



Final Report



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EPPI-Centre

The effect of travel modes on children's mental health, cognitive and social development; a systematic review



Evidence for Policy and Practice
Information and Co-ordinating Centre

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS	4
EXECUTIVE SUMMARY	5
ES 1 Aims and methods	5
ES 2 Interview / focus group study.....	5
ES 3 Broad mapping of research literature	6
ES 4 Detailed mapping on effects on CMHCSD.....	6
ES 5 Research and travel policy	6
ES 6 Conclusions and Recommendations	8
1. INTRODUCTION	11
1.1 Background and aims	11
1.2 Systematic reviews	11
1.3 Research design.....	11
1.4 Children’s mental health and cognitive and social development (CMHCSD).	12
2. INTERVIEW / FOCUS GROUP STUDY	14
2.1 Aims	14
2.2 Participants	14
2.3 Method	14
2.4 Results	15
2.5 Conclusions	17
3. MAPPING THE LITERATURE.....	18
3.1 Broad map: methods.....	18
3.2 Search process results	19
3.3 Broad map: findings	20
3.4 Broad map: conclusions	21

4. DETAILED MAP OF SUB-GROUP OF STUDIES ON CMHCSD.....	23
4.1 Detailed map: methods.....	23
4.2 Studies included	24
4.3 Reported findings about modes of travel and the component experiences of travelling	30
5. RESEARCH AND TRAVEL POLICY.....	36
5.1 Physical activity related to travel.....	36
5.2 Children’s environment when travelling	38
5.3 Diet when travelling	39
5.4 Social experiences with significant others, other adults or peers when travelling.....	40
5.5 Cognitive experiences when travelling.....	41
5.6 Effects of modes of travel suitable for journey to school	42
5.7 Effects of mode of travel.....	43
5.8 Effects of mass use of different modes of travel	44
6. CONCLUSIONS AND RECOMMENDATIONS.....	46
7. REFERENCES.....	50
8. APPENDICES.....	52
APPENDIX 1 ACKNOWLEDGEMENTS	52
APPENDIX 2 SEARCH TERMS USED IN ELECTRONIC DATABASE SEARCHING	54
APPENDIX 3 WEB SITES SEARCHED INCLUDING WEBBASED JOURNALS	58
APPENDIX 4 STUDIES IDENTIFIED BY DATABASE SEARCHES BY FOCUS OF STUDY	59
APPENDIX 5 STUDIES BY INCLUSION CRITERIA	67
APPENDIX 6 ALPHABETICAL LIST OF REFERENCES FOR ALL STUDIES INCLUDED IN BROAD MAP	75
APPENDIX 7 DeTR KEYWORD GUIDELINES/ DEFINITIONS AND STRATEGY	92

APPENDIX 8	KEYWORD/DATA EXTRACTION STRATEGY	103
APPENDIX 9	STRUCTURED SUMMARIES OF INCLUDED STUDIES	106
APPENDIX 10	DETAILED MAP OF INCLUDED STUDIES: MODE OR COMPONENT OF TRAVEL BY COUNTRY, OUTCOME AND TYPE OF STUDY	145

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EXECUTIVE SUMMARY

ES 1 Aims and methods

The purpose of this project was to establish what research is available on the effect of modes of travel on children's mental health and cognitive and social development (CMHCSD) and potential for further research to give robust, meaningful findings to extend existing knowledge.

The research project was commissioned by the Department of the Environment, Transport and the Regions (DETR) to support policy interests in travel to school including the work of the School Travel Advisory Group (STAG). Although, the primary interest was in travel to school, the Group wished to consider not only research about travel to school but also research about modes of travel suitable for journeys to school. This was to ensure that research on child travel was considered even if it did not directly address school travel issues.

Children travel to school using a variety of methods, such as walking, bicycling, bus, car, and others. On the way to school, they encounter a wide variety of experiences which may affect their learning, social skills or mental health status, interactions with situations and people. It was beyond the scope of the project to consider all research on all possible components of journeys to school. It was, however, important to consider research addressing the component activities involved in travel and travel to school, where the link to travel was explicit.

The research project had three stages:

- (i) an interview / focus group exercise in which a number of individuals concerned with schools, travel to school, travel policy and children were interviewed where the purpose was to explore the respondents' views of likely effects of travel on CMHCSD and to gather names of key individuals and key pieces of research on this topic;
- (ii) a systematic search and a broad mapping of the literature on the effects of travel on CMHCSD; and
- (iii) a more detailed mapping of one subset of the literature explicitly examining the effects of travel on CMHCSD, but without a very detailed investigation of the findings or quality of this research.

ES 2 Interview / focus group study

The interview / focus group study involved asking a number of people concerned in different ways with travel to school, including a focus group of young people, about the issues they felt were important in relation to the current study and for any suggested further contacts or knowledge of relevant studies. The purpose of this interview / focus group study was to inform a subsequent systematic review, by ensuring that the questions asked by the review were relevant to those involved in these issues and by searching for leads for relevant studies.

The interview / focus group study identified many different issues concerning the potential effects of travel on CMHCSD. Most of the issues raised by respondents related to the components of travel, of physical activity, diet, environment, social experiences, cognitive experience and effects on children of mass travel of different types.

ES 3 Broad mapping of research literature

A two stage process was undertaken. Using relevant terms identified through the interview / focus group study, there was first a search for and mapping of the literature of concern to the systematic review. Second there was a more detailed mapping of one subset of the first stage mapping, based on feedback from the project's steering committee. The two levels of mapping focused on what research had been undertaken rather than what can be reliably learnt from it.

Our searches of electronic databases identified reports relevant to the effects of these sub-components. A total of 3,228 references were located through electronic databases. Of these, 1,464 came from PubMed, 684 were from Eric, 644 were from PsycInfo, 109 from Sociological Abstracts, 312 were from Transport and 15 were from BiblioMap. Once detailed inclusion and exclusion criteria of relevance were applied to the 3,228 references, a total of 353 remained. Approximately one third of these studies were coded as borderline for inclusion leaving 177 studies for inclusion in a broad map of the literature.

In general, the range of reports identified was more limited than the ideas suggested by respondents in the interview / focus group exercise, but there were a few examples where the studies revealed other topics, such as: the effects of noise pollution, the effects of stress and daily hassles on children, the importance of car pools to social networks, risk taking and disruptive behaviour by some children, social responsibility of teenagers allowed/able to drive, the psychological effects of road traffic accidents and assault.

ES 4 Detailed mapping on effects on CMHCSD

The next stage of the review involved producing a more detailed map of a sub-group of identified studies concerned with effect of modes of travel to school, or components of travelling to school, on children's cognitive, social or mental health status. To further focus on the more specific sub-group topic, the 353 studies initially identified plus further studies from websites and interviews and personal contacts were subjected to a 'second round' of inclusion/exclusion screening, that specified research examining the effects of travel to school, travel suitable for travel to school or components of such suitable travel on CMHCSD. Thirty nine of the studies were considered relevant and included in the detailed review. As these studies covered a number of different component aspects of travel there were few studies on each component area.

ES 5 Research and travel policy

Finally, the nature of the research studies was compared with the suggestions for the likely effects of travel on CMHCSD identified by the interview / focus group study. Many of the suggested effects had been studied but only by a few studies using a variety of different research methodologies. These

methodologies have been described in this review but they have not been fully quality assessed. This should be a first priority to ensure that the reported results can be a basis for policy and practice decisions. If the results cannot be strongly relied upon, then further research will be needed on those topics.

Section 5 of the report provides details on the interview/focus group and identified research studies under the following headings:

ES 5.1 Physical activity related to travel

Five studies were identified. For example, Craft (1983) reported no effect of exercise on cognitive development, whereas Basile *et al.* (1995) reported that exercise reduced disruptive behaviour. Not all of the ideas suggested by the interview/focus group study were covered by the identified research. For example, exhaustion that might be caused by too much physical activity.

ES 5.2 Children's environment when traveling

Five studies were identified. All of the studies were concerned with the effect of travel in causing tension and anxieties or the effect of noise pollution on mental activity. Ideas suggested by the interview/focus group study included the effect on children of being wet and cold from walking or waiting at bus stops in the rain.

ES 5.3 Diet when traveling

Two studies were identified and these reported no effect of school breakfast on academic performance or attendance. The one idea from the interview/focus group study not covered by the research studies was the effect of diet on concentration.

ES 5.4 Social experiences when traveling

Three studies were identified. For example, the positive effects that bus drivers could have on social skills of children (Edwards and Johnson, 1977). Several issues not covered by the research studies were raised by the interview/focus group exercise. For example, quality of parental time with children when traveling together and reduction in personal responsibility in walking buses.

ES 5.5 Cognitive experiences when traveling

Two studies were identified. Both were concerned with the importance of intentional action on cognition. Issues raised by the interview/focus group study included the money and time management and road safety skills involved in independent travel.

ES 5.6 Effects of modes of travel suitable for travel to school

Three studies were identified. Two were concerned with safety skills and one with the effects of car ownership on school students. No other issues were raised in the interview/focus group study.

ES 5.7 Effects of mode of travel to school

Thirteen studies were identified. These included studies on the negative effects of long journeys to school, the social and other effects of car pools and of busing policies, and the social and other skills from use of walking buses.

In terms of research to inform the current policy on increasing use of walking, taking buses and cycling to school (and hence reducing use of cars in travel to school), there are some general suggestions that can be made. Very few of the identified studies were concerned with an evaluation of the impact of new initiatives to directly or indirectly achieve the current policy objective. This is

the most clear need for further research. One example, of this approach is the study by Bickerstaff and Shaw (2000) which evaluated a walking bus scheme. The study did not use independent measures which limits the relevance of the results, but it provides a good example of the research that most clearly and directly addresses policy issues.

ES 5.8 Effects of mass use of different modes of travel

No studies directly assessed the effects of mass modes of travel, though there is highly relevant research on, for example, changing patterns of mobility and independence (Hillman 1993; Hillman *et al.*, 1990). Many ideas on this issue were suggested by the interview/focus group study. For example, the effects that mass use of school buses has on the atmosphere of the school and the local sense of community.

ES 6 Conclusions and recommendations

Children's travel to school is a complex subject, comprising many ways of getting to school, a variety of experiences along the way, and different potential effects on children. Because of the broad nature of the research, the studies included in the review form a disparate and not always cohesive body of research on the effects of different modes of travel on children's mental health and social and cognitive development.

This suggests four different research strategies for the future.

ES 6.1 Research addressing components of the travelling experience

First, research could address each of the component experiences of modes of travelling such as physical activity, diet and nutrition, and environmental, social, and cognitive experiences.

(1) We recommend

More detailed critical appraisal of all the studies identified on each component of travel in this review.

Quite separate literatures exist on the effects of such things as physical activity, physical environment, diet, social and cognitive experiences on CMHCSD. Only those parts of those literatures related to travel were included in the current review.

(2) We recommend

Systematic reviews of the literatures on the effects of physical activity, physical environment, diet, social experiences, cognitive experiences on CMHCSD. In the meantime we urge caution in the interpretation of non systematically synthesized research results. Many primary studies have weak research designs or are correlational designs where causal effect is often assumed without evidence (for example, assuming that a correlation between exercise and academic achievement is due to a causative effect of exercise on academic performance).

(3) We recommend

Primary studies to address questions relevant to reducing car use for travel to school that have not been sufficiently answered by current research findings. We understand that such reviews and primary studies are not the primary responsibility of policy makers in transport.

Comparison of research findings with ideas revealed by the interview / focus group study identified gaps in knowledge about the effects of specific components of the travel experience.

(4) We recommend

Primary studies of the modes of travel to school which address the components of the travel experience (physical activity, nutrition and diet, social, cognitive and environmental experiences) in terms of outcomes identified in the interview / focus group study (readiness to learn, lethargy, exhaustion, academic performance, social and cognitive skills).

ES 6.2 Modes of travel to school or suitable for travel to school

A second strategy is to undertake research directed at different modes of travel rather than the separate components of the travel experience.

(1) We recommend

More detailed critical appraisal of all the studies identified in this review on modes of travel to school and travel suitable for travel to school.

(2) We recommend

That the findings of reliable research about modes of travel to school and components of the travel experience be shared with pupils, parents, teachers and school governors and local authorities. Qualitative research should address how this evidence is perceived and whether and how it influences decisions about modes of travel to school.

Relatively few studies have been found to address the different modes of travel to school, and fewer still are likely to be considered reliable once appraised for their rigour and relevance to English school children.

(3) We recommend

Small sample surveys (which make up the bulk of research identified in the current review) for examining and developing hypotheses about causal processes and participant views about different services and travel arrangements (but not to show causal effect).

(4) We recommend

Experimental studies where school students are randomly assigned to either experimental or control groups on an individual or cluster basis. We are not in a position to suggest which of the many current practices or special school travel initiatives is a priority for experimental evaluation, but brief examples of possible studies are given for illustrative purposes. The lack of experimental studies in the literature and the strength of their findings for informing policy about the efficacy of different strategies make this approach a priority for future research.

The size of sample needed for such study would depend upon whether individual or cluster random allocation was used and the outcome measures applied.

ES 6.3 Community and travel planning and children

Thirdly, the interview / focus group study revealed concern about the effects of mass use of modes of transport that was not matched by literature identified by the systematic searching about travel.

(1) We recommend

Systematic reviews of literatures addressing community and travel planning and children's mental health and social and cognitive development.

(2) We recommend

Primary research about the impact of mass use of different modes of transport on children's independence, social networks, opportunities to participate in after school activities and sense of wider community.

ES 6.4 Involving children in research

Historically, children have had little influence over decisions about their travel arrangements. Also, many of the studies identified in this review have been conducted in the USA such that the evidence about children's travel and its impact on their mental health and social and cognitive development has been largely by American academics.

(1) We recommend

That children be involved in planning and evaluating changes in their travel arrangements.

1. INTRODUCTION

1.1 Background and aims

The Government aims to achieve an integrated transport policy, which includes collaboration with other policy areas such as education and health. Increasing reliance on the car for the journey to school is of direct concern to all three policy areas. The School Travel Advisory Group (STAG), represents a wide range of interests and aims to develop a coherent approach to school travel issues and to promote best practice in increasing the use of walking, cycling and bus use by children

The purpose of this research study was to establish what is known about the effect of these modes of travel on children's mental health and cognitive and social development (CMHSD) and the potential for further research to give robust, meaningful findings to extend existing knowledge.

It aims to inform that debate by describing the research literature on the effect of the mode of travel or component experiences of such travel on children's mental health, cognitive or social health status, and using this research review to assess the need for further research on the topic.

The project was commissioned by the Department of the Environment, Transport and the Regions (DETR) at the request of the School Travel Advisory Group (STAG). Although, the primary interest was in travel to school, the project was asked to consider both travel to school and modes of travel that might be involved in travel to school. This was to ensure that research on child travel was considered even if it did not directly address school travel issues.

Children travel to school using a variety of methods, such as walking, bicycling, bus, car, and others. En route to school, they may encounter a wide variety of experiences which may affect their learning, social skills or mental health status. It was beyond the scope of the project to consider all research on all possible components of all possible activities that might occur during travel by children. It was however important to consider the component activities involved in travel and travel to school, where the link to travel was explicit.

1.2 Systematic reviews

Systematic reviews are reviews of the research literature that use explicit, comprehensive methods to locate and evaluate all of the relevant research available. Systematic reviews have the advantage of bringing together and interpreting all studies on a topic whether their findings corroborate or conflict with each other. Just as in primary research, the findings of a systematic review can be interpreted within the context of knowledge of the methods used to generate the review, and that the review is repeatable and updateable.

1.3 Research design

The research project involved a three stage process:

- (i) An interview / focus group exercise in which a number of individuals concerned with schools, travel to school, travel policy and children were interviewed. The purpose was to explore the respondents' views of likely effects of travel on CMHCSD and key individuals and key pieces of research on this topic.
- (ii) A systematic search and a broad mapping of the literature on the effects of travel on CMHCSD.
- (iii) A more detailed mapping of one subset of the broad mapping of the literature explicitly examining the effects of travel on CMHCSD.

