelled by car, and 6% cycled or used public transport. In control schools, 71% walked, 23% travelled by car and 7% cycled or used public transport. Adjusted OR 0.98 (95% CI 0.61 to 1.59) for walked, cycled, or took public transport That is, having a School Travel Plan did not change travel patterns compared with school with no Travel Plan	Proportion of schools which developed and implemented a School Travel Plan; plus survey to all parents of all pupils in Years 2 and 5 in intervention and control schools two months after intervention – assessed parental safety concerns.	Low risk of bias. Self-selection of schools but then randomised and intervention and control schools were similar at baseline	Yes - UK
Staunton 2003	Uncontrolled before and after [+]	SRS/STP	To evaluate the impact of a programme to increase walking and biking to school and decrease car use	Elementary and middle schools – 7 public, 4 private by 2002-03	Behavioural programme included: mapping safe routes to school; walk and bike to school days; frequent ride miles contest; classroom education; walking school buses and bike trains; newsletter and promotions	2 years	Hands-up surveys in class	Increase in walking of 64% by spring of 2002, a 114% in biking, 91% increase in carpooling and a 39% decrease in children arriving by private car carrying only one student	39% decrease in pupils arriving by car carrying only one pupil and 91% increase in car pooling	Heavy reliance on volunteers and self report data – show of hands. Inexperienced volunteers – results often incomplete, some schools did not complete the survey at all	Somewhat - US

Evidence Table 1; Walking Bus

First Author and date	Study design & research type/quality	Setting	Research question	Study Population, country, sample size	Description of interventions	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
DETR 1999d	Uncontrolled before and after [+]	Primary school	To assess the effectiveness of a walking bus and other associated measures in reducing car travel to school. Walking Bus seen as most effective element	370 pupils 7-11, mixed gender, adjacent to secondary school, Sandringham, and shares a site with a nursery, infant and middle school in suburbs of St. Albans. 89% of pupils live within 1 mile of school. 2% fee school meals.	The school developed a School Travel Plan including curriculum work. Head teacher was champion for non-car use and messages go through governor's meetings public meetings, exhibitions, school newsletter, press coverage. Walking and cycling training provided by Herts County Council.	30 months	Before and after travel surveys in class	Between summer 1996 and December 1998 walking increased from 53% to 69%, cycle use increased from 0% to 2%, bus use from 3% to 8%,	Car use to school declined from 44% to 21% between summer 1996 and December 1998	Data for Walking Bus and 'walking' more generally not disaggregated. Local authority believes that about 30-40% of the project's success is due to road safety measures, and the rest to good promotion and the involvement of local people.	Yes - UK

First Author and date	Study design & research type/quality	Setting	Research question	Study Population, country, sample size	Description of interventions	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
Mackett 2005	Uncontrolled before and after [+]	Primary schools	To examine the effects of car use on children's physical activity and health; examine the effects of car use by children on their potential long-term car dependency; develop a framework to evaluate the impacts of travel-to-school initiatives	5 Primary school locations across Hertfordshire, UK, 101 participating pupils at time of launch	Walking bus route promoted within school and by meetings and information sent home	Between 18 and 30 months	Child mode of transport to school through travel survey questionnaires	About 62% of the children using walking buses had previously travelled to school by car. Some children used the walking bus fewer than five days a week. Overall, the reduction in the number of children travelling by car seems to be about 50% of the number of children on a walking bus. On average, each child who previously travelled by car who switched to walking, walked for 22 minutes on the walking bus each time it was used. For a child that uses the walking bus every day, this is nearly two hours of extra physical activity a week.	Interview data from both children and parents have been used to ascertain how many of the children registered to use the walking bus were previously driven to school.	Self report data	Yes - UK