The resources of the project were invested in the interview/focus group exercise and the two levels of broad and detailed mapping. There was no detailed data extraction and quality assessment of individual studies.

1.4 Children's mental health and cognitive and social development (CMHCSD).

There are three outcomes of interest in this review: children's (i) mental health (ii) cognitive development and (iii) social development. In two of the three components of this study (i.e. social and cognitive) we were specifically concerned with child development. The subject of child development is a topic of much debate and controversy with several schools of thought. We acknowledged this at the outset of the research and it led us to make a number of decisions. Before outlining our decisions, below is a brief note about some of the methodological issues in this area of research.

1.4.1 Methodological issues

Theories of child development

In the area of child psychology there are (broadly) four theories of nature and nurture on development:

- (1) the empiricist/behaviourist position which stresses the role of the environment (nurture).
- (2) the rationalist/nativist position which stresses the role of the child's innate potential (nature).
- (3) the interactionist/constructivist position which stresses the interaction of biological and environmental factors and
- (4) the social-constructivist position which emphasizes the history and culture of the social group in which the interactions that result in development take place.

Child development – as a whole or components thereof

Related to point (1.4.1) above, we also acknowledge that many people would argue that that we should be looking at the development of the child as a whole and not looking at, for example, cognitive development in isolation. Related to this point is the difficulty in strictly separating social outcomes from cognitive, and both of these from mental health outcomes.

Child development – study design

There are special difficulties with studying development. A piece of research about child development needs to describe change over time: what changes and how, and the cause and effect relationships surrounding such changes. One aspect of this is to look at developmental milestones and compare a particular child to "normative" data (i.e. functioning typical for that child's

chronological age). Researchers tend to have adopted one of two approaches in attempting to describe changes over time: cross-sectional or longitudinal methods.

Cross-sectional methods

For example, to look at development in the sophistication of use of language, a researcher might compare three groups of children aged 3 yrs, 5 yrs and 10 years. The finding might be that language becomes progressively more “sophisticated”, the older the child is.

Longitudinal methods

This method involves repeat observations on the same subjects at different points in time. In considering evidence/claims about children’s cognitive and social development, the first “filtering” question is whether or not the researchers used one of these two study designs.

Generally, in considering data (“evidence”), we should remember that data concerning adults (e.g. about attention span) cannot necessarily be generalised to children. Within the population of “children” further subdivisions need to be made. For example, developmental psychologists make fine distinctions between “infancy, “early childhood” etc.

1.4.2 Decisions we made in the current study

In the light of these methodological complexities, we made some decisions early on in the study:

- (1) Our work was not influenced by any particular theoretical view on child development (we have thus avoided the so-called “nature versus nurture” debate) and we have presented the results of the studies we found impartially using the study authors’ own words.
- (2) Whilst being aware of the methodological complexities inherent in looking at components of child development, again, we have reported the results of studies we found with no critical appraisal.
- (3) Because two types of study design are particularly important to the study of child development (cross-sectional and longitudinal studies), we specifically key-worded these two study designs (but also looked at other designs).
- (4) Although we were specifically asked to look at *development* for two of the components (i.e. social and cognitive outcomes) we also looked for research which addressed cognitive and social status i.e. addressed cognitive and social outcomes but not within a study designed to look at child development.
- (5) We keyworded for different age-groups. As the review was concerned with travel to school or travel suitable for travel to school, children were defined as school age children between the approximate ages of five and eighteen years.
- (6) Finally, our consideration of the study “outcomes”, and our classification of these into cognitive, social and mental health were informed by the published literature. We referred to a number of established classification systems currently being used by child psychologists and psychiatrists. To give just one example, to inform our consideration of childhood mental health outcomes, we consulted the most widely-used mental health classification system, the Diagnostic and Statistical Manual – fourth edition (DSM-IV) devised by the American Psychiatric Association (APA).

2. INTERVIEW / FOCUS GROUP STUDY

2.1 Aims

The interview / focus group study involved asking a number of people concerned in different ways with children and / or education and /or travel about the issues they felt important in relation to the current study and for any suggested further contacts or knowledge of relevant studies. The purpose was to inform the systematic review by ensuring that the questions asked by the review were relevant to those involved in these issues and by searching for leads for other personal contacts and for relevant studies.

2.2 Participants

The persons included in the interview / focus group review consisted of:

- primary contacts suggested by the study's steering group;
- secondary and tertiary contacts provided by those interviewed for the interview / focus group exercise including members of school governor and community paediatric email lists;
- a focus group of children at a junior mixed infant school just outside London.

2.3 Method

The method of recruiting and interviewing participants consisted of:

- telephone contact where an outline of the study was given and participants were asked if they would be able to assist the study (all people contacted agreed to help);
- email or fax letter providing a written summary of the study, the researchers' names and employing organization, confirmation of the date for the telephone interview, and the issues that would be raised;
- twenty to thirty minute telephone interview.

The questions asked during the interview covered:

- relevant issues and important examples of practice and research;
- people or organizations with knowledge of the subject;
- relevant publications;
- what possible sub-components of different modes of travel and travel to school might affect CMHCSD.

If interviewees did not spontaneously suggest them, they were prompted to consider the following aspects of travel and travel to school:

1. key issues about travel to school and potential effects of different modes of travel on CMHCSD;
2. physical activity experienced during the journey and its possible effects, for instance on thinking and other components of cognitive function;
3. physical experience of environment and its possible effects such as pollution on cognition;
4. diet and how this might be modified in association with the school journey such as buying breakfast on way to school, or attending breakfast clubs on arrival, and possible effects on cognitive skills or social skills;

5. social experiences with other adults influencing development of interpersonal skills or raising awareness of not talking to strangers;
6. social experiences with significant others such as meeting others on the way to school and enjoying social interactions and play;
7. social experiences with other children, friends or not, which may involve taking responsibility for others or bullying;
8. cognitive experiences which may help develop cognitive skills when walking such as planning, route-finding, orientation, memory or time-keeping;
9. social experiences of the whole environment encouraging a child's sense of their world;
10. indirect effects of mass use of different modes of transport and possible consequences with social mixing, building community networks with communal travel, effect of traffic on social interactions.

Finally, interviewees were asked if they had any other suggestions or concerns about other related issues.

The focus group consisted of one member of the research team leading a discussion on the effects of different modes of travel to school on CMHCSD. The class teacher was also present and occasionally contributed to the discussion.

2.4 Results

A large number of ideas related to the issue of travel to school were suggested by respondents in the interview / focus group exercise. Many of the issues concerned the wider context of school travel. The following is a list of the main issues in relation to the effect of mode of travel, and components of the travel experience, on children's social and cognitive behaviour and development.

1. Effects of physical activity
 - Arriving alert, and fresh ready for learning
 - Feeling fit, well set up for the day, with a positive body image and high self esteem
 - Uses up excess energy, thereby decreasing disruptive behaviour
 - Avoids lethargy and dependent mind set
 - Exhausted from too much physical activity
 - Focus group: exercise is good, exercise wastes energy, by car allows more time to rest in bed, walking wakes you up and clears your head of things at home and you can begin to think about what you will be studying at school, if run to school arrive all sweaty, cars make you lazy and grow up lazy, cars make you cranky
2. Effects of physical experiences of the environment
 - Pollution, less pollution whilst walking, so more alert
 - Travel sickness
 - Focus group: Being wet and cold, pollution, falling over on ice and breaking leg or arm, being hit by a car, in a car in a car crash, if walk in the cold and arrive at warm school it makes you want to make the most of the lesson
3. Effects of diet
 - Effect of diet on concentration

- Some children arrive at school not having eaten breakfast and not in a fit state to learn
 - Focus group: breakfast wakes you up, you need breakfast otherwise you are hungry and cannot concentrate, if you go by car you feel sleepy and then need another breakfast to wake you up again
4. Effects of social experiences with other adults
 - Social education experiences involved in walking and taking bus
 - Benefits of interacting with strangers of many types
 - Attitudes and behaviour of some bus drivers colour children's attitudes to adults which leads to lack of trust and encourages use of bad language
 - Pupil cyclists in fear of chastisement by other road users
 - Focus group: danger of being kidnapped, stabbed, kerb crawlers, if approached by stranger it might put you off being able to study
 5. Effects of social experiences with significant others
 - Parental time and quality time with child including discussion of school issues, but less so if in car
 - Parents sharing non home/external experiences with child
 - Walking buses reducing personal responsibility
 - Negative effect of parental road rage and increased chastisement of child
 - Focus group: opportunity to spend time with busy unavailable parents on way to school, parents help with school work on way to school in car, don't walk to school with parents as they are embarrassing if they meet and talk to anyone and then you cannot concentrate on anything
 6. Effects of social experiences with children
 - Responsibility for other children
 - Group responsibility of children
 - Coping with social interactions with peers; ability to socialise, study together and develop mutual trust and responsibility
 - Stress from bullying
 - Stress from rule breaking of other children (e.g. on bus)
 - Focus group: being with friends makes going to school fun, walking to school leads to better friendships, talking whilst walking to school might make you chat less in class, it might make you chat more, being bullied on route to school
 7. Effects of cognitive experiences involved in different modes of travel
 - Cognitive experience and skills involved in walking and cycling
 - Cognitive and social skills of time management, being organized, being responsible, being independent in independent travel to school. Negative effects for children unable to cope with these responsibilities.
 - Car users require less planning and so less organisational skills
 - Responsibility for money in taking bus to school
 - Focus group: can benefit from listening to music in car, listening to radio in car prevents you listening to other things going on around you, walking is slower so allows you to notice things and these can be included in stories you write at school, whilst walking you can practice counting the house numbers or car number plates, walking helps you to be focused and thus study which effects your qualifications and later job, going by car helps you learn how to drive
 8. Effects of social experiences of whole environment
 - Children's freedom

- Children's need to take risks
 - Children's sense of and identity with the community
 - Children's sense of their local and wider environment
 - Attitude of public transport to children affects children's attitudes to society and respect for it
 - Social connotations for child of use of cars in travel to school that continues into their adult life
 - Focus group: no relevant responses
9. Effect of the overall experience of travelling
- Length of journey affecting children's attention spans
10. Indirect effects of mass use of different modes of travel
- Children have more opportunity for independence in safer environments
 - Children's social networks limited by traffic on roads
 - Sharing lifts in cars increases sense of community
 - Parents meeting at school gates encourages friendships and sense of community
 - Restrictions of available travel limit participation in after school activities
 - Mass use of bus changes school atmosphere / sense of community
 - Focus group: no relevant responses
11. Other issues raised
- Including children with special needs has positive effects on feeling of mutual support and sense of community
 - Police taking buses off road with no notice due to safety is disturbing for nervous children
 - Focus group: no relevant responses

2.5 Conclusions

The interview / focus group exercise confirmed the view that the effects of different modes of travel to school (or travel suitable for travel to school) on children was complex involving many dimensions. The focus group with children also provided different but overlapping perspectives on key issues for children in travel to school. The results of the interview / focus group exercise are considered with the results of the detailed mapping exercise in Section 4.

3. MAPPING THE LITERATURE

3.1 Broad map: methods

3.1.1 Search strategy development

The interview / focus group exercise provided a route to references through key informants. In addition, interviewees' key phrases or concepts about children's experiences in travelling to school were noted in the interview record by two independent reviewers. These terms were then incorporated into a broad search strategy developed from previous experience of systematic searching for health promotion literature (Harden *et al.*, 1999). Search terms were developed using a combination of terms describing young people, and the context of travel to school, or travel suitable for travel to school, and mental health, social, and cognitive outcomes. Complete search strategies of all databases searched are found in Appendix 2.

Electronic bibliographic databases, journals and WWW sites were searched systematically (see Appendix 3), and publications recommended by key contacts in the interview / focus group exercise were sought.

3.1.2 Databases

A total of six electronic databases were searched for potentially relevant literature: the American National Library of Medicine's PubMed (including Medline); Eric (Educational Resources Information Center); PsycInfo; Sociological Abstracts; OECD's Transport (a combination of several transport databases including the International Roads Research Database) and the EPPI-Centre's in-house health promotion BiblioMap database (current to September 2000). Databases were searched for literature from their inception dates until November 2000.

3.1.3 Hand Searching / Web searching

In addition to searching electronic databases, hand searching of four journals with abstracts of articles published on the web and a number of other web sites were also searched for any potentially relevant reports. The on-line journals and web sites are listed in Appendix 3.

3.1.4 Inclusion criteria

Titles and abstracts of reports identified through electronic database searches, and full reports found elsewhere, were scanned for relevance to the study. Reports were included if they addressed one of four core criteria. There was no restriction at this stage for study design.

(1). Mode of travel to school (e.g. walking, cycling, car, bus, train, motorcycle), where both 'mode of travel' and 'to school' is explicit.

(2). Children or young people i.e. under age 18 AND mode of travel suitable for route to school (as in 1 above) AND social, cognitive or mental health states (NB see below for examples of terms used for searching)

(3). Children or young people i.e. under 18 AND social, cognitive or mental health states (as in 2 above) AND component experiences of travelling to school where component experiences include:

- Physical activity suitable for travel to school (e.g. walking, cycling but not dancing or gymnastics)

- Physical environment which might be experienced on route to school (e.g. pollution, busy roads, but not rock faces, nor swimming)
- Diet where amenable to influence while travelling to school (e.g. sweetshops and breakfast clubs, but not home economics classes or canteen menus)
- Social experiences with significant others in similar contexts to travelling to school (e.g. in cars, and walking or cycling together, but not camping or flying)
- Social experiences with peers in similar contexts to travelling to school (e.g. in cars, and walking or cycling together, but not camping or flying)
- Social experiences with other adults in similar contexts to travelling to school (e.g. relating to bus conductors, traffic controllers and shop keepers, but not relating to swimming pool life guards)
- Cognitive experiences in similar contexts to travelling to school (e.g. buying tickets for public transport, but not board games)
- Social awareness in similar contexts to travelling to school (e.g. being streetwise, naïve or fearsome)

(4). Mass use of modes of travel to school.

3.1.5 Exclusion criteria

Because of the particular issues involved, travel to school by children with special needs was considered a more complex topic that could not be adequately covered within the current review. These studies were therefore excluded from this systematic review.

Reviewers erred on the side of over-inclusion if they had any doubts about the relevance of an identified report. Additional reports were included for further consideration if they did not fit these criteria but appeared to offer background information relevant to the context of the review.

The titles and abstracts resulting from each electronic search were scanned by one reviewer. In order to clarify understanding of the scope of the study and the important relevant concepts, and to improve inter-rater reliability of report selection, a subset of searches was scanned by two or more reviewers. Where necessary, disagreements were resolved by a third reviewer who made an independent decision on inclusion or exclusion of the identified report.

3.2 Search process results

A total of 3,228 references were located through electronic databases. Of these, 1,464 came from PubMed, 684 were from Eric, 644 were from PsycInfo, 109 from Sociological Abstracts, 312 were from Transport and 15 were from BiblioMap.

It is important to note that some references may have appeared in more than one source. Time constraints did not allow screening for duplicate references between sources. Once the inclusion and exclusion criteria were applied to the 3,228 references, a total of 353 remained for inclusion in the review. Table 3.1 provides a description of located and included studies by each source.

Table 3.1 Sources of references identified for the review

Source	Reports Located	Reports Included
PubMed	1,464	37
ERIC	684	45
PsycInfo	644	137
Sociological Abstracts	109	35
Transport	312	91
BiblioMap	15	8
Total	3,228	353

3.2.1 Evaluation of Search Strategy

A few key reports, which were recommended by interviewees and personal contacts, were not located in the searches conducted for this review. To determine the cause of this omission, a search for several of these key reports by author was undertaken again in Eric, PubMed and BiblioMap. Only two of the missing studies were located in these databases and their key terms compared to the search terms used for this review. In order for the reports to be picked up in the searching, they would have had to be key worded with travel terms, and age-related terms, and social, cognitive or mental health outcome terms. Neither of the two reports located were key worded in this manner. This explains why they were not picked up in the electronic searching.

Missing relevant literature in database searching raises an important point about the value of searching a wide spectrum of literature sources for a systematic review. It has been noted that searching various 'fugitive' sources such as key informants can impact on the comprehensiveness of literature uncovered for a systematic review (Brunton *et al.*, 1999; Helmer *et al.*, 1999). Given the results observed here, it appears that locating literature by contacting key informants in the transportation and community sectors (as was done in this review) is as important as searching conventional electronic databases. However, locating hard copies of this literature may require additional time and resources, as they are not readily obtainable through direct database document retrieval or library retrieval services.

3.3 Broad map: findings

After amending the list by deleting duplicates and studies coded as borderline, 177 studies met the inclusion criteria and are listed in Appendix 4 according to the content of the study with a short description of the focus of the study.

Many of the studies are concerned with describing features of different modes of travel or the nature of children without being directly related to the effects of the mode of travel on children's social and cognitive behaviour and development. The research designs of these descriptive-analytical studies allow the examination of naturally occurring variables and their associations.

Descriptive-analytic including such variables as:

- Physical development
- Psychological skills
- Behaviour
- Safety
- At risk groups and behaviour
- Children as users of different modes of travel

Other studies are concerned with the effects of interventions. These are related to safety or choice of mode of travel, but some are also concerned with cognitive or behavioural outcomes:

Interventions addressing safety
Various safety skills

Interventions addressing behavioural or cognitive outcomes
Preventive interventions re behaviour of high risk
Prevention re disruption on buses
Increasing physical exercise
Benefits of breakfast programs

Interventions addressing usage of travel mode
Various studies about the choice of travel mode

The studies most relevant to the concerns of this systematic review are those concerned with the effects of modes of travel and related policy issues:

Effects on society
Busing and segregation
Quality of life and freedom of movement for children

Effects on social behavioural and relationships
Stress leading to social behaviour and school problems
Positive effects of exercise, relaxation, and bus driver behaviour
Proximity including car-sharing leading to friendships
Teenage driving leading to social responsibility

Effects on mental health effects
Various mental health consequences of accidents and other trauma

Effects on cognition
General cognitive effects
Physical activity and mental performance
Specific experiences and cognitive skills
Physical activity and self esteem
Noise and chemical pollution and other noxious effects

Policy issues
Transport planning
Travel distances
Community alliances

3.4 Broad map: conclusions

Searches of electronic databases identified reports relevant to the effects of components of the experience of travelling on mental health and social and cognitive development, for instance the effects of physical activity or social experience. In general, the range of reports identified was more limited than the ideas suggested by respondents in the interview / focus group exercise. However, there were a few examples where the studies revealed other topics. These included the effects of noise pollution, the effects of stress and daily hassles on children, the importance of car pools to social networks, risk taking and disruptive behaviour by some children, social responsibility of teenagers

allowed/able to drive, the psychological effects of road traffic accidents and assault. Each of these issues could in future be the focus of a separate detailed systematic review to determine the quality of studies and reliability of the findings.

As expected, we found little research comparing the effects of different modes of travel to school on children apart from safety issues. This indicates a need for new primary research addressing the key research questions of this review.

4. DETAILED MAP OF SUB-GROUP OF STUDIES ON CMHCSD

The next stage of the review involved producing a more detailed map of a sub-group of identified studies concerned with the effect of modes of travel to school, or components of travelling to school, on children's cognitive, social or mental health development or status.

4.1 Detailed map: methods

Following discussion with the steering group, it was decided to exclude studies of the effects of individual traumatic events such as those identified in Section I.3 in Appendix 4

To focus more on the specific sub-group topic, the 353 studies initially identified from electronic databases plus further studies identified from other sources were subjected to a 'second round' of inclusion/exclusion screening. This involved using the following criteria.

Studies were included in the final review if they:

- A. were concerned with the effects of different modes of travel on children or components of different modes of travel on children (for example, this would include studies that examined the spatial abilities of children who took different modes of travel to school whether or not the study found any differential effects of different modes of travel).

Studies were excluded from the final review if they met either of the criteria below.

- B1. intervention studies not concerned with the effects of different modes of travel or components thereof. This excluded studies that, for example, examined age rather than the effects of experience in spatial ability related to travel.
- B2. studies describing how variables occur and co-vary with no direct assessment of the effects of mode of travel or sub components thereof.

Full reports of the 233 studies which met the 'second round' inclusion criteria were retrieved from libraries (and listed under the ABC inclusion criteria in Appendix 5 and as full references listed alphabetically in Appendix 6). Two reviewers independently assessed the full reports again for 'second round' inclusion, and then extracted data on characteristics of these included studies using an adapted version of a previously adapted tool. Reviewers met to discuss and come to agreement on final inclusion or exclusion and the data extracted.

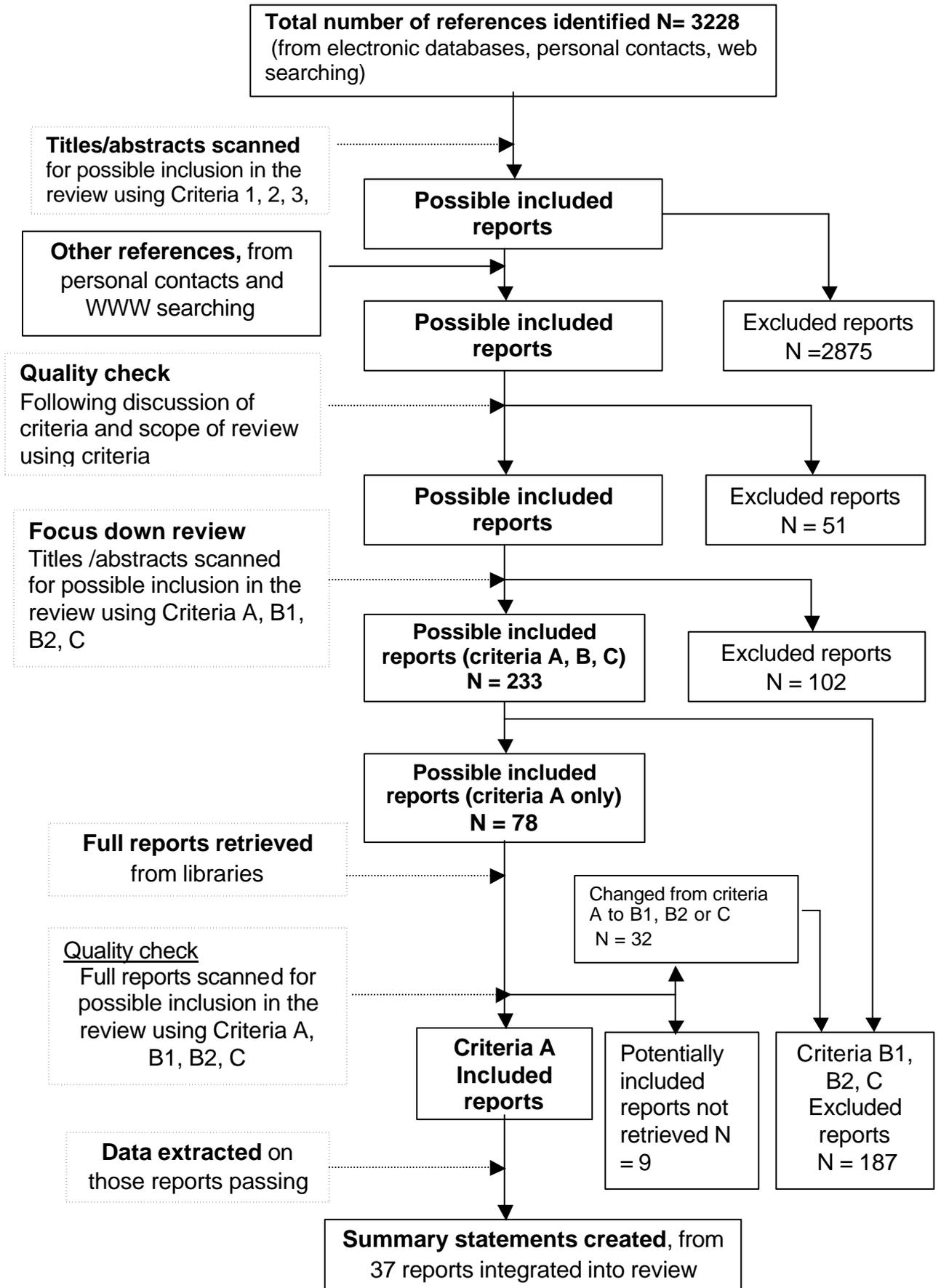
Reviewers independently examined each report for its study design, participant population and the mode of travel or component and types of outcome addressed. Records of the response rate and information about

participants dropping out of the study were made where applicable. The tools to support this exercise are included in Appendices 7 and 8. Data extracted was entered into ProCite 3.2 software. Descriptive analysis was completed using ProCite software search utilities. Included studies were also summarized, using a structured template to enhance consistency. Information was recorded about publication, country, aim of the study, kind of evidence, participant population, setting, mode of travel and/or component experiences, outcomes, results, qualifications of methodological limitations, and a statement regarding interpreting the authors' results. These summaries appear in Appendix 9.

4.2 Studies included

Using the second round screening criteria, a total of 78 of the 335 reports initially described in the mapping were deemed relevant. Of these 78 studies, 69 (88%) were retrieved within the timelines set for this review. Twenty-eight of these 32 studies were excluded from the review, using the second round screening criteria, when the full report was read. The remaining thirty-seven published reports were included for data extraction. Two published articles each described two research studies (Foreman *et al.*, 1994; Tolmie *et al.*, 1998); hence the numbers reflect 37 published reports describing 39 research studies. This created a total of 39 studies for data extraction.

Review Process



4.2.1 Document type/study design

Data was extracted from seven abstracts and 31 full reports for the 39 studies included. All 37 reports were published in peer-reviewed journals. Two reports included two studies each, making a total of 39 studies. Twenty-eight studies were from articles, six were from reports, three were thesis dissertations, and two were conference abstracts. A total of 18 studies were cross-sectional surveys, one of which was retrospective and 16 of which were at one point in time. Twenty-one studies were of prospective longitudinal design. Ten of these were randomized controlled trials.

Quantitative methods of data collection using measures with predetermined categories of answer were used in 35 of the studies. Qualitative methods recording participants' own descriptions of phenomena were used in five of the studies. One study (Bjoerklid, 1994) used both of these methods of data collection.

4.2.2 Completeness of Data

As a minimum assessment of completeness of data, response rates, details of non responders, drop out rates and details of drop outs were examined across the 39 studies. Such methodological data is important because non response or drop out may not be random resulting in a response bias in the results.

Eight studies clearly described the response rate they received, while 28 studies did not. Two studies were not clear in their response rate. Non-respondents' details were not reported in any of the studies. Of the 21 longitudinal studies assessed, only two described their drop out rates. A further 18 studies did not mention drop out rate at all, and one study was not clear in describing its drop out rate. Details of those participants who dropped out were provided in only one study, and were not reported in 20 studies.

4.2.3 Country

Table 4.1 shows the distribution of countries in which the studies took place. The largest number of studies (18 or 46%) was conducted in the United States, with 21 studies (31%) taking place in the United Kingdom.

Table 4.1 Country of study (N=39)

Country	N	%
USA	18	46
England	9	23
Scotland	3	8
Canada	2	5
Japan	2	5
Holland	1	3
Israel	1	3
Sweden	1	3
Norway	1	3
Bulgaria	1	3

4.2.4 Sample Characteristics

Characteristics of participant populations are outlined in Table 4.2. Participants ranged in age from four years to eighteen years. The number of participants was clearly identified in 28 of the studies; in 9 studies, it was not clearly specified. For example, in the study by Bjoerklid (1994), both children and adults participated, the number of children was explicit but the number of

adults was not. In two studies, the number of participants was not specified at all.

The sex of the participants in the research samples was identified in 25 of the 39 studies; in 23 of these studies, both males and females were identified. Two included studies sampled males only. Social class was identified clearly in only 12 of the studies. Ethnic groups were explicitly described in only 10 studies.

Table 4.2 Characteristics of study samples (N=39)

Characteristics of participants	Reported		Not reported	
	N	%	N	%
Number*	27	70	2	5
Sex	25	64	14	36
Socio-economic class	12	31	27	69
Ethnicity	10	26	29	74

* for 9 studies (24%) the number of participants was unclear

4.2.5 Setting

A total of twenty-one studies actually addressed travel to school. One study did not describe the setting. Eight studies described a setting other than travelling to school, listed in Table 4.3. In studies where study participants used exercise equipment in an unspecified setting, it was decided that a laboratory was inferred as the setting.

Table 4.3 Study setting (N=39)

Setting	N	%
Travel to school	21	54
Setting not stated	1	3
Laboratory	11	28
In School	4	10
'Room'	1	3
Participant's homes	1	3

4.2.6 Mode of travel

A variety of modes of travel were addressed in the studies. Seventeen studies described walking, nine studies examined bicycling, five studies evaluated car travel, eight studies measured travel by bus, and one study evaluated travel by boat and by train. Two studies did not specifically mention the mode of travel, although the study was clearly about travel to school. Table 4.4 describes the modes of travel evaluated.

Table 4.4 Mode of Travel* (N=39)

Mode of Travel	N	%
Walking	17	44
Bicycling	9	23
Bus	8	21
Car	5	13
Boat	1	3
Train	1	3
Mode not specified	2	5

* Studies sometimes addressed more than one type of mode of travel, hence numbers add up to more than 100%.

4.2.7 Aspects of travel

Various component experiences of travel were described in this body of literature. Table 4.5 illustrates the components addressed.

Table 4.5 Aspects of experience of travel addressed* (N=39)

Aspect of travel	N	%
Role		
Driver	6	15
Passenger	11	28
Pedestrian	15	38
Accompaniment Status		
Alone	2	5
With parent	3	8
With other adult	4	10
With siblings	1	3
With friends	1	3
With peers	4	10
Responsibility for self or others	0	0
Choice		
Child's choice	3	8
Parent's choice	0	0
Other aspect of experience of travel		
Time to commute	1	3
Experience of exercise when younger	1	3
Child's experience of travel to school	1	3
Desegregation	2	5
Culture orientation/subjective culture	1	3
Bus transport vs. not bus	1	3
Car ownership	1	3
Social class of friend	1	3
Sibling relationship	1	3
Verbal greetings and farewells on bus	1	3
Victim of racial harassment	1	3
Wearing a bike helmet	1	3
Transportation curriculum	1	3
Accidents/ injuries/ getting lost/ being bullied/ smoking/ shoplifting/ vandalism/sexual assault/ abduction/ illness/ being bitten/ truancy/	2	5
Traffic safety/ traffic environment/ danger/ rules/ vision/ noise & exhaust	4	10
Pedestrian skill training/pedestrian ability/driver behaviour	4	10
Attendance at breakfast program	2	5

* Studies sometimes addressed more than one type of component experience, hence numbers add up to more than 100%.

The aspects of the experience of travel varied widely across studies. Thirty-two studies described the role of the participants (e.g., driver, passenger or pedestrian). Fourteen studies described the accompaniment status of the participants (i.e., alone or accompanied by others). No studies directly evaluated the issue of responsibility for self or others. Only three studies addressed some aspect of the child's choice in travel (Study 1 and Study 2, Foreman *et al.*, 1994; Foreman *et al.*, 1990).

4.2.8 Outcomes

The outcomes addressed were grouped under cognitive, social and mental health outcomes. Where possible, the authors' own descriptions of the outcome were also used. Table 4.6 illustrates the variety of outcome measures used.