First Author and date	Study design & research type/quality	Setting	Research question	Study Population, country, sample size	Description of interventions	Length of follow up	Physical activity outcome variables (inc measures)	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
Cairns 2006c	Uncontrolled before and after [+]	RC Primary and Nursery School.	To reduce the amount of cars coming to school and promote effects of healthy living associated with decreased car use.	Suburb of Liverpool, UK, The area around the school is mostly Victorian or Edwardian terrace housing. 37.2%of 309 pupils have free school meals	The school considers their main initiatives to be the three walking buses. Other initiatives like walk to school days and park away days have happened as a result of the walking buses. The walking buses are clearly critical both in terms of the number of children who use them, and their effect in raising awareness and encouraging other parents to re-think how their children get to school. New street lighting was also provided along routes.	14 months	Not stated (but likely to combination of hands-up and paper survey work as part of Travel Plan monitoring)	Increase in walking from 60% to 68.3% in 14 months, approximately 25% of all walking is with walking buses.	Car use declined from 40% to 27.3% over intervention period	Data collection methods not stated	Yes - UK
Bickerstaff & Shaw 2000	Uncontrolled before and after [-]	Primary school	Evaluation of the effectiveness of a Walking Bus in reducing car use for the school journey	First school pupils 4-9, mixed gender, a community school in a residential area with 216 pupils	Parent meetings to recruit volunteers, publicity issued to all parents by school. Establishment of Walking Bus	3 months	Teacher counts of pupils using walking bus	Overall walking levels declined and so did the number using the Walking Bus from 22 to 14 after 4 months. A third (36%) of Walking Bus users were previously driven to school.)	Interviews with head teacher and parents post intervention	Poor quality of implementation and rigour in assessment. Implementation affected by weather between manual counts of mode use between September and November	Yes - UK

Evidence Table 1; Walking promotion

First Author and date	Study design	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
McKee 2007	Controlled before and after [+]	Primary schools	To assess the impact of a combined intervention on children's travel behaviour.	Two Year 5 classes in primary schools in villages in West Dumbartonshire, UK, roughly 3 miles apart – 31 pupils in intervention and 29 in control	A Travelling Green project was delivered in the intervention school during term 3 using Curriculum materials (a resource pack for Teachers designed by Sustrans). The pack was also to be used by children and parents at home to engage them in the project outside of the formal curriculum. Pack contained a customised map of the school community and illustrated the core path networks linking the wider community to the school.	10 weeks	Mean distance to school in the intervention group increased from 198 to 772 metres – a 389% increase while mean distance walked to school in the control group increased from 242m to 285m at follow up, an increase of 17%. Mean difference between intervention and control schools 555m, t (38) =24.679, p,0.001 (95% CI 2315m to 2795m). 23 intervention school children positively changed their behaviour from baseline to follow-up by increasing the distance travelled to school by walking	Decreasing distance travelled to school by car from 2018metres to 933 metres. 71% (n=20) of the intervention group progressed to a higher ''stage of change'' of behaviour change relating to active commuting or remained in the ''action''' and maintenance'' stages compared with 52% (n=14) of the control group in relation to making an active journey to school. OR 1.90, 95% CI 0.63 to 5.73 – this outcome was calculated by CC from raw data	Random sampling not possible but authors not that sought to control for as many threats to internal validity as possible. No checks that intervention school pupils were more or less active than control group ie more amenable to more walking	Yes – UK

First Author and date	Study design	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
TAPESTRY 2003	Controlled before and after [+]	Primary schools	School travel initiative linked to a national (UK) "Walk to School Week" campaign: to increase levels of walking to school.	11 Primary schools across Hertfordshire, UK, in urban areas	The national Walk to School campaign is supported by schools across the country. Leaflets on benefits of walking, posters and banners for display within schools, stickers, certificates, curricular packs, campaign website. Education packs linked to the national curriculum are also provided. These include teachers notes and suggestions for activities (such as discussions around posters showing good / bad environments). In addition classroom planners are provided to assist with monitoring overall activity from the class throughout walk to school week.	3-4 weeks	Proportion of children walking to school at least once per week. No significant difference (proportion increased from 75% to 76% in intervention schools and decreased from 78% to 77% in control schools	Parents reported they would probably walk to school in target schools. Baseline 36% to 41% at four weeks post intervention.	All eleven-campaign schools had previously had a walk to school campaign in either 2001 or 2000 - the 2 control schools had not	Yes - UK

First Author and date	Study design	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
Cairns 2006a	Uncontrolled before and after [+]	First school	Objectives and targets of the school travel plan were to improve travel safety and encourage more families to walk rather than to drive to school.	H179 pupils, aged 4-7, mixed gender. School, on the edge of Holmer Green village, Buckinghamshire, UK, is predominantly rural on one side, whilst more suburban and residential on the other. 0% free school meals.	School Travel Plan working group oversaw consultation process and support for a walking bus. Also identified need for section of pavement. Go for Gold is a walking incentive scheme. Children have a card which is stamped every morning that they walk to school. Recently walking home has also been incorporated into the scheme with parents initialling the card which is then stamped again the next day. Children arriving by bike or scooter can also receive the incentives; cycle training; pedestrian training; park and walk; talks at parent induction; curriculum work; assemblies on school travel; newsletter	41 months	April 2000 - 62% car, 30% walk, 8% park and walk, 0 cycle, October 2003 25% car, 58.5% walk, 12.5 park and walk, 4% cycle.	Car use from 62% to 25% for school journey in 42 months	Not clearly stated how travel mode use is monitored	Yes - UK