Table 4.6 Outcomes addressed* (N=39)

Outcomes	N	%
Cognitive	32	82
Academic	6	15
Intelligence	3	8
Complex cognitive	19	49
Other cognitive (attention; critical thinking; decision-making; priority-setting)	5	13
Social	16	41
Community relationships	3	8
The family	3	8
Friendships	3	8
Social skills	3	8
Socio-moral understanding	1	3
Self-concept and identity	6	15
Mental health	13	33
Crime	3	8
Anxiety	4	10
Stress	1	3
Drugs / depression / diet / psychosis / trauma	0	0
Other mental health outcome (satisfaction / friction, dissatisfaction, difficulty / perception of academic achievement, happiness, enjoyment)	6	15
Other outcome (risk perception / participation / comfort of bus ride, access, length of school day / absentee rate / physical discomfort / anthropometric measures)	5	13

* *Studies sometimes addressed more than one type of outcome, hence numbers add up to more than 100%.*

Most often, studies addressed a cognitive outcome (32 of 39 studies, 82%). The majority of cognitive outcomes measured were of complex cognitive skills, such as memory and spatial ability (e.g., Craft, 1983; Foreman *et al.*, 1990; Foreman *et al.*, 1994; Foster *et al.*, 1974; Herman *et al.*, 1982; Rivara *et al.*, 1991), or academic skills (Fite, 1980; McNaughten and Gabbard, 1993; Reid, 1994; Sheehan, 1978; Stapp *et al.*, 1983; Whitebread and Neilson, 1998).

Sixteen studies (41%) considered social outcomes. Self-concept and identity were measured in six studies (Adler and Adler, 1984; Basile *et al.*, 1995; Davis and Jones, 1996b; Hofstetter *et al.*, 1990; Howland *et al.*, 1989; Ressler and Toledo, 1997). Community relationships (Adler and Adler, 1984; Bickerstaff and Shaw, 2000; Bolton, 1974), friendships (Adler and Adler, 1984; Bickerstaff and Shaw, 2000; King and Easthope, 1973), family (Adler and Adler, 1984; Davis and Jones, 1996b), and social skills (Adler and Adler, 1984; Bickerstaff and Shaw, 2000; Edwards and Johnston, 1977) were addressed in two studies each. Socio-moral understanding was addressed in a single study (Adler and Adler, 1984).

Thirteen studies (33%) addressed mental health outcomes. Anxiety was the most frequently addressed mental health outcome, occurring in four studies (Bjoerklid, 1994; Cromer *et al.*, 1990; Davis and Jones, 1996b; Lee and Rowe,

1994). Crime was addressed in three studies (Basile *et al.*, 1995; Bickerstaff and Shaw, 2000; Davis and Jones, 1996b). Stress was addressed in one study (Solstad, 1975). The remaining five studies addressed a variety of mental health outcomes, ranging from discomfort to satisfaction and happiness.

Some other outcomes addressed did not fit readily into the created categories but were considered relevant for this review. They included perception of risk, comfort of bus ride, access and participation in school activities, length of school day, absentee rate, and physical discomfort of travel.

4.3 Reported findings about modes of travel and the component experiences of travelling

The interview / focus group exercise and the primary inclusion criteria for research studies differentiated the effects of different modes of travel and the effects of components of the experience of travel (e.g. physical activity or social interaction). This section describes studies related to the review question, starting with those more distantly related and ending with those more precisely related to the review question. Specifically this section describes identified studies addressing:

1. components of the travel experience;
2. the effects of modes of travel suitable for the route to school; and
3. the effects of modes of travel to school.

They are all described here in terms of the country in which they were conducted, the types of outcomes studied, the types of research methods employed, and their detailed research topics and reported research findings.

Summaries of each study are presented in alphabetical order in Appendix 9 and characteristics of these studies (country, outcome measures, and study type) are tabulated in Appendix 10. Tables summarizing the topic of study and reported findings are included below under each sub-section on components of the travel experience or modes of travel. It is very important to note that the studies have not been quality assessed and therefore caution is necessary in interpreting the reported findings of studies. Only brief reference to the research designs is provided in this section. Information on the research methods of each study is provided in the summaries in Appendix 9.

4.3.1 Physical activity related to travel

Studies principally concerned with the physical activity component of the travel experience involved walking and other exercise; the outcomes included self concept, identity, and academic achievement (Appendix 10). The studies reported that exertion improves immediate cognitive functioning and reduces disruptive behaviour (Table 4.7). The study of long term effects, however, reported little effect of exercise when young on adult self efficacy.

In the studies concerned with the physical activity involved in cycling, the outcomes were primarily cognitive tasks involved in cycling. The studies reported no direct effect on cognition, but that basic skills and self pacing of activity could be learnt. None of the studies focused on physical activity involved in travel by bus or by car.

Table 4.7 Research topics and reported findings about physical activity related to travel

REPORT	TOPIC	REPORTED FINDINGS
Basile <i>et al.</i> (1995)	Antecedent exercise as a treatment for disruptive behaviour	Exercise reduced disruptive behaviour; no effect from mastery or self concept
Craft (1983)	Exercise and cognitive performance	No effect
Foster and Ellis (1974)	Development of strategies for self pacing when cycling	Strategies learnt with experience reduce physiological stress.
Hofstetter <i>et al.</i> (1990)	Effect of early experiences of exercise on adult self efficacy	Only indirect effects mediated by contemporary factors
Van Schagen and Brookhuis (1994)	Comparison of training strategies for cyclists with traffic	Both strategies effective on basic behaviours and not on priority setting

4.3.2 Physical environment when travelling

Studies concerned with children's experience of their environment had outcome measures of self concept and mental health (Appendix 10). The studies reported (Table 4.8) that children were anxious about traffic dangers, stranger dangers and the effects that these fears held by them and their parents might have in curbing their freedom and independence. The study that compared parental and child fears reported that there was little agreement in the rating of levels of different risks, though bullying was reported as a high level risk by both parents and children.

Table 4.8 Research topics and reported findings about the physical environment when travelling

REPORT	TOPIC	REPORTED FINDINGS
Bjoerlkid (1994)	Views of traffic environment	Tension for teachers between child safety and child's need for challenges. Children anxious about pollution and limits to freedom and mobility.
Davis and Jones (1996b)	Children's views on transport and the environment	Traffic and stranger danger made children anxious plus concern about parental restrictions on their mobility.
Lee and Rowe (1994)	Perceived risks of travel to school for children	Parents and children perceive different degrees of risk, though bullying high risk for both.
McNaughten and Gabbard (1993)	Effect of exertion on mathematical performance	Exertion significantly related to improved mathematical performance
Simeonova (1980)	Effect of traffic noise on cognition	30 minutes exposure affected mental working capacity, particularly for younger children.
Yokoo and Mitani (1982)	Effect of noise on mental efficiency	Mental efficiency reduced by intermittent noise after chronic exposure to noise

The studies concerned with environmental stressors of noise and pollution on children had outcome measures on cognition. The studies reported that the stressors reduced immediate mental functioning.

One study on the effects of long journeys had outcome measures of tiredness and academic achievement. This study reported similar negative effects as the studies on long bus journeys in Section 4.3.1 on different modes of travel to school.

4.3.3 Diet when travelling

Two studies were concerned with the effects of school provided breakfasts on cognitive outcomes and anxiety (Appendix 10). The studies reported no effects on cognitive outcome (Table 4.9).

Table 4.9 Research topics and reported findings about diet when travelling

REPORT	TOPIC	REPORTED FINDINGS
Cromer <i>et al.</i> (1990)	School breakfast	No impact of breakfast compared to low calorie meal.
Morrell and Atkinson (1977)	Effects of school breakfast programme	No difference in academic performance or attendance.

4.3.4 Social experiences with significant others, other adults or peers when travelling

Studies concerned with the social component of travel modes suitable for travel to school all measured social outcomes (Appendix 10). A variety of different studies were of this type. Studies reported that children could be persuaded by their siblings about risk judgments in travel, friendly bus drivers made for more friendly and pleasant journeys, and that children feared derision from wearing cycle helmets, but admired those who did wear them (Table 4.10).

Table 4.10 Research topics and reported findings about social experiences with significant others, other adults or peers when travelling

REPORT	TOPIC	REPORTED FINDINGS
Edwards and Johnston (1977)	Friendly greetings by bus drivers	More friendly and pleasant bus ride.
Howland <i>et al.</i> (1989)	Social barriers to cycle helmet use	Fear of derision from wearing helmets, but respect for those who do.
Morrongiello and Bradley (1997)	Effect of sibling persuasion on risk taking judgements	Persuasion could increase and decrease risk taking judgements
Ressler and Toledo (1997)	Social factors in use of cycle helmets	Greater impact from social factors rather than experience of injury in cycle helmet wearing

4.3.5 Cognitive experiences when travelling

Studies concerned with the cognitive component of travel suitable for travel to school measured cognitive outcomes (Appendix 10). Studies report that active

intention rather than passive movement has an impact on the development of spatial memory (Table 4.11).

Table 4.11 Research topics and reported findings about cognitive experiences when travelling

REPORT	TOPIC	REPORTED FINDINGS
Foreman <i>et al.</i> (1990)	Effect of locomotion and choice on spatial memory	Active choice not locomotion affected spatial memory
Forman <i>et al.</i> (1994)	“	“
Herman <i>et al.</i> (1982)	Motor involvement and intention effects on memory	Effect only for kindergarten not grade 3 children.

4.3.6 Modes of travel suitable for journeys to school

Studies concerned with walking addressed outcomes related to being a responsible and skilled pedestrian (Appendix 10). Briefly, these studies reported that new cognitive skills could be learnt (Table 4.12).

Table 4.12 Research topics and reported findings about modes of travel suitable for journeys to school

REPORT	TOPIC	REPORTED FINDINGS
Fite (1980)	Effect of automobile availability on school students	Car ownership and car maintenance but not car availability negatively affected grades.
Rivara <i>et al.</i> (1991)	Effect of a training programme on pedestrian skills	Improvement on looking whilst crossing, but not on kerb or pavement behaviour.
Tolmie <i>et al.</i> (study 1) (1998)	Correlates of understanding safety	Marked age trends in children's attention to relevant versus irrelevant features
Tolmie <i>et al.</i> , (study 2 and 3) (1998)	Training and understanding of safety	Improvements at roadside matched those found on video tasks; adult guidance more effective than peer guidance or exposure

For the study concerned with car use by young people, the outcomes included academic achievement. The study reported negative effects of student car ownership and car maintenance but not of car availability on students' academic achievement.

None of the studies in this section (on mode of travel suitable for travel to school) focused primarily on cycling or travel by bus.

4.3.7 Modes of travel to school

Some studies precisely addressed modes of transport to school. Of these, studies concerned with the mode of travel of walking, the outcomes were primarily either friendships, community relationships, bullying and youth crime, or a range of complex cognitive skills involved in travelling to school (Appendix 10).

Studies reported positive findings for social and cognitive effects, though the studies either did not control for confounding variables or did not have independent outcome measures (Table 4.13).

Table 4.13 Research topics and reported findings about modes of travel to school

REPORT	TOPIC	REPORTED FINDINGS
Adler and Adler (1984)	Carpool and socialization	Models of socialization under combined influence of school, family, and peer group influences
Bickerstaff and Shaw (2000)	Evaluation of walking bus	Increased road sense, social development and independence
Bolton (1974)	Busing and desegregation	Most believed that education and race relations had improved
King and Easthope (1973)	Social class, friendship and travel	Best friends likely to be friends out of school and to live nearby. Some travel to school together
Lewis <i>et al.</i> (1998)	Children's perception of danger and their behaviour	Understanding of danger grows with experience and age. More distracted children more reckless
Milazzo (1976)	Busing policies effects on social class	Tendency for middle class to develop low income values. Low income children less social and lower self image.
O'Brien (1982)	Factors affecting participation in school	Travel time effects on all and non school participation rather than school participation
Reid (1994)	Busing and social and economic achievements	Long school day, uncomfortable bus ride and inability to participate in extra curricular activities related to poor academic achievement.
Sheehan (1978)	Desegregation, busing and predictors of classroom climate	No effect from desegregation.
Solstad (1975)	Pupils' perception of long travel distances	Long journeys associated with feeling unwell. Effects less if travelling with friends and on school not public transport.
Thomson and Whelan (1997)	Road safety education	Substantial improvement in trained children in safe traffic skills
Whitebread and Neilson (1998)	Development of children's pedestrian skills	Being aware and in control of own cognitive strategies significantly related to pedestrian skill level
Yoshida (1996)	Consistency of behaviour of parents delivering children to school	Parents more consistent than children.

Several of the studies on travel by bus were concerned with issues of segregation and social mixing and the outcome measures were similarly on friendships, community relationships and class and racial interaction. The reported findings of these studies were mixed (Table 4.7). One study reported that best friends tended to live and travel near to each other. Another study reported that social mixing had little effect. A further study reported that social mixing had negative effect on middle and low income family children. Another study reported positive effects of busing policies on race relations and education.

Other studies on travel by bus were concerned with the effects of long journey times with outcome measures of stress and dissatisfaction and participation in school and other activities. All the studies reported negative effects such as children and young people feeling ill, lower academic achievement, and less participation in activities.

Studies concerned with travel by car had outcomes on friendships, community, identity and children's cognitive skills.

None of the studies in this section (on mode of travel to school) focused primarily on cycling.

5. RESEARCH AND TRAVEL POLICY

In order to consider not only what research has addressed the effects of modes of travel to school, but also what research is missing, we compare here the ideas revealed by the interview / focus group exercise with the research identified in the detailed map, and discuss how they both relate to the Government's and STAG's (1991) aim to increase the proportion of children who walk, cycle or take the bus for journeys to school.

In determining research needs it is important to bear in mind that the research studies described in this review have not been quality assessed. Where ideas raised in the interview / focus group study match identified research a first priority is critically to appraise these studies to ensure that the reported results are a reliable basis for policy and practice decisions. If the results cannot be strongly relied upon, then further better designed primary research will be needed on those topics.

Conclusions and recommendations drawn from the comparison of the interview / focus group study and the systematic literature search described above are presented in section 6.

5.1 Physical activity related to travel

The effects of physical activity on children's mental health and social and cognitive development were identified both in the interview / focus group study and by the systematic search for relevant literature (Table 5.1).

Table 5.1: Determining research gaps about physical activity related to travel

Interview / focus group study	Research identified	Research needed
Feeling fit, well set up for the day, with a positive body image and high self esteem.		Primary research, informed by systematic reviews of broader literature
Avoids lethargy and dependent mind set.	No short term studies. Only indirect effect of early experiences of exercise on adult self efficacy (Hofstetter <i>et al.</i> , 1990)	Primary research, informed by systematic reviews of broader literature
Exhausted from too much physical activity.		Primary research, informed by systematic reviews of broader literature
Arriving alert, and fresh ready for learning.	No effect of exercise on cognitive performance (Craft 1983)	Critical appraisal of identified study
Uses up excess energy, thereby decreasing disruptive behaviour	Exercise reduced disruptive behaviour; no effect on mastery or self	Critical appraisal of identified study

	concept (Basile <i>et al.</i> , 1995)	
	Strategies learnt by cyclists for self-pacing and coping with traffic (Foster and Ellis, 1974; Van Schagen and Brookhuis, 1994)	Critical appraisal of identified studies

As Table 5.1 shows, the following are areas of research suggested by the interview / focus group study that were not covered to any extent by studies in the detailed map of included studies:

- Feeling fit, well set up for the day, with a positive body image and high self esteem
- Avoids lethargy and dependent mind set
- Exhausted from too much physical activity

All of this proposed research is concerned with outcomes of cognition and self image. To assess the need and relevance for this research it would be preferable to undertake a detailed review of all research on physical activity on cognition and self image. An example of this background research is provided by the systematic review by Mutrie and Parfitt (1998) that examined the evidence for effects of exercise on the mental and social health of young people. Nearly all the studies had major methodological limitations of being correlational without control for direction of effect or other confounding variables or experimental studies with high levels of sample drop out, or with self report data. With these qualifications, Mutrie and Parfitt conclude that:

- Physical activity can increase self esteem and decrease anxiety and depression.
- Only a little evidence that physical activity improves academic or cognitive performance or at least does not hinder academic performance
- No equivocal evidence that exercise reduces anti social behaviour

Sallis *et al.*, (2000) undertook a systematic review of the correlates of physical exercise in children and young people. The interest was in variables that might lead to increased levels of exercise (i.e. exercise was the dependent variable), but most correlational studies are not able to indicate the direction of cause or cause by another unknown correlate, so the studies are also relevant to the effects as well as the cause of exercise. The review found that the only cognitive, social or mental health variables consistently associated with exercise were, for adolescents, achievement orientation, perceived competence, intention to be active, less likely to be depressed, and sensation seeking. The results for body image were indeterminate. No association was found for external locus of control, self motivation, and perceived stress. For children, self efficacy, perceived competence and attitudes to physical activity were indeterminate. No association was found for body image or self esteem.

Policy

To ascertain potential benefits or harms related to exercise of policies aimed at reducing car travel, primary research is needed on the immediate and longer term effects of exercise on cognition and self esteem. Some evidence may already be available about the effects of physical activity on disruptive behaviour, self-efficacy and cognition, although these studies should be critically appraised before being drawn on to determine policy.

In terms of achieving the policy changes of reduced use of car travel to school, research is needed on initiatives that increase physical activity. A review of barriers and facilitators to young people's behaviour change in terms of physical activity is currently underway at the EPPI-Centre (2001).

5.2 Children's environment when travelling

The potential impact of the physical environment was raised in both the interview / focus group study and the literature review.

Table 5.2: Determining research gaps about the physical environment

Interview / focus group study	Research identified	Research needed
Being wet and cold		Primary research
Greater independence in safer environments	Tensions and anxieties re: traffic (Bjoerklied, 1994; Davis and Jones, 1996b; Lee and Rowe, 1994)	Critical appraisal of identified studies
Social networks limited by road traffic		Primary research
	Noise reduces cognition and mental efficiency (Simeonova, 1980; Yokoo and Mitani, 1982)	Critical appraisal of identified studies

As Table 5.2 indicates, the following are areas of research suggested by the interview / focus group study that were not covered to any extent by studies in the detailed map of included studies:

- Being wet and cold
- Children's social networks limited by traffic on roads
- Mass use of bus changes school atmosphere / sense of community

Such research is concerned with either negative physical experiences on the way to school or children's experience of their wider environment.

Some forms of negative experiences were covered by studies of uncomfortable journeys and noise pollution, but these could be broadened to other adversities.

To assess the need and relevance for research on negative environmental factors it would be preferable to quality assess the review by Mutrie and Parfitt (1998) and undertake an updated full systematic review of all research on effects of the environment on children's mental health and social and cognitive development. Much of the research on travel to school and the physical environment is related to issues of physical safety rather than cognitive and social effects. Pollution, however, is one aspect of the physical environment that can affect learning. A review by the Environmental Transport Association (ETA, 1997) reviewed the evidence for exposure to different levels of air pollution from different modes of travel and concluded that pollution was greatest in cars, then buses, then for bicyclists, and lowest for pedestrians.

Noise pollution is also an increasing problem as well as the stress of travelling in congested roads and the discomfort of different forms of transport.

Policy

To ascertain potential benefits or harms related to the environment of policies aimed at reducing car travel, more research is needed on the harms of noise and traffic. Some evidence may already be available although these studies should be critically appraised before being drawn on to determine policy.

In terms of achieving the policy changes of reduced use of car travel to school, research is needed on initiatives that increase the barriers to car driving but decrease the stressors involved in bus, cycling, and walk to school. There may even be simple indirect issues such as an unsafe road to cross that may be a barrier to walking to school.

5.3 Diet when travelling

The one area of research suggested by the interview / focus group study that was not covered to any extent by studies in the detailed map of included studies was the effect of diet on concentration (Table 5.3).

Table 5.3: Determining research gaps about diet when travelling

Interview / focus group study	Research identified	Research needed
Diet	Different school breakfasts had no impact on academic performance or attendance (Cromer <i>et al.</i> , 1990; Morrell and Atkinson, 1977)	Critical appraisal of identified studies
Lack of breakfast		Primary research

Studies were identified that examined school breakfast programmes but these did not look at wider issues of diet and thinking.

To assess the need and relevance for this research it would be preferable to undertake a detailed review of all research on diet and thinking. There are many ways that travel to school may affect diet including the opportunity for eating before departure from home, during travel to school, after arrival at school, before departure from school, during return travel to home, and after return home. These variations in diet may be caused by time and social factors such as visiting shops or cafes with friends or may be determined by physiological responses involved in different methods of travel or due to changes in self concept (such as healthy lifestyles). There are then secondary effects of the variations in diet on children including body shape and self esteem and social grouping and possible effects of diet on cognition.

Policy

To ascertain potential benefits or harms related to diet of policies aimed at reducing car travel, primary research is needed on the direct and indirect effects of different forms of travel on diet, and to assess the effect of diet on CMHCSD.

In terms of achieving the policy changes of reduced use of car travel to school, there is a need for research about the effect of diet on the choice of travel. For instance, does provision of school breakfasts affect choice of travel.

5.4 Social experiences with significant others, other adults or peers when travelling

Social experiences received much attention both in the interview / focus group study and the literature review.

Table 5.4: Determining research gaps about social experiences when travelling

Interview / focus group study	Research identified	Research needed
Cyclists' fears of chastisement		Primary research
Parental quality time when travelling		Primary research
Walking buses reducing personal responsibility		Primary research
Parents' road rage		Primary research
Street credibility and independence		Primary research
Misbehaviour of others		Primary research
Bus drivers colour children's attitudes towards adults	Bus drivers encouraging social skills (Edwards and Johnson 1977)	Critical appraisal of identified study
	Social barriers to cycle helmet use (Howland <i>et al.</i> , 1989)	Critical appraisal of identified study
	Persuasion could increase and decrease risk taking judgments (Morrongiello and Bradley 1997)	Critical appraisal of identified study

Table 5.4 lists the following as areas of research suggested by the interview / focus group study that were not covered to any extent by studies in the detailed map of included studies on the effects of travel on CMHCSD and so may require further research:

- Pupil cyclists in fear from chastisement by other road users
- Parental time and quality time with child including discussion of school issues, but less so if in car
- Parents sharing non home/external experiences with child
- Walking buses reducing personal responsibility
- Negative effect of parental road rage and increased chastisement of child
- Don't walk to school with parents as they are embarrassing if they meet and talk to anyone and then you can not concentrate on anything
- Stress from rule breaking of other children (e.g. on bus)

To assess the need and relevance for this research it would be preferable to undertake a detailed review of all research on direct and indirect effects of the social experiences that might be involved in travel to school. The topic of

social experiences involved in different modes of travel to school is so wide that it requires basic descriptive research to inform which aspects require further attention.

Policy

The interview / focus group study and literature review showed considerable discrepancies in the attention paid to the social experience of travelling to school. This suggests that research focused here may have considerable potential for influencing decisions about travel to school.

To ascertain potential benefits or harms related to social experience when travelling of policies aimed at reducing car travel, primary research is needed on the effects of travelling with, or meeting on the way, friends, acquaintances, parents, other significant others, other adults and children. Such social interactions may be either positive or negative and there is far too little evidence to assess the relative likelihood to enhancing or damaging experiences.

In terms of achieving the policy changes of reduced use of car travel to school, research is needed on the direct and indirect effects of different forms of travel on children's social experiences to ensure that these apply in a positive direction in relation to less car travel.

5.5 Cognitive experiences when travelling

Table 5.5: Determining research gaps about cognitive experiences when travelling

Interview / focus group study	Research identified	Research needed
Road safety skills		Primary research
Time management and organisational skills		Primary research
Money skills		Primary research
	Spatial memory (Foreman <i>et al.</i> , 1994)	Critical appraisal of identified study
	Motor involvement and intention effects on memory (Herman <i>et al.</i> , 1982)	Critical appraisal of identified study

Table 5.5 shows that the following areas of research suggested by the interview / focus group study that were not covered to any extent by studies in the detailed map of included studies on the effects of travel on CMHCSD and so may require further research:

- Negative effects for children unable to cope with the responsibilities of cognitive and social skills of time management, being organized, being responsible, being independent in travelling to school.
- Car users require less planning and so less organisational skills
- Responsibility for money in taking bus to school
- Cognitive benefits of car use

To assess the need and relevance for this research it would be preferable to undertake a detailed review of all research on the importance of different cognitive experiences of children outside of the school environment. There is a very large body of research on cognitive development in children and an applied sub set of this research has been concerned with the cognitive abilities of children in relation to the skills they use and need as pedestrians in traffic, for example, the skills in relation to accidents and personal safety (Chapman 1998).

Policy

Cognition was another component of travelling to school where the interview / focus group study revealed much interest which was not matched by research literature. This is therefore another priority for gathering evidence which may influence decisions about mode of travel to school.

To ascertain potential benefits or harms related to cognition when travelling of policies aimed at reducing car travel, primary research is needed about the development of skills for way finding, time management, money management and organisation.

In terms of achieving the policy changes of reduced use of car travel to school, research is needed on the direct and indirect effects of different forms of travel on children's cognition to ensure that these apply in a positive direction in relation to less car travel.

5.6 Effects of modes of travel suitable for journey to school

In the interview / focus group study interviewees focused specifically on the journey to school and components of this experience. The literature search revealed some studies that were not specifically about the journey to school but were about modes of travel which would be suitable for the journey to school.

Table 5.6: Determining research gaps about modes of travel suitable for travel to school

Interview / focus group study	Research identified	Research needed
	Student car ownership and car maintenance but not car availability negatively affected grades (Fite 1980)	Critical appraisal of identified study
	Pedestrian training improved looking whilst crossing, but not kerb or pavement behaviour (Rivara <i>et al.</i> , 1991)	Critical appraisal of identified study
	Marked age trends in children's attention to relevant versus irrelevant features of safety (Tolmie <i>et al.</i> , 1998)	Critical appraisal of identified study

The three studies identified on modes of travel suitable for travel to school considered pedestrian traffic skills (Rivara *et al.*, 1991, Tolmie *et al.*, 1998) and student car ownership (Fite 1980). Pedestrian traffic skills are considered by studies identified for modes of travel to school, whereas car ownership was only considered in terms of travel suitable for school.

Policy

Although there may be lessons to be learnt from studies about modes of travel suitable for travel to school, interpreting findings to inform policy issues would be easier from studies addressing more precisely the journey to school, and primary research in this area cannot be recommended for this purpose. The few studies identified that addressed children's development in relation to modes of travel suitable for the journey to school suggest that this would not be a fruitful area to pursue either with systematic literature reviews.

5.7 Effects of mode of travel

Table 5.7 shows that the relationship between journey and relaxation time is an area of research suggested by the interview / focus group study. This was not covered to any extent by studies in the detailed map of included studies.

Table 5.7: Determining research gaps about total mode of travel to school

Interview / focus group study	Research identified	Research needed
	Best friends likely to be friends out of school and to live nearby. Some travel to school together (King and Easthope 1973)	Critical appraisal of identified study
	Walking bus: Increased road sense, social development and independence (Bickerstaff and Shaw 2000)	Critical appraisal of identified study. Repeat study with objective outcome measures
	Factors related to improvement in safe traffic skills (Lewis <i>et al.</i> , 1998; Thomson and Whelan 1997; Whitebread and Neilson 1998).	Critical appraisal of identified studies
	Delivery of children to school: Parents more consistent than children in behaviour (Yoshida 1996).	Critical appraisal of identified study
	Carpools: models of socialization under combined influence of school, family, and peer group influences (Adler and Adler 1984)	Critical appraisal of identified study

Long journeys to school: affect children's attention span and reduces relaxation time	Long journeys: negative effects on feelings of well being, academic achievement and participation in activities (O'Brien 1982; Reid 1994; Solstad 1975).	Critical appraisal of identified studies
	Busing: effects on race relations and social class and academic achievement (Bolton 1974; Milazzo 1976; Sheehan 1978)	Critical appraisal of identified studies

To assess the need and relevance for this research it would be preferable to undertake a detailed review of all research on the importance of different activities and relaxation time for children. This could be linked to issues of children's independence and rights (Greenfield *et al.*, 2000, Hillman 1993, Mathews and Limb 2000).

One study that did evaluate a mode of travel to school described a walking bus scheme (Bickerstaff and Shaw 2000). The study did not use objective outcome measures which limits the interpretation of the results, but it provides a good example of the research that most clearly and directly addresses policy issues. An alternative strategy would be to assess the impact of different modes of travel by conducting large scale longitudinal surveys.

Policy

The literature review identified studies that may provide useful evidence about the benefits and harms of different modes of travel to school in terms of children's social and cognitive development. These studies need appraising for their reliability and relevance to English school children. Should these studies stand up to such scrutiny, their findings need to be shared with children, parents, teachers and local education authorities to advance the debate about travel to school. Observational or experimental research may investigate whether people's choices about mode of travel to school is influenced by such evidence.

Very few of the identified studies were concerned with an evaluation of the impact of new initiatives to directly or indirectly achieve the current policy objective. This is the clearest need for further research on the effects of travel on children's mental health and social and cognitive development.

5.8 Effects of mass use of different modes of travel

The interview / focus group study revealed a concern about the effects of mass use of modes of transport that was not matched by literature identified by the systematic search.

All of these issues need addressing by primary research, although some of them may be informed by the literature about town planning. Systematic searching of town planning literature which addresses children's mental health and social and cognitive development could be fruitful. Any literature in this area would have been missed if terms used in the titles and abstracts, or terms used to code studies on bibliographic databases did not overlap with

those about travel. Alternatively town planning literature may not have addressed children's mental health and social and cognitive development.

Table 5.8 Effects of mass use of modes of transport

Interview / focus group study	Research identified	Research needed
Children have more opportunity for independence in safer environments		Primary research about school journeys, and systematic review of town planning literature
Children's social networks limited by traffic on roads		Primary research about school journeys, and systematic review of town planning literature
Sharing lifts in cars increases sense of community		Primary research about school journeys, and systematic review of town planning literature
Parents meeting at school gates encourages friendships and sense of community		Primary research about school journeys, and systematic review of town planning literature
Restrictions of available travel limit participation in after school activities		Primary research about school journeys, and systematic review of town planning literature
Mass use of bus changes school atmosphere / sense of community		Primary research about school journeys, and systematic review of town planning literature

Over the last decade there has been a growing awareness of children and young people as citizens in their own right rather than simply as potential or soon to be adults requiring adult protection and direction. The protection of children from the dangers of traffic and of adults in the street plus adults' dependence and use of private cars can mean that children are denied the right to mobility and the ability to explore and know their own community (Hillman 1993; Hillman *et al.*, 1990; Tranter 1996). Surveys by Hillman and colleagues (1993) have shown the extent that children's independent mobility has been curtailed as parents aim to protect their children from perceived traffic safety risks. This results in greater car use and thus greater levels of traffic to be avoided. Children's lack of freedom of choice is also linked to children's involvement and representation in decisions about travel and the urban environment (Davis and Jones, 1996a; Greenfield *et al.*, 2000). In addition, the consequences of the adult based decision making leading to high car use leads to further consequences for children and young people. For example, the increased risk of traffic accidents leads to further restriction on cycling and walking. It also reduces the level of communication between neighbours and general social life on the street (Appleyard and Lintell, 1972) which is one of the main locations for social life of young people (Mathews and Limb, 2000).