First Author and date	Study design	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
Cairns 2006b	Uncontrolled before and after [+]	Primary school	The encouragement of walking is the main objective of the travel plan, with Park and Stride for those needing to use a car.	St Michaels Primary School has 585 puils, aged 4-11, of mixed gender. It is located on a housing estate, four miles north of Bristol, UK, built in the early 1980s, bounded by roads carrying heavy traffic volumes during peak hours. The area, Stoke Gifford is in many ways a dormitory settlement where many people commute to work from to Bristol.	Walk on Tuesdays and Thursdays (WOTT) and Commit to Walk includes incentives (certificates, stickers, a trophy, pencils). Commit to Walk' for other times of the year when the weather is more inclement.. On the WOT (Walk on Tuesdays) and WOTT days, record cards are signed off by parents to confirm that children have walked and certificates & "Champion Walker" gold pencils awarded to everyone who maintained their walking record all term; Park and Stride (a 4 minute walk from a pub car park).	48 months	March 1999: car 36.5%, walk 53.3%, Park and walk 9%, bus 1.4; March 2003: car 26.6, walk 58.7%, Park and walk 14%		Not clearly stated how travel mode use is monitored	Yes - UK

First Author and date	Study design	Setting	Research question	Study Population, country, sample size	Description of intervention	Length of follow up	Main results	Non physical activity outcomes	Confounders/ potential sources of bias	Applicability to the UK
Ziccari, Dirkis., 2003	Uncontrolled before and after [+]	Primary school	The project aimed to raise awareness about the benefits of walking and to increase the number of primary school children to and from school instead of being driven	Suburb of inner Sydney, Australia. All pupils engaged - 243	234 pupils given a 4 week travel diary to complete each day. Use of map to locate home, painting of 36 school banners. 9 Newsletters were produced on a weekly basis during term 1 to raise the school community's awareness of the problems created by driving to school. Involvement of local press, plus a school assembly on Walk to School. Police enforcement against pavement parking during the intervention period	4 weeks	The percentage of car trips decreased by 3.4% and the percentage of walking trips increased by 3.4%. Journey to school comparisons between the first week and the fourth week indicated an overall 6% increase in the number of children walking to school	3.4% reduction in car use for school journey over the 4 week intervention period	self-reported data	Yes - similar inner urban settlement type - although AUS

Appendix A – Included studies

Included studies

Bickerstaff, K., Shaw, S., 2000 An evaluation of the Walking Bus at Pirehill First School. CAST: Staffordshire University.

Cairns, S., (2006a) Making School Travel Plans Work (Holmer Green First School), in Marsden, G.R. (ed) *Wasted Miles, Wasted Money: A less congested, more energy efficient future*, London: CICC Publications.

Cairns, S., (2006b) Making School Travel Plans Work (St Michael's Primary School), in Marsden, G.R. (ed) *Wasted Miles, Wasted Money: A less congested, more energy efficient future*, London: CICC Publications.

Cairns, S., (2006c) Making School Travel Plans Work (St Sebastian's Primary School and Nursery), in Marsden, G.R. (ed) *Wasted Miles, Wasted Money: A less congested, more energy efficient future*, London: CICC Publications.

DETR, 1999 School travel strategies and plans, London: DETR. A) Burnholme Community College.

DETR, 1999 School travel strategies and plans, London: DETR. B Horndean Community School.

DETR, 1999 School travel strategies and plans, London: DETR. C) Sandringham School.

DETR, 1999 School travel strategies and plans, London: DETR. D Wheatfields Junior School.

DETR, 1999 School travel strategies and plans, London: DETR. E Kesgrave High School.

Mackett, R., Lucas, L., Paskins, J., Turbin, J. (2005) Walking Buses in Hertfordshire: Impacts and lessons. UCL: Transport Studies Centre.

http://www.cts.ucl.ac.uk/research/chcaruse/Walking%20bus%20report%20-%20UCL.pdf accessed 3rd September 2007

McKee, R., Mutrie, N., Crawford, F., Green, B. 2007 Promoting walking to school: results of a quasi-experimental trial, Journal of Epidemiology and Community Health, 61: 818-823.