6. Conclusions and Recommendations

Children's travel to school is a complex subject, comprising many ways of getting to school, a variety of experiences along the way, and different potential effects on children. The research studies identified by this review cover many different topics. Because of the broad nature of the research questions posed, the studies included in the review form a disparate and not always cohesive body of research on the effects of different modes of travel on children's mental health and social and cognitive development.

The various activities and experiences that can be involved in travel have been studied as issues quite separately from any concern for travel. This has meant that most of the studies identified by the review are a small subset of a number of different bodies of research literature. This suggests four different research strategies for the future.

6.1 Research addressing components of the travelling experience

First, research could address each of the component experiences of modes of travelling such as physical activity, diet and nutrition, and environmental, social, and cognitive experiences. This review identified a few studies from these different literatures that were explicitly concerned with travel suitable for journeys to school and children's mental health and social and cognitive development.

(1) We recommend

More detailed critical appraisal of all the studies listed in tables 5.1 to 5.5

Quite separate literatures exist on the effects of such things as physical activity, physical environment, diet, social and cognitive experiences on CMHCSD. Only those parts of those literatures related to travel were included in the current review. The review did not, for example, include Cochrane Collaboration systematic reviews on the effects of exercise or pollution on mental health that were not specifically concerned with children and travel. A full assessment of the relevance of these component experiences of travel on CMHCSD requires systematic research syntheses of these separate literatures. Over time research on the separate components of travel suitable for school could build up together into an integrated area of research on the effects of travel on CMHCSD. Progress towards such an integrated area of research would depend on the level of research investment but would likely to be slow due to the lack of research to date and lack of a coherent research base and framework as identified by the current report. In the meantime we urge caution in the interpretation of non systematically synthesized research results. Many primary studies have weak research designs or are correlational designs where causal effect is often assumed without evidence (for example, assuming that a correlation between exercise and academic achievement is due to a causative effect of exercise on academic performance).

(2) We recommend

Systematic reviews of the literatures on the effects of physical activity, physical environment, diet, social experiences, cognitive experiences on CMHCSD. In the meantime we urge caution in the interpretation of non

systematically synthesized research results. Many primary studies have weak research designs or are correlational designs where causal effect is often assumed without evidence (for example, assuming that a correlation between exercise and academic achievement is due to a causative effect of exercise on academic performance).

(3) We recommend

Primary studies to address questions relevant to reducing car use for travel to school that have not been sufficiently answered by current research findings. We understand that such reviews and primary studies are not the primary responsibility of policy makers in transport.

Comparison of research findings with ideas revealed by the interview / focus group study has identified gaps in knowledge about the effects of specific components of the travel experience.

(4) We recommend

Primary studies of the modes of travel to school which address the components of the travel experience (physical activity, nutrition and diet, social, cognitive and environmental experiences) in terms of outcomes identified in the interview / focus group study (readiness to learn, lethargy, exhaustion, academic performance, social and cognitive skills). To facilitate easy interpretation we recommend that the setting for these studies be specifically journeys to school. As only one focus group was used in the current review, such a process would be informed by more such discussion with different age groups in different geographical areas in England and Wales.

6.2 Modes of travel to school or suitable for travel to school

A second strategy is to undertake research directed at different modes of travel rather than the separate components of the travel experience. Primary studies addressing modes of travel to school or modes of travel suitable for travelling to school were identified by the systematic search (tables 5.6 and 5.7).

(1) We recommend

More detailed critical appraisal of all the studies listed in tables 5.6 and 5.7.

These studies may provide useful research evidence to inform decisions about modes of travel to school.

(2) We recommend

That the findings of reliable research about modes of travel to school and components of the travel experience be shared with pupils, parents, teachers and school governors and local authorities. Qualitative research should address how this evidence is perceived and whether and how it influences decisions about modes of travel to school.

Relatively few studies have been found to address the different modes of travel to school, and fewer still are likely to be considered reliable once appraised for their rigour and relevance to English school children. More primary research is required in this area. This could either be basic research on the different modes of travel or applied research designed to specifically address policy issues. The emphasis could be on examining the effects on

CMHCSD of current modes of travel or the effects of special school travel initiatives.

(3) We recommend

Small sample surveys (which make up the bulk of research identified in the current review) for examining and developing hypotheses about causal processes and participant views about different services and travel arrangements (but not to show causal effect).

An efficient research strategy for assessing the impact of interventions is the use of experimental designs which control for the effects of the many other variables involved. In the current review, the most common design was the analysis of naturally occurring variables rather than experimental designs. The only studies that applied full experimental designs were some studies of specific components such as experience and memory.

One identified study did take an experimental approach to evaluating a mode of travel by assessing the impact of a walking bus scheme (Bickerstaff and Shaw, 2000). Although, there was no random allocation to groups of independently assessed outcome measures, the study provides a good example of the potential for research to evaluate new initiatives. Many such initiatives are being introduced by government, local authorities and by individual schools. These are interesting ideas, but objective research evidence is necessary to assess whether they achieve the hypothesized outcomes.

(4) We recommend

Experimental studies where school students are randomly assigned to either experimental or control groups on an individual or cluster basis. We are not in a position to suggest which of the many current practices or special school travel initiatives (also informed by the background studies for the current review listed in Appendices 5 and 6 and ideas from the interview/focus study) is a priority for experimental evaluation, but the following brief examples are given for illustrative purposes:

(i) Random allocation of individuals to (a) special travel provision, in order to assess their effects on car use and children's learning; or (b) different levels of quality of student storage facilities at school (such as size, user friendliness, attractiveness).

(ii) Cluster random allocation of classes or schools to (a) special travel provision in out of school initiatives or (b) other initiatives (such as special schemes to encourage walking and cycling; separate or combined walking and cycle routes to avoid isolation of special walkways; banning and strict enforcement of car parking close to schools; etc) in order to assess their effects on mode of travel and children's learning.

The lack of experimental studies in the literature and the strength of their findings for informing policy about the efficacy of different strategies make this approach a priority for future research. The size of samples needs for such study would depend upon whether individual or cluster random allocation was used and the outcome measures applied. If outcome measures with a low range of variation in prevalence in the population are used, then a larger sample is required in order that the experiment has the power to identify a change in this prevalence. There are simple statistical tests to determine the sample size necessary for variables of different prevalence.

6.3 Community and travel planning and children

Thirdly, the interview / focus group study revealed concern about the effects of mass use of modes of transport that was not matched by literature identified by the systematic searching about travel. All of these issues need addressing by primary research, although some of them may be informed by the literatures on town planning and on the sociology of childhood and children's environments.

(1) We recommend

A systematic reviews of literatures addressing community and travel planning and children's mental health and social and cognitive development.

(2) We recommend

Primary research about the impact of mass use of different modes of transport on children's independence, social networks, opportunities to participate in after school activities, and sense of wider community (see Table 5.8).

6.4 Involving children in research

Historically, children have had little influence over decisions about their travel arrangements. Many of the studies identified in this review have been conducted in the USA such that the evidence about children's travel and its impact on their mental health and social and cognitive development has been largely by American academics.

(1) We recommend

That children be involved in planning and evaluating changes in their travel arrangements. It is only by listening to them that we shall be able to develop strategies that are more likely to be acceptable and effective.

7. References

(See Appendix 6 for references of identified studies)

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8. APPENDICES

APPENDIX 1 ACKNOWLEDGEMENTS

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Roger Mackett	Transport Studies
Mark McCarthy	
Julie McGrane	St Thomas Moore School and
Joyce Nicholls	Birmingham City Dept of Education
Paul Osborne	Project Dir. - Safe Routes to School
David Pitches	Birmingham Health Authority
Ian Roberts	Institute of Child health, UCL

Kathy Saunders
Carol Sheriff
James Stephenson

Andrew Stuck

Steve Swanney
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Poole Council
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Department, City of Wakefield MDC
Travel Awareness Campaign
Co-ordinator
Devon and Cornwall Police
Hertfordshire County Council
Health Development Agency

Thanks also to the anonymous members of a Focus group from a class at a junior mixed infant school in London led by a research team member with class teacher participating, and to the six anonymous members of a school governors' email list contacted by Fran Hollis.

APPENDIX 2 SEARCH TERMS USED IN ELECTRONIC DATABASE SEARCHING

PubMed

- 1 transportation OR walking OR bicycling OR motorcycles OR automobiles OR travel
- 2 child OR adolescence OR child [TI] OR child [AB] OR “young people”[TI] OR “young people”[AB] OR young adult*[TI] OR young adult*[AB] OR youth[TI] OR youth[AB] OR juvenile[TI] OR juvenile[AB] OR teenager*[TI] OR teenager*[AB] OR adolescent*[TI] OR adolescent*[AB] OR “school student*”[TI] OR “school student*”[AB] OR dropout*[TI] OR dropout*[AB] OR pupil*[TI] OR pupil*[AB]
- 3 “behavior and behavioral mechanisms”[MH] OR “mental processes”[MH]
- 4 1 AND 2 AND 3

Eric

- 1 exp air transportation/ or exp bus transportation/ or exp rail transportation/ or exp student transportation/ or Distance/ or Mobile classrooms/ or Motor vehicles/ or Proximity/ or Public facilities/ or Road construction/ or Traffic control/ or Transportation/ or Travel/ or Vehicular traffic/
- 2 exp motor vehicles/ or exp transportation/ or exp travel/
- 3 exp commuting students/ or exp school location/ or exp student transportation/
- 4 exp pedestrian traffic/ or exp walking/
- 5 exp bicycling/
- 6 exp motor vehicles/ or exp traffic safety/ or exp vehicular traffic/
- 7 exp bus transportation/ or exp school buses/
- 8 exp ancillary school services/ or exp bus transportation/ or exp busing/ or exp commuting students/ or exp distance/ or exp distributive education/ or exp mobile classrooms/ or exp motor vehicles/ or exp proximity/ or exp public facilities/ or exp rail transportation/ or exp road construction/ or exp school buses/ or exp student transportation/ or exp students/ or exp technology education/ or exp traffic circulation/ or exp traffic control/ or exp transportation/ or exp travel/ or exp vehicular traffic/
- 9 exp daily living skills/ or exp motor vehicles/ or exp transportation/ or exp travel/ or exp walking/ or Travel training/
- 10 exp pedestrian traffic/ or exp physical fitness/ or exp physical mobility/ or exp walking/

- 11 exp bicycling/
- 12 exp bus transportation/ or exp feeder patterns/ or exp school buses/ or exp student transportation/
- 13 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12
- 14 limit 13 to elementary secondary education
- 15 limit 14 to English language

PsycInfo

- 1 ('Commuting-Travel' in DE) or ('Travelling-' in DE) (364 records)
- 2 ('Air-Transportation' in DE) or ('Ground-Transportation' in DE) or ('Public-Transportation' in DE) or ('Transportation-Accidents' in DE) or ('Transportation-' in DE) or ('Water-Transportation' in DE) (875 records)
- 3 'Walking-' in DE (596 records)
- 4 ('Motor-Vehicles' in DE) or ('Motor-Traffic-Accidents' in DE) (1625 records)
- 5 ('Highway-Safety' in DE) or ('Automobiles-' in DE) (1083 records)
- 6 'Motor-Vehicles' in DE (276 records)
- 7 1 or 2 or 3 or 4 or 5 or 6 (4182 records)
- 8 (TRAVEL) or (TRAVEL-COST) or (TRAVEL-DISTANCE) or (TRAVEL-MODE) or (TRAVEL-PLANNING) or (TRAVEL-RELATED) or (TRAVEL-SLIDE) or (TRAVEL-STUDY) or (TRAVEL-TIME) or (TRAVELED) or (TRAVELER) or (TRAVELER-GUIDE) or (TRAVELER-INFORMATION) or (TRAVELER-TYPE) or (TRAVELERS) or (TRAVELLING) or (TRAVELLING-) (2681 records)
- 9 (TRANSPORTATION) or (TRANSPORTATION-) or (TRANSPORTATION-ACCIDENTS) or (TRANSPORTATION-COMMUNICATIONS) or (TRANSPORTATION-DISTANCE) or (TRANSPORTATION-RELATED) or (TRANSPORTATION-RESEARCH-PART-F-TRAFFIC-PSYCHOLOGY-AND-BEHAVIOUR) (1996 records)
- 10 WALK (1277 records)
- 11 (WALKING) or (WALKING-) or (WALKING-ASSOCIATED) or (WALKING-EXERCISE) or (WALKING-RELATED) (2635 records)
- 12 (BICYCLE) or (BICYCLE-AUTOMOBILE) or (BICYCLE-CAR) or (BICYCLE-HELMET) or (BICYCLE-MOTOR) or (BICYCLE-ONLY) or

- (BICYCLE-RELATED) or (BICYCLED) or (BICYCLES) or (BICYCLING) or (BICYCLIST) or (BICYCLISTS) (622 records)
- 13 (MOTORCYCLE) or (MOTORCYCLE-RELATED) or (MOTORCYCLES) or (MOTORCYCLING) or (MOTORCYCLIST) or (MOTORCYCLISTS) or (MOTORCYCLE) or (MOTORDRIVING) or (MOTORDRIVEN) (184 records)
- 14 (AUTOMOBILE) or (AUTOMOBILE-DEPENDENT) or (AUTOMOBILE-DRIVING) or (AUTOMOBILE-PATH-FOLLOWING) or (AUTOMOBILE-SPEED) or (AUTOMOBILES) or (AUTOMOBILES-) (1663 records)
- 15 (CAR) or (CAR-ACCIDENT) or (CAR-ATTENUATING) or (CAR-BICYCLE) or (CAR-BICYCLIST) or (CAR-BUS-AIRPLANE) or (CAR-CONTROLLING) or (CAR-CULTURE) or (CAR-CYCLIST) (1759 records)
- 16 (BUS) or (BUS-AIRPLANE) or (BUS-AIRPLANE-CAR) or (BUS-AIRPLANE-CAR-TRAIN) or (BUS-ALL) or (BUS-DRIVING) or (BUS-INDUCED) or (BUS-LINES) or (BUS-RELATED) or (BUS-RIDING) or (BUS-ROUTE) or (BUS-TRAFFIC) or (BUS-TRAIN) (507 records)
- 17 (COMMUTE) or (COMMUTE-VARIABILITY) or (COMMUTED) or (COMMUTER) or (COMMUTER-CAMPUS) or (COMMUTER-TYPE) or (COMMUTERS) or (COMMUTES) or (COMMUTING) or (COMMUTING-RELATED) or (COMMUTING-STRAIN) or (COMMUTING-TRAVEL) (382 records)
- 18 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 (12310 records)
- 19 7 or 18 (13831 records)
- 20 ('Boarding-Schools' in DE) or ('Elementary-School-Students' in DE) or ('Elementary-School-Teachers' in DE) or ('Elementary-Schools' in DE) or ('High-School-Students' in DE) or ('High-Schools' in DE) or ('Institutional-Schools' in DE) or ('Intermediate-School-Students' in DE) or ('Junior-High-School-Students' in DE) or ('Junior-High-Schools' in DE) or ('Middle-School-Education' in DE) or ('Middle-School-Students' in DE) or ('Nontraditional-Education' in DE) or ('Parent-School-Relationship' in DE) or ('Primary-School-Students' in DE) or ('Public-School-Education' in DE) or ('School-Adjustment' in DE) or ('School-Administrators' in DE) or ('School-Age-Children' in DE) or ('School-Attendance' in DE) or ('School-Club-Membership' in DE) or ('School-Dropouts' in DE) or ('School-Environment' in DE) or ('School-Expulsion' in DE) or ('School-Facilities' in DE) or ('School-Integration' in DE) or ('School-Learning' in DE) or ('School-Leavers' in DE) or ('School-Readiness' in DE) or ('School-Refusal' in DE) or ('School-Retention' in DE) or ('School-Suspension' in DE) or ('School-Transition' in DE) or ('School-Truancy' in DE) or ('Schools-' in DE) or ('Vocational-School-Students' in DE) or ('Private-School-Education' in DE) or ('School-Enrollment' in DE) or ('Educational-Administration' in DE) or ('Technical-Schools' in DE) (132683 records)
- 21 19 and 20 (644 records)