Osborne, P., (2006) Bike It, in WHO, Collaboration between health and transport sectors in promoting physical activity: examples from European countries (CD Rom). Copenhagen: WHO.
http://www.euro.who.int/InformationSources/Publications/Catalogue/20070503_2 accessed 22nd November 2007

Rowland, D., DiGuiseppi, C., Gross, M., Afolabi, E., Roberts I. (2003) Randomised controlled trial of site specific advice on school travel patterns, Archive of Disease in Childhood, 88: 8-11.

Staunton, C., Hubsmith, D., Kallins, W. 2003 Promoting Safe Walking and Biking to School: The Marin County Success Story, American Journal of Public Health, 93(9): 1431-1434.

Sustrans, 2007 Bike It Case Study – Cinnamon Brow Primary School.

TAPESTRY, 2003 Walking to School campaign case study, Hertfordshire. (CD ROM).

Zaccari, V., Dirkis H. 2003 Walking to school in inner Sydney, Health Promotion Journal of Australia, 14(2): 137-140.

Appendix B – Excluded Studies

Active Travel – Excluded studies

		Reason for exclusion
1.	Ball,K., Timperio,A., Salmon,J., Giles-Corti,B., Roberts,R., Crawford,D., (2007). Personal, social and environmental determinants of educational inequalities in walking: a multilevel study. Journal of Epidemiology & Community Health, 61(2), 108-114.	Not intervention study
2.	Barton,B.K., Schwebel,D.C., Morrongiello,B.A.,. (2007). Brief report: Increasing children's safe pedestrian behaviors through simple skills training. Journal of Pediatric Psychology, 32(4), 475-480.	Not intervention study
3.	Berrigan,D., Troiano,R.P., McNeel,T., Disogra,C., Ballard-Barbash,R., (2006). Active transportation increases adherence to activity recommendations. American Journal of Preventive Medicine, 31 (3), 210-216.	Not intervention study
4.	Besser,L.M., Dannenberg,A.L., Besser,L.M., & Dannenberg,A.L. (2005). Walking to public transit: steps to help meet physical activity recommendations. American Journal of Preventive Medicine, 29(4), 273-280.	Not intervention study
5.	Beuret,K., & Camara,P. (1998). Walking six miles a day – no way! Realistic approaches to the journey to school.	Not intervention study
6.	Boom,L. (2006). School Run in the UK. International Union of Public Transport/Union Internationale des Transports Publics.	Not intervention study
7.	Bradshaw,R., Lane,R., & Turner,G. (1998). Levels of activity relating to safer routes to school type projects and green transport plans. Final report. (p.101).: University of Westminster, London (GB). Transport Studies Group.	Not intervention study
8.	Brunsveld-Van,HulT., & Knippenbergh,,L. (1996). Road safety improvements for children inside and outside the schools in the Netherlands.	Not intervention study
9.	Cambourne,B., & Hills,A.P. (2002). Walking to school – a sustainable environmental strategy to prevent childhood obesity.	Not intervention study
10.	Cohen,D.A., Ashwood,S., Scott,M., Overton,A., Evenson,K.R., Voorhees,C.C., Bedimo-Rung,A., & McKenzie,T.L. (2006). Proximity to School and Physical Activity Among Middle School Girls: The Trial of Activity for Adolescent Girls Study. [References]. Journal of Physical	Not Intervention Study

Activity & Health, 3(Suppl1), S129-S138.