Sociological Abstracts

(((((transportation or travel or commute or commuting or commuter or walking or walk or bicycling or bicycle or bicyclist or motorcycle or motorcycles or motorcycling or automobile or automobiles or car or cars or motor vehicles or bus or buses or train or trains or rail)) OR ((de=((traffic))) OR (de=((railroads))) OR (de=((automobiles))) OR (de=((transportation) or (air transportation) or (public transportation) or (automobiles) or (highways) or (railroads) or (tourism) or (traffic) or (travel))) OR (de=((travel) or (commuting (travel)) or (transportation)))))) AND (de=((children) or (age groups) or (adolescents))))

Transport

- 1 (TRANSPORT) or (TRANSPORTATION-) or (TRANSPORTATION-A) or (TRANSPORTATION-ACCIDENT) or (TRANSPORTATION-ACCIDENTS) or (TRANSPORTATION-ACTION-MODEL) or (TRANSPORTATION-ACTIVITY-FORECASTING) or (TRANSPORTATION-ADEQUACY-MEASURE) or (TRANSPORTATION-ALLOWANCE-PROGRAMS) or (TRANSPORTATION-ALLOWANCES) or (TRANSPORTATION-ALTERNATIVES) or (TRANSPORTATION) or (TRAVEL) or (TRAVEL-) or (TRAVEL-ACCESSIBILITY) or (TRAVEL-ANALYSIS) or (TRAVEL-ASSUMPTIONS) or (TRAVEL-BEHAVIOR)
- 2 (CHILD) or (ADOLESCENT)
- 3 1 AND 2

EPPI-Centre's healthy eating & physical activity database

TRANSPORT or TRANSPORTATION

APPENDIX 3 WEB SITES SEARCHED INCLUDING WEBBASED JOURNALS

(Websites searched Dec 2000)

Source	Interval searched
European Journal of Physical Education	Vol 2 No 1 1996 to Vol 5 No 2, 2000
Journal of Physical Education, Recreation and Dance (JOPERD)	Jan 1999 to November/December 2000
Journal of Health Education	November/December 1999 TO May/June 2000
Research Quarterly for Exercise and Sport	September 2000 Vol. 71, No. 3 and December 2000 Vol. 71, No. 4

American Association for Health Education:
<http://www.aahperd.org/aahe/aahe-main.html>

Centre for Exercise Science and Medicine (CESAME), University of Glasgow:
<http://www.medther.gla.ac.uk/cesame/doc1.html>

Centre for Alternative and Sustainable Transport (CAST). School of Sciences, Staffordshire University. Site includes the Third National Walking Conference: Walking And Health:
<http://www.staffs.ac.uk/schools/sciences/geography/cast/>

Centre for Transport Studies, University College London:
<http://www.ucl.ac.uk/transport-studies/>

Children's Health and Exercise Research Centre, University of Exeter (including European Journal Of Physical Education):
<http://www.exeter.ac.uk/cherc/research.htm>

Department of the Environment, Transport and the Regions School Travel:
<http://www.local-transport.detr.gov.uk/schooltravel/index.htm>

Health Walks Research and Development, School of Health Care, Oxford Brookes University:
www.brookes.ac.uk/schools/hcs/healthwalks/index.html

Sustrans (sustainable transport):
<http://www.sustrans.org.uk/>

Transport Research Institute, Napier University:
<http://www.tri.napier.ac.uk/>

Transport Studies Group , University of Westminster:
<http://www.wmin.ac.uk/transport/>

Walking the Way to Health, the Countryside Agency:
http://www.countryside.gov.uk/activities/special/walkhealth_01.htm

APPENDIX 4 STUDIES IDENTIFIED BY DATABASE SEARCHES BY FOCUS OF STUDY

Psy = Psychinfo

Soc - Sociological abstracts

Rec = Procite database printout number (NOT database number) of 18/12/00

Societal effects (E1)

Busing and segregation

Quality of life and freedom of movement for children

Code	Description
Psy 576	Busing leading to enforced social contact / SES
Psy 597	Busing leading to increase in racial segregation
Psy 544	Bus segregation and classroom climate
Rec 118	Freedom benefits of child friendly travel
Rec 126	Children, transport and quality of life
Rec 105	Children transport and quality of life
Rec 36	Stress and quality of life of school children

Social, behavioural, relationship effects (E2)

Stress leading to social behaviour and school problems

Positive effects of exercise, relaxation, and bus driver behaviour

Proximity including car-sharing leading to friendships

Teenage driving leading to social responsibility

Code	Description
Rec 39	Social stresses and anti social behaviour
Rec 41	Daily hassles and adjustment
Psy 588	Long travel to school leading to upset, school not enjoyable
Rec 43	Daily hassles and anti social behaviour
Psy 137	Anxiety and fear for children from increase in traffic = environmental stress
Rec 48	Taxonomy of situations leading deviant children to experience social difficulties
Psy 373	Exercise and rest leading to decrease in anxiety
Psy 569	Muscle relaxation leading to decrease in tense behaviour

Code	Description
Psy 116	Exercise leading to decrease in disruptive behaviour, but not self concept
Psy 557	Bus driver behaviour leading to friendly child behaviour leading to increase in a more pleasant journey
Psy 616	Frequent interaction leading to friendship in schools
Rec 35	Proximity and sex and race and friendships
Psy 410	Car pool leading to social relationships
Soc 66	Car pools - to socialization and education
Psy 392	Social network and support re socio emotional functioning
Rec 79	Teenage driving licence and effect on other behaviour
Soc 69	Teen car drivers more socially responsible
Rec 123	Travel behaviour at early age can influence later behaviour

Mental health effects (E3)

Various mental health consequences of accidents and other trauma

Code	Description
Psy 58	RTA leading to psychology consequences
Psy 110	RTA leading to school involvement and recovery (problems include behaviour, executive dysfunction)
Psy 111	Motorbike RTA leading to disability
Psy 174	RTA leading to psychological social consequences
Psy 513	Bus kidnapping leading to psychological trauma
Psy 532	Bus kidnap leading to psychological trauma
Psy 140	School psychologist using therapy for bereavement re RTA
Psy 159	RTA leading to PTSD

Cognitive effects (E4)

General cognitive effects

Physical activity and mental performance

Specific experiences and cognitive skills

Physical activity and self esteem

Noise and chemical pollution and other noxious effects

Code	Description
Rec 115	Cognitive impact of mode of travel
Psy 556	Effect of busing on academic achievements
Psy 613	Achievement of black students forced to bus
Psy 172	Exercise leading to increase in mental performance
Psy 342	Familiarity with route leading to increase in accuracy at direction estimates
Psy 347	Exptal experience leading to increase in accuracy re bearing and distance estimates
Psy 525	Familiarity with route leading to better estimates of distance
Psy 150	Experience as independent road user leading to skill re where to cross
Psy 187	Expert vs novice cyclists and skill re interpreting eye movements
Psy 325	Exptal activity leading to increase in spatial representations
Psy 396	Experience leading to spatial knowledge
Rec 50	Physical activity effects on self concepts of adolescents
Rec 51	Exercise and self esteem
Rec 86	Chronic exposure to train noise leading to mental efficiency
Rec 96	Chronic exposure to train noise leading to mental efficiency
Rec 65	Train noise on mental efficiency of elementary children
Rec 66	Railway noise and thinking processes of school children
Soc 86	Child lead consumption
Rec 189	Effects of pollution on cognition
Psy 192	Migraine and travel sickness

Indirect effects (E5)

Code	Description
Rec 114	School travel health and the environment
Rec 71	Heart and other benefits of walking to school
Rec 72	Effect of bicycle injuries on subsequent bicycling
Rec 73	Effect of bicycle injuries on subsequent bicycling
Rec 81	Aerobic effects of walking training on sedentary teenagers

Interventions re safety (I 1)

Various safety skills

Code	Description
Psy 430	Training re road safety
Psy 542	Teaching pedestrian skills to children
Rec 77	Israeli bicycle helmet campaign
Rec 78	Israeli bicycle helmet campaign
Rec 91	School training to prevent pedestrian injuries
Psy 90	School bus safety: Children as flight attendants leading to increase in attitudes and behaviour
Rec 57	Bicycle helmet give away and safety

Interventions re behavioural or cognitive outcomes (I 2)

Preventive interventions re behaviour of high risk

Prevention re disruption on buses

Increasing physical exercise

Benefits of breakfast programs

Code	Description
Rec 75	Social skills training of emotionally disturbed children
Rec 1	Teaching responsibility to high risk
Psy 332	Assertiveness training leading to increase in cooperation v aggression during travel
Psy 383	Effect of traffic and marijuana safety intervention on attitudes and behaviour
Psy 510	Intervention to decrease disruptive behaviour on buses that lead to accidents
Psy 530	Behavioural counselling leading to decrease in disruption on buses
Psy 541	Music leading to decrease in disruptive behaviour on bus
Psy 608	Time out leading to decrease in disruptive behaviour on bus
Soc 48	Media leading to increase in physical activity
Psy 359	Reinforcing and progressing re exercise for obese
Rec 55	Breakfast program effects on school performance and attendance
Rec 56	School breakfast program and cognition

Interventions re usage of travel mode (I 3)

Various re choice of travel mode

Code	Description
Psy 229	Training re way finding strategies
Psy 563	Intermittent reinforcement leading to increase in bus use
Psy 605	Educational training workshops and decisions to bus
Rec 28	Home alone advice

Studies of nature of situation / co-occurrence of variables (B)

Physical development
 Psychological skills
 Behaviour
 Safety
 At risk groups and behaviour
 Children as users

Code	Description
Psy 606	Child pacing of work on cycle ergometer
Rec 74	Development of gait patterns in childhood
Rec 76	Instrument for measuring physical activity
Rec 80	Variations in energy expenditure of 14-15 year old school girls
Rec 82	Activity levels in children in USA
Rec 83	Predictive significance of slow walking and talking
Rec 84	Validation of a Type A measure of children
Rec 85	Validation of a Type A measure of children
Rec 88	Relationship between vigilance deficits and traffic injuries
Psy 534	Dev. Aspects of cognitive mapping
Psy 546	Distance estimates of cues used
Psy 549	Dev. Of spatial representations
Rec 69	Children's perceptions of bicycle injury risks and their risky behaviour
Rec 70	Testing children's spatial abilities
Psy 217	Developmental differences in ability to give directions from a map
Psy 259	Experienced cyclists use automated thinking processes re cycling so can do other mental tasks
Psy 302	Skills re way finding
Psy 304	Constructive learning and influence and the micro world
Psy 348	Children use of map in maze
Psy 349	Social marking and spatial transformation tests

Code	Description
Psy 394	Walking effort and estimates of distance
Psy 523	Auditory concept of speed
Psy 606	Development and ability to judge velocity
Soc 42	Children and adult re children's knowledge of traffic safety rules
Soc 51	Traffic safety re young drivers
Soc 76	Parental fears has more impact than TV on child being fearful
Rec 47	Cognitive relativity effect on social isolation and depression
Psy 626	Personality and road behaviour
Soc 63	Parental role & teenage driving
Soc 67	Mother role and child travel: working & single mothers leading to autonomous children and travel on own
Psy 514	Training and social factors re road safety
Rec 67	Motorcycling attitudes and behaviours
Rec 68	Motorcycling attitudes and behaviours
Rec 116	Qualitative study on bicycle use
Rec 117	Transport related accidents to children
Rec 64	Children pedestrian risk and SES
Psy 601	Children risk as pedestrians
Psy 568	To analyse case study re child afraid to walk to school
Soc 47	Individual value ability & neighbourhood leading to pedestrian and cycle injury risk
Soc 53	Geographical and socio ecological factors and traffic accidents
Soc 80	Traffic safety for children in Norway
Rec 136	Considering safer effect on travel
Rec 127	Children and RTA's
Soc 25	Parental relations leading to child use of safety equipment
Soc 29	Parental relations leading to child use of safety equipment
Rec 87	Prevention of traffic accidents in children
Rec 89	Factors related to increased injury risk of some child pedestrians and cyclists
Rec 90	Critique of blaming children for pedestrian injuries
Soc 19	Consistency of parents duty and children crossing road
Soc 62	Teenage legal & illegal driving: driving behaviour
Soc 44	Explanations of gang behaviour
Soc 57	Stress seeking, risk taking and accidents
Rec 25	Coping strategies and culture
Rec 26	Social competence and recess problems
Rec 37	Daily stress levels by gender, perception and experience

Code	Description
Rec 38	Social skills and team learning on delinquency and absenteeism
Rec 40	Academic, discipline, and peer interactions of high risk males re antisocial behaviour
Rec 42	Discrimination, difficult circumstances and rule of school
Soc 28	Social networks and to risk related behaviours (HIV)
Psy 77	Methods of assessing stress and the strain on the individual
Rec 53	After school contact as risk for externalizing problems
Rec 54	Effect of violence on children's physical, psychological and social development
Rec 119	Teenage travel by public transport
Rec 120	Children's independent mobility
Rec 121	Freedom of children to explore their own neighbourhood
Rec 124	Children discuss their transport needs
Psy 612	Pupil attitudes towards busing
Rec 125	Feeling and being safe on public transport
Soc 8	Age and agency in Finland
Rec 44	Features of friendship patterns with age
Soc 109	Role of cars in youth culture
Soc 49	Leisure activities of suburban adolescents
Rec 45	Conventional strategies of Franco Ontarian students
Rec 52	Children's views on travel and their coping strategies
Soc 39	Children's understanding of bus ownership
Soc 70	Parents role re child's concepts of different jobs
Rec 128	Children as a nuisance
Psy 32	Bus driver's role re context of bullying
Psy 552	Features of bus driver to their work
Rec 111	Tele leaving and mobility
Rec 112	Transport specialties
Rec 32	Trying to lose/gain weight and psychological adjustment
Rec 34	Stress/culture shock programmes
Soc 107	Race and who sits next to who on bus
Rec 92	Negative health effects of low flying aircraft and other environmental stressors
Rec 95	Psychological effects of low flight military aircraft
Rec 188	Motility studies
Psy 391	Teacher attitudes and inter group practice re race in class

Policy issues (P)

Transport planning

Travel distances

Community alliances

Code	Description
Rec 122	Public transport planning
Rec 108	Smarter and safer bus transport
Rec 109	Transport study and its implementation
Rec 46	Educating children in difficult circumstances - building community alliances
Rec 113	Home to school transport
Rec 135	Accessing new schools after closure of primary schools
Rec 110	Increasing travel distances to school
Psy 619	Value to parents of having a school in walking distance

APPENDIX 5 STUDIES BY INCLUSION CRITERIA

I. Studies concerned with different effects, or components of, different modes of travel on children (A)

- Adler PA, Adler P (1984)
Basile VC, Motta RW, Allison DB (1995)
Bickerstaff K, Shaw S (2000)
Bjoerkliid P (1994)
Bolton RP (1974)
Chiron M, Le Breton B, Alauzet A, Weber D (1994)*
Craft DH (1983)
Cromer BA, Tarnowski KJ, Stein AM, Harton P *et al.* (1990)
Davis A, Jones L (1996)
Edwards KA, Johnston R (1977)
Engfors C, Fog H (1978)*
Fite JO (1980)
Foreman N, Foreman D, Cummings A, Owens S (1990)
Foreman N, Gillett R, Jones S (1994)
Foster LE, Ellis MJ (1974)
Herman JF, Kolker RG, Shaw ML (1982)
Hofstetter CR, Hovell MF, Sallis JF (1990)
Houg T, Gundersen H (1914)*
Howland J, Sargent J, Weitzman M *et al.* (1989)
Junger TI (1995)*
King R, Easthope G (1973)
Lee T, Rowe N (1994)
Lewis V, Dunbar G, Hill R (1998)
Lindeijer J (1992)*
McNaughten D, Gabbard C (1993)
Milazzo, PA (1976)
Morrell G, Atkinson DR (1977)
Morrongiello BA, Bradley MD (1997)
O'Brien, JE (1982)
Prinssen J, Kropman J (1992)*
Reid, RA (1994)
Ressler WH, Toledo E (1997)
Rivara FP, Booth CL, Bergman AB, Rogers LW, Weiss J (1991)
Sheehan DS (1978)
Simeonova G (1980)
Solstad KJ (1975)
Stapp WB, Cox DA, Zeph PT, Zimbelman KS (1983)
Strand A (1981)*
Thibeault RJ, Zetler AG, Wilson AP (1977)*
Thomson JA, Whelan KM (1997)
Tolmie AK, Thomson JA, Foot HC, McLaren B, Whelan KM (1998)
van Schagen IN, Brookhuis KA (1994)
Whitebread D, Neilson K (1998)
Yokoo Y, Mitani Y (1982)
Yokoo Y, Sebayashi T (1981)*
Yoshida S (1996)

* We were unable to retrieve this document. Thus, its categorisation is based on the document's abstract only, and not the full text.