11. Collins, D.C., & Kearns,R.A.,(2001). The safe journeys of an enterprising school: negotiating landscapes of opportunity and risk. Health & Place, 7,293-306.	Not an intervention study
12. Cooper,A.R., Andersen,L.B., Wedderkopp,N., Page,A.S., Froberg,K., (2005). Physical activity levels of children who walk, cycle, or are driven to school. American Journal of Preventive Medicine, 29 (3), 179-184.	Not intervention study
13. Cooper,A.R., Page,A.S., Foster,L.J., Qahwaji,D., (2003). Commuting to school: are children who walk more physically active? American Journal of Preventive Medicine, 25(4), 273-276.	Not intervention study
14. Cooper,A.R., Wedderkopp,N., Wang,H., Andersen,L.B., Froberg,K., Page,A.S., (2006). Active travel to school and cardiovascular fitness in Danish children and adolescents. Medicine & Science in Sports & Exercise, 38(10), 1724-1731.	Not Intervention Study
15. Corsi,M.(2002) The child friendly cities initiative in Italy. Environment & Urbanization, 14(2),169-179.	Not Intervention Study
16. Cuddihy,T.F., Davidson,M., & Michaud-Tomson,L. (2003). Walk to school – does it make a difference in children's physical activity levels?	Not intervention study
17. Delattre,E., Garcin,M., Mille-Hamard,L., Billat,V.,. (2006). Objective and subjective analysis of the training content in young cyclists. Applied Physiology, Nutrition, & Metabolism, Physiologie Appliquee, Nutrition et Metabolisme, 31(2), 118-125.	Not intervention study
18. Dwass,E. (2001). Kid health. Stay on the path to safety when walking to and from school. Los Angeles Times, Health: S2. S2.	Not intervention study
19. Evenson,K.R., Motl,R.W., Birnbaum,A.S., Ward,D.S., (2007). Measurement of perceived school climate for active travel in children. American Journal of Health Behavior, 31(1), 86-97.	Not intervention study
20. Fulton,J.E., Shisler,J.L., Yore,M.M., Caspersen,C.J., (2005). Active transportation to school: findings from a national survey. Research Quarterly for Exercise & Sport, 76(3), 352-357.	Not intervention study
21. Gorman,D.R., Ramsay,L.J., Bull,M., McGuigan,D., (2000). Uptake of the children's traffic club in Lothian. Health Bulletin, 58(1), 58-62.	Not Intervention Study
22. Harten,N., Olds,T., Harten,N., & Olds,T. (2004). Patterns of active transport in 11-12 year old Australian children. Australian & New Zealand Journal of Public Health, 28(2), 167-172.	Not intervention study
23. Hu,G., Pekkarinen,H., Hanninen,O., Yu,Z., Tian,H., Guo,Z., Nissinen,A.,	Not Intervention

(2002). Physical activity during leisure and commuting in Tianjin, China. Bulletin of the World Health Organization, 80(12), 933-938.	Study
24. Kerr,J., Rosenberg,D., Sallis,J.F., Saelens,B.E., Frank,L.D., Conway,T.L., (2006). Active commuting to school: Associations with environment and parental concerns. Medicine & Science in Sports & Exercise, 38(4), 787-794.	Not intervention study
25. Legg,S.J., Laurs,E., Hedderley,D.I., (2003). How safe is cycling with a schoolbag? Ergonomics, 46(8), 859-869.	Not an Intervention Study
26. Mackett, R.L., Gong,Y.,Kitazawa,K., Paskins,J., (2007) Children's local travel behaviour – how the environment influences, controls, and facilitates it. Presented at the 11th World Conference on Transport Research, Berkeley, California, 24-28th June 2007. From personal communication	Not intervention study
27. Morris,B.A., Trimble,N.E., (1991). Promotion of bicycle helmet use among schoolchildren: a randomized clinical trial.[see comment]. Canadian Journal of Public Health, Revue Canadienne de Sante Publique. 82(2), 92-94.	Not Intervention Study
28. Nagel,R.W., Hankenhof,B.J., Kimmel,S.R., Saxe,J.M., (2003). Educating grade school children using a structured bicycle safety program. Journal of Trauma-Injury Infection & Critical Care, 55(5), 920-923.	Not intervention study
29. Pendergrast,R.A., Ashworth,C.S., DuRant,R.H., Litaker,M., (1992). Correlates of children's bicycle helmet use and short-term failure of school-level interventions. Pediatrics, 90(3), 354-358.	Not Intervention Study
30. Preston,B. (1995). Cost Effective Ways To Make Walking Safer For Children And Adolescents.	Not intervention study
31. Rosenberg,D.E., Sallis,J.F., Conway,T.L., Cain,K.L., McKenzie,T.L., (2006). Active transportation to school over 2 years in relation to weight status and physical activity. Obesity, 14(10), 1771-1776.	Not intervention study
32. Saksvig,B.I., Catellier,D.J., Pfeiffer,K., Schmitz,K.H., Conway,T., Going,S., Ward,D., Strikmiller,P., & Treuth,M.S. (2007). Travel by walking before and after school and physical activity among adolescent girls. Archives of Pediatrics & Adolescent Medicine, 161(2), 153-158.	Not intervention study
33. Sirard,J.R., Ainsworth,B.E., McIver,K.L., Pate,R.R., (2005). Prevalence of active commuting at urban and suburban elementary schools in Columbia, SC. American Journal of Public Health, 95(2), 236-237.	Not intervention study
34. Sirard,J.R., Riner,W.F., Jr., McIver,K.L., Pate,R.R., (2005). Physical activity and active commuting to elementary school. Medicine & Science in Sports & Exercise, 37(12), 2062-2069.	Not intervention study

35. Sleap,M., Warburton,P., (1993). Are primary school children gaining heart health benefits from their journeys to school? Child: Care, Health & Development, 19(2), 99-108.	Not Intervention Study
36. Smith,P.B., Balicki,J.A., & Pesci,S.T. (2003). State Of Maine's Safe Ways To School Research Project.	Not Intervention Study
37. Spallek,M., Turner,C., Spinks,A., Bain,C., McClure,R., (2006). Walking to school: distribution by age, sex and socio-economic status. Health Promotion Journal of Australia, 17(2), 134-138.	Not intervention study
38. The Scottish government research (2002). Why do parents drive their children to school. Development Department Research Programme research findings. no. 143 (p.6).: Scottish Executive, Edinburgh (United Kingdom).	Not intervention study
39. The Scottish Government (2002). Young people and transport. Research findings. no. 155 (p.1).: MORI Scotland (GB); Scotland.	Not intervention study
40. Timperio,A., Ball,K., Salmon,J., Roberts,R., Giles-Corti,B., Simmons,D., Baur,L.A., Crawford,D., (2006). Personal, family, social, and environmental correlates of active commuting to school. American Journal of Preventive Medicine, 30(1), 45-51.	Not intervention study
41. Tudor-Locke,C., Neff,L.J., Ainsworth,B.E., Addy,C.L., Popkin,B.M., (2002). Omission of active commuting to school and the prevalence of children's health-related physical activity levels: the Russian Longitudinal Monitoring Study. Child: Care, Health & Development, 28(6), 507-512.	Not an Intervention Study
42. Waters,A., Trace,F., Nicholson,A.J., (2006). The "Road to Safety" in Irish children over the past five years. Irish Medical Journal, 99(1), 19-21.	Not intervention study
43. Yang,S., Zarr,R.L., Kass-Hout,T.A., Kourosh,A., Kelly,N.R., (2006). Transportation barriers to accessing health care for urban children. Journal of Health Care for the Poor & Underserved, 17(4), 928-943.	Not intervention study
44. University of York (2001). Ontario walkability study, trip to school: children's experiences and aspirations. University of York, Engalnd, United Kingdom.	Not an intervention study
45. Zhu,W., (1997). A multilevel analysis of school factors associated with health-related fitness. Research Quarterly for Exercise & Sport, 68(2), 125-135.	Not Intervention Study
46. Ziviani,J., Scott,J., Wadley,D., Ziviani,J., Scott,J., & Wadley,D. (2004). Walking to school: incidental physical activity in the daily occupations of Australian children. Occupational Therapy International, 11(1), 1-11.	Not intervention study

47. Austin,K. (1993). The safer routes to school project.	Inappropriate outcome measure
48. Ball,S.C., Linnan,L.A.,Ahlport,K., Giles, C., Vaughn, A., Ward, D.S. (2005) Active travel to school: a coalition based intervention to increase physical activity in elementary school children, Journal of the American Dietetic Association A11.	Inappropriate outcome measure
49. Collins,D.C., Kearns,R.A.,. (2005). Geographies of inequality: child pedestrian injury and walking school buses in Auckland, New Zealand. Social Science & Medicine, 60(1), 61-69.	Inappropriate outcome measure
50. Delaney,A., Newstead-S (Monash University Accident Research Centre (MUARC), & CORBEN,B. (2003). Outcome evaluation of the Safe Routes to Schools Program.	Inappropriate outcome measure
51. Dixey,R.(1998) Improvements in child pedestrian safety: have they been gained at the expense of other health goals? Health Education Journal 57;60-69.	Inappropriate outcome measure
52. Hotz,G., Cohn,S., Castelblanco,A., Colston,S., Thomas,M., Weiss,A., Nelson,J., Duncan,R., Pediatric Pedestrian Injury Task Force., (2004). WalkSafe: a school-based pedestrian safety intervention program. Traffic Injury Prevention, 5(4), 382-389.	Inappropriate outcome measure
53. Kearns,R.A, Collins, D.C, & Neuwelt, P.M (2003) The Walking school bus: extending children's geographies? Area 35.3, 285-292.	Inappropriate outcome measure
54. MacArthur,C. (2007). Bicycle skills training for preventing bicycle-related injuries in children and young people. Cochrane Database of Systematic Reviews, 2, 2007.	Inappropriate outcome measure
55. MacArthur,C., Parkin,P.C., Sidky,M., Wallace,W., (1998). Evaluation of a bicycle skills training program for young children: a randomized controlled trial.[see comment]. Injury Prevention, 4(2), 116-121.	Inappropriate outcome measure
56. Mackett,R.L, Lucas,L, Paskins,J, & Turbin,J (2003) A methodology for evaluating Walking Buses as an instrument if urban transport policy. Transport Policy 10, 179-186.	Inappropriate outcome measure
57. Mackett,R.L, Lucas,L, Paskins,J, & Turbin,J (2005) The therapeutic value of children's everyday travel. Transportation research part A 39,205-219	Inappropriate outcome measure
58. Merom, D., Rissel C., Mahmic, A., Bauman, A. (2005). Process evaluation of the New South Wales Walk Safely to School day. Health Promotion Journal of Australia, 16, 100-106.	Inappropriate outcome measure
59. Merom,D., Tudor-Locke,C., Bauman,A., Rissel,C., (2006). Active commuting to school among NSW primary school children: implications for	Inappropriate outcome measure

public health. Health & Place, 12(4), 678-687.	
60. Mulvaney,C.A., Kendrick,D., Watson,M.C., Coupland,C.A., (2006). Increasing child pedestrian and cyclist visibility: cluster randomised controlled trial. Journal of Epidemiology & Community Health, 60(4), 311-315.	Inappropriate outcome measure
61. Pettitt,T., Frost,P., & Thornthwaite,S. (1995). Travel To School: Influencing Modal Choice And Encouraging Safer Journeys.	Inappropriate outcome measure
62. Pilling,A., Murray-S (Greater Manchester Centre for Voluntary Organisation), & Turner,J. (1998). Catching them young. Community-based project to increase transport awareness and influence travel behaviour amongst young people.	Inappropriate outcome measure
63. Traffic Safety Center, USA(2004). Healthier kids, safer neighborhoods: safe routes to school encourages walking while educating kids and parents abut pedestrian safety. Traffic Safety Center Online Newsletter 2 (1).	Inappropriate outcome measure
64. Wall,J. (2000). The NSW Safer Routes to School program: a community behavioural approach to a traditional engineering intervention.	Inappropriate outcome measure
65. Boarnet, M.G., Day, K., Anderson,C., McMilan,T. & Alfonzo,M.,(2005) Impacts on walking, bicycling, and pedestrian safety. Journal of the American Planning Association 71 (3),301-317.	Included in Environment and physical activity review
66. Boarnet MG, Anderson CL, Day K, McMillan T, Alfonzo M. (2005) Evaluation of the California Safe Routes to School legislation. Am. J. Prev. Med., 28(2S2):134-140.	Included in Environment and physical activity review
67. Caunter,P., & Browne,L. (1999). Trail blazers. All aboard the Walking Bus; a guide to Walking Bus schemes around the country. (p.18).: Pedestrians Association, London (GB).	Review of case studies – used for source of primary studies
68. Davison,K.K., & Lawson,C.T. (1919). Do attributes in the physical environment influence children's physical activity? A review of the literature. International Journal of Behavioral Nutrition & Physical Activity, . 3, 2006. Article Number 19.	Review paper
69. Department for Transport (2002). Making travel plans work. Lessons from UK case studies. (p.93). Department for Transport, London (GB).	Review of case studies – used for source of primary studies
70. Morrison,D.S., Petticrew,M., Thomson,H., (2003). What are the most effective ways of improving population health through transport interventions? Evidence from systematic reviews. [Review] [61 refs]. Journal of Epidemiology & Community Health, 57(5), 327-333.	Review – used to source primary studies

71.	Ogilvie,D., Foster, C.E., Rothnie, H., Cavill, N., Hamiton, V., Fitzsimons, C.F., Mutrie, N. (2007) Interventions to promote walking: a systematic review. BMJ doi:10.1136/bmj.39198.722720.	Review
72.	Tudor-Locke,C., Ainsworth,B.E., Popkin,B.M., (2001). Active commuting to school: an overlooked source of childrens' physical activity?. [Review] [29 refs]. Sports Medicine, 31(5), 309-313.	Review
73.	Blakeslee,G. (2004). Go for Health! Partnership-Supporting the Link Between Transportation Choices and Routine Physical Activity. Transportation Research Board.	Guidance document
74.	Browne,L. (1999). The walking class. Walking to school – travelling green: a campaign guide. (p.70).: Pedestrians Association, London (GB).	Guidance document
75.	Center for Chronic Disease Prevention and Health Promotion (DHHS/CDC) KidsWalk-to-School: A Guide To Promote Walking to School. Report: ED451166.65pp.2000.	Guidance document
76.	Local Government Association (2003). Children on the move. Accessing excellence: the future of school travel. (p.15). Local Government Association (United Kingdom).	Guidance document
77.	US Department of Transportation (1997).Walk-ride-walk: getting to school Safely.	Guidance document
78.	Cycle Training UK Ltd (2004) Survey of the effectiveness of cycle training. London: CTUK Ltd.	Inappropriate outcome data

9 Appendix C – Search strategy for Medline

1. child$.tw.
2. kid$1.tw.
3. infant$1.tw.
4. youth$1.tw.
5. toddler$1.tw.
6. girl$1.tw.
7. boy$1.tw.
8. young$.tw.
9. (baby or babies).tw.
10. child/
11. child, preschool/
12. infant/
13. exp adolescent/
14. young people$.tw.
15. young person$.tw.
16. teen$1.tw.
17. teenager$.tw.
18. (under 18 or under 18s).tw.
19. or/1-18
20. ((active or activity) adj5 (transport$1 or transportation or journey$)).tw.
21. ((active or activity) adj5 travel$).tw.
22. (travel$ adj5 (bike$ or walk$ or biking or cycle or cycling or bicycl$ or mode$1 or route$ or pattern$1 or plan$1 or planning or rollerblad$ or skateboard$ or scooter$ or rollerskat$)).tw.
23. ((transport$1 or transportation) adj5 (bike$ or walk$ or biking or cycle or cycling or bicycl$ or mode$1 or route$ or pattern$1 or plan$1 or planning or rollerblad$ or skateboard$ or scooter$ or rollerskat$)).tw.
24. (journey$ adj5 (bike$ or walk$ or biking or cycle or cycling or bicycl$ or mode$1 or rollerblad$ or skateboard$ or scooter$ or rollerskat$ or route$ or pattern$1 or plan$1 or planning)).tw.
25. (commut$ adj5 (bike$ or walk$ or biking or cycle or cycling or bicycl$ or mode$1 or route$ or pattern$1 or plan$1 or planning rollerblad$ or skateboard$ or scooter$ or rollerskat$)).tw.
26. (school$ adj5 (bike$ or walk$ or biking or cycle or cycling or bicycl$ or route$ or rollerblad$ or skateboard$ or scooter$ or rollerskat$)).tw.
27. ((biking or cycle or cycling or bicycl$ or walk or walking or walks) adj1 route$).tw.
28. (road adj3 (safety or awareness or education or training)).tw.
29. ((bike or biking or cycling or bicycl$ or walk or walking) adj1 (bus or buses)).tw.
30. ((bike or biking or cycling or bicycl$) adj1 (budd$3 or train$ scheme$)).tw.
31. (walking budd$3 or walking crocodile$).tw.
32. travel plan$.tw.
33. (travel$ adj5 school$).tw.
34. national cycle network.tw.
35. bike it.tw.
36. ((link$1 or route or routes) adj5 school$).tw.
37. Connect2.tw.
38. travelsmart.tw.
39. safe$ route$.tw.
40. (bicycling/ or walking/ or skating/) and (schools/ or route$.tw. or travel$.tw. or transport$1.tw. or transportation.tw. or journey$.tw. or commut$.tw. or mode$1.tw. or train$.tw.)
41. transportation/
42. (travel$ or transport or transports or transportation or commut$ or journey$).tw. and (physical$ activ$.tw. or motor activity/)
43. or/20-42

44. 19 and 43
45. (editorial or letter).pt.
46. 44 not 45
47. limit 46 to (english language and yr="1990 - 2007")

10 Appendix D: Glossary

CBA	controlled before and after
CPHE	Centre for Public Health Excellence
DfES	Department for Education and Skills
DfT	Department for Transport
DH	Department of Health
CC	Collaborating Centre
NHS	National Health Service
NICE	The National Institute for Health and Clinical Excellence
NSF	national service frameworks
PDF	portable document format
PHCC	Public Health Collaborating Centre
PDG	Programme Development Group
QALY	Quality-adjusted life year
RCT	Randomised controlled trial
Safe routes to school	Aim to increase walking and cycle use through the implementation of behavioural and physical infrastructure measures, typically paths for walking and cycling, away from motor traffic.
School Travel Plans	A school Travel Plans has been defined as “a comprehensive plan setting out a package of measures which may include walking, cycling, and public transport initiatives; engineering, educational;, travel awareness and school policy measures” (STAG, 2000)
UBA	uncontrolled before and after
Walking Bus	Where parents and carers arrange for their children to walk to school as part of a pre-arranged group along a set route, usually with a ‘timetable’ for what time pupils will be collected or dropped off from the Walking Bus to and from school

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