II. Interventions re safety, behavioural or cognitive outcomes, usage of travel mode (B1)

- Anonymous, ITE Journal 2000.
Bader F (1986)
Beuret K, Camara P (1998)
Butki BD (1998)
Campbell DP, Adams RM, Ryabik JE (1974)
Carmichael LM, Carmichael RS (1972)
Caunter P, Browne L (2000)
Cheung Y, Kroes E (1995)**
Cornell EH, Heth CD, Broda LS (1989)
Cornell EH, Heth CD, Rowat WL (1992)
Cross T, Thornthwaite S (1997)
Deslauriers BC, Everett PB (1977)
Dunn BJ (1972)
Gatehouse RW, Frankie GH (1980)
Genemans L, Laemers M (1992)
Goodwin P, McKenzie R (1987)
Greene BF, Bailey JS, Barber F (1981)
Gross D, Soken N, Rosengren KS, Pick AD, Pillow BH, Melendez P (1991)
Hegger W, Van Schagen I (1993)
Hill E, Last A (1994)**
Hillman M, Adams J (1991)
Hillman M, Henderson I, Whalley A (1973)
Hillman M, Hederson I, Whalley A (1976)**
Jacobs M, Smeets M (1996)
Kayser R (1992)
Knippenberg Den Brinker C, Lameijer I, Clarke M (1983)
Krappmann L *et al.* (1993)
Levelt P (1993)**
Lobb N [No Date]
Melbye M, Biggar RJ (1994)
Miller J, Johnson (Lawrence) and Associates (1978)
Nielson O, Rassen J (1986)
O'Reilly D (1989)**
Peterson L, Thiele C (1988)
Pettit GS, Bates JE, Dodge KA, Meece, DW (1999)
Pfeffer K, Barnecutt P (1996)
Pilling A, Murrays S (1998)**
Posthuma AB, Carr JE (1974)
Rat J, Janssen J (1994)
Rommel EA Jr (1975)
Schmitz S (1995)
Tanner VL, Holliman WB (1988)
Wierda M, Brookhuis KA (1991)
Wittink R (1994)
Wittink R, Van Schagen I (1992)

** This study meets both categories, B1 and B2.

III. Studies that describe the nature of the world, how variables occur and co-vary without referring to effects of mode of travel or sub-components thereof (B2)

- Allen GL, Kirasi KC, Siegel AW, Herman JF (1979)
Ampofo-Boateng K, Thomson JA, Grieve R, Pitcairn T *et al.* (1993)
Anderman EM, Kimweli DMS (1997)
Anonymous (1991)
Anooshian LJ, Nelson SK (1987)
Arnberg, PW (1979)
Association of London Authorities (1989)
Audit Commission for Local Authorities, National Health Service (1991)
Beagley T [No Date]
Bell G, Tether C (1983)
Bernow R, Temaplan AB (1991)
Beschen D (1972)
Biddle S, Sallis J, Cavill N (1998)
Blades M, Medicott L (1992)
Blades M, Spencer C (1987)
Bowerman R, Hall B (1995)
Breisch, SL (1990)
Bryan-Brown K, Thomas H, O'Reilly D (1998)
Bryant BK (1985)
Carpenter S, Dix M (1980)
Chapman, AJ (1998)
Cheung Y, Kroes E (1995)**
Clark D, Marcon RA (1997)
Cleary Hughes Associates (1995)
Cohen R, Baldwin LM, Sherman RC (1978)
Cohen R, Weatherford DL (1980)
David SS, Foot HC, Chapman AJ (1990)
De Boer E (1980)
De Boer E (1980)
De Boer E (1988)
De Boer E, Nederveen A, Tacken M (1992)
Dekkers M (1985)
Dekkers MA (1984)
Del Rey P, Steiner S (1976)
Demetre JD, Gaffin S (1994)
Demetre JD, Lee DN, Pitcairn TK, Grieve R *et al.* (1992)
Department of the Environment TatRD (1998)
Department of Transport L (1984)
DETR (1999)
DiGuseppi C, Roberts I, Li L, Allen D (1998)
Dix M, Read P (1993)
Dodge KA *et al.* (1985)
Epstein JL (1985)
Erlandsen H (1995)
Fahs ME (1987)
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III. Studies that describe the nature of the world, how variables occur and co-vary without referring to effects of mode of travel or sub-components thereof (B2)

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APPENDIX 7 DeTR KEYWORD GUIDELINES/ DEFINITIONS AND STRATEGY

1. Document information:

How are these keywords allocated?

This keyword assigned on the most complete version available; therefore it is assumed that if keyworded on 'abstract' that title was also present.

Term	Definition	Use keyword
title	title of the report only	Title
abstract	abstract and title only	Abstract
full report	title, with or without abstract, and full report	Fullreport
selection	title, with or without abstract, and an incomplete part of a document	selection

What is the publication status of the material?

Term	Definition	Use keyword
published	published in a peer-reviewed journal or for an organisation as a peer-reviewed document.	published
in press	awaiting publication as above	inpress
unpublished	no evidence of peer-review process	unpublished

In what country/countries was the study carried out?

If the authors have not stated specifically where the study took place, it can be inferred from the authors' affiliations.

Term	Definition	Use keyword
England		england
Wales		wales
Ireland		ireland
Scotland		scotland
Other(specify)		holland (for example)

Document purpose:

Term	Definition	Use keyword
for background section of review	material which provides discussion and perspective on the issue of travel to school and/or childrens' cognitive, social and mental health status	background
for analysis section of review	research study examining the effect or relationship of modes of travel to school and childrens' cognitive, social and mental health status	analysis
exclude (specify criteria)	must meet exclusion criteria B1 or B2 as specified in second screening.doc	'B1' or 'B2' or 'C' or 'exclude'

2. What kind of evidence is it ?

What is the format of the printed material?

The four types likely to be found most often are listed first.

Term	Definition	Use keyword
report	for a published / unpublished report or journal article	report
policy document	a document which describes an organisation's current understanding of a phenomenon; primarily to provide information about an organisation in relation to a phenomenon for the organisation's readership	policy
guidelines	as for a policy document but actually provides information on how policy should be implemented, or the result of the policy information	guidelines
conference program	program listing of a particular conference	conferenceprogram
interview text		interview
book	for a text book only	book
correspondence		correspondence
internal document	e.g. a memo	internaldoc
mass media	radio transcript, television script, newspaper article	massmedia
web page		www
newsletter		newsletter
resource	for a poster (not containing a report), leaflet, publicity flyer etc.	resource
thesis	Dissertation by graduate student	thesis
conference abstract	abstract of a presentation given at a conference	conferenceabstract
conference paper	full paper of a presentation given at a conference	conferencepaper
published letter	e.g., in BMJ letters to the Editor	letter

IF STUDY WAS BACKGROUND OR WAS EXCLUDED UNDER 'DOCUMENT PURPOSE', STOP KEYWORDING HERE.

Format of printed material

This may or may not include a research design.

Term	Definition	Use keyword
developmental study	study examining effect by age, or using age as a co-variable	developmental
survey	study examining a multitude of variables	survey
cross-sectional study	study measures variables at one point in time	xsectional

longitudinal study	study measures variables at more than one point in time	longitudinal
bibliography	refers to a list of references of published/unpublished reports. It usually lists the author(s), title, publication/report date, and details of the journal/book/research institution etc. where the report can be located	bibliography
book review	discusses the scope and contents of a book	bookreview
case control study	a study in which the investigator compares one group of people (cases) among whom a problem (e.g. cardiovascular disease) is present with another group (controls) where the problem is absent, to find out which factors may have contributed to the problem. For example, whether certain risk factors (e.g. fat intake, low levels of exercise, stress) have been more prevalent in the cases' past than in the controls' past. A case control study is therefore <i>retrospective</i> , i.e. looks back in time.	casecontrol
cohort study	A study in which a group of individuals (study group) that is exposed to a risk factor (e.g. smoking) is compared with a group of individuals (control group) not exposed to the risk factor. The researcher follows both groups over time and compares the occurrence of a problem expected to be related to the risk factor (e.g. lung cancer) in the two groups, to determine whether a greater proportion of those with the risk factor are indeed affected by the problem. A cohort study is <i>prospective</i> , i.e. looks forward in time.	cohort
case study	Research where only one entity (e.g., situation, person) is under study	case
commentary	An opinion piece	commentary
economic evaluation	This assesses the financial implications of an intervention or naturally occurring event or situation.	economic eval
glossary	A glossary lists and explains terminology	glossary
intervention description	Description of an intervention without any data or results given	intervention
instrument design	This describes the process or stages involved in developing an 'instrument', e.g. an examination, a diagnostic procedure, etc.	instrument
meta analysis	A meta analysis combines <i>statistically</i> the results from a number of previous experiments or studies examining the same question, in an attempt to	metaanalysis

	summarise the totality of evidence relating to a particular issue ² .	
methodology	A methodology study may discuss a statistical technique, a recruitment procedure, a particular way of collecting or analysing data etc	methodology
needs assessment	A needs assessment is a particular type of cross sectional survey. It aims to establish the need for a particular intervention, service etc. Need can be defined as either of the following : felt need is what people say they want or what they think are the problems that need addressing; expressed need refers to what one can infer about the need of a community by observing their use of services; normative need refers to what expert opinion defines as need; comparative need is derived from examining for example the services provided in one area to one population and using this as the basis to determine the sort of services needed in another area with a similar population.	needs
outcome evaluation/RCT	An outcome evaluation is designed to establish whether an intervention works or not, i.e. whether or not the intervention changes outcomes (e.g. knowledge, attitudes, intentions, behaviour, service use) specified in the aims of the study AND the participants are allocated to the different groups in a random manner ie the report states 'randomised' and no further information is given; or if a random numbers Table, a random code or numbered sealed envelopes are used	rct
outcome evaluation/trial	As outcome evaluation RCT AND the participants are allocated to the different groups in a non-random manner ie any method of allocation different from randomisation as above, or the method of allocation is not stated/unclear, but the evaluation definitely involves different groups	trial
outcome evaluation/other design	If there is only ONE group ie post-test only; pre- and post test; time series; or other design different from above	otherdesign
outcome evaluation/not stated		nooutcome

process evaluation	A process evaluation examines the acceptability and feasibility of an intervention; studies the ways in which the intervention is delivered; assesses the quality of the procedures performed by the programme staff etc. It is designed to describe what goes on rather than to establish whether it works or not, and may suggest ways in which the programme design and implementation could be improved.	process
review	A review of literature relevant to a topic which can be: narrative , in which results are described but not combined in any meaningful way; systematic , described below; or integrative , in which the author combines results from several studies (by systematic or unsystematic methods) to advance a theory, idea, or perspective on a subject.	review
secondary analysis		secondaryanalysis
secondary report-intervention	In a secondary report the authors briefly describe an intervention or evaluation of an intervention which they have not undertaken themselves or which has been/will be reported in full elsewhere.	reportintervention
secondary report-outcome evaluation		reportoutcome
secondary report-process evaluation		reportprocess
survey	This aims to quantify the distribution of certain variables in a study population at one point in time. An example is a study of the relationship between walking to school and cognitive ability. Can be cross sectional (measured at one point in time) or longitudinal (measured at several points in time).	survey
systematic review	A particular issue is discussed by bringing together the opinions/findings/conclusions from a range of previous reports. A systematic review is explicit in its reporting of the search for studies for a) specific database(s) and/or the list of hand-searched journals, and b) the criteria for including and excluding studies. It may include meta analysis.	systematic

3. Who was under study?

Characteristics of the study population (those whom the data is about)

Term	Definition	Use keyword
Children	0-10 years	Children
young people	11-21 years	young
Parents		parents
Adults	22-54 years	Adults
older people	55+	Elderly

Perspective

Term	Definition	Use keyword
child's perspective		childperspective
parent's perspective		parentsperspective
perspective not stated		noperspective
perspective no applicable		naperspective
other perspective (specify)		otherperspective

4. Was the study actually about travel to school?

Setting of study

Term	Definition	Use keyword
travel to school	study is actually about travelling to school	toschool
other experience (specify)	study is about some component of travelling to school but data measurement does not actually occur while children are travelling to school	otherexp
setting not stated		nosetting

5. Was it mode of travel or component experiences?

Mode of Travel

Term	Definition	Use keyword
Walk		walk
Bicycle		bicycle
Motorcycle		motorcycle
Car		car
Bus		bus
train/Tube		rail
not stated		notravel
not applicable		natravel

Social context of travel

Term	Definition	Use keyword
driver		driver
passenger		passenger
pedestrian		pedestrian
not stated		notravelstatus
not applicable		natravelstatus

Term	Definition	Use keyword
alone		alone
accompanied by parent(s)		accparent
accompanied by other adult		accadult
accompanied by older child		accchild
accompanied by sibling(s)		accsiblings
accompanied by friend(s)		accfriends
accompanied by peer(s)		accpeers
not stated		noaccompaniment
not applicable		naaccompaniment

Term	Definition	Use keyword
responsible for self		respself
responsible for others		respothers
not stated		noresp
not applicable		naresp

Term	Definition	Use keyword
child's choice of transport		childchoice
parent's choice of transport		parentchoice
social context not applicable		nasocial
social context not stated		nosocial
other context experiences (specify)		othercontext

6. What outcome was under study? (specify for all)***Cognitive outcome***

Term	Definition	Use keyword
school/academic	Components of school-work e.g. reading, spelling, numeracy. Outcome measure might be results of e.g. spelling test.	academic
intelligence	Outcome measure might be a child intelligence test. Most widely used such test in the UK is the WISC (but there are several others). Depending on how the results are reported, the scores might be broken down into different components (verbal tests versus performance tests) or might be presented as overall scores.	intelligence
pure/complex cognitive	‘Pure’ cognitive: assessing components of cognition. Any study addressing one of the areas of cognition (see list I previously emailed). Examples of components of cognition: memory, language, reasoning. Examples of outcome measures: tests of memory. ‘Complex’ cognitive: assessing multiple components of cognition. Any study addressing outcomes related to cognition but not discrete components. Example = ability to cross the road. There are multiple components of cognition involved in the ability to cross the road. Researchers may or may not have teased out each component.	complexcognitive
other (specify)		other (specify)

Social outcome

Term	Definition	Use keyword
community relationships		community
the family	Attachments; Infant-mother attachment; Parenting; Poverty and childhood social development; Divorce and childhood social development	family
friendships	Having friends; identity of children’s friends; friendship quality; peer relations	friendships
social skills	Social skills in the classroom; school adjustment; social understanding; self and society; children’s perceptions of emotions (in others); understanding emotional display rules; coping with negative emotions	socialskills
socio-moral understanding	Theories of moral development; from socially determined standards to self-constructed insights; social knowledge	sociomoral
self-concept and identity	including gender and identity, and development of interpersonal orientation	identity
other (specify)		other (specify)

Mental health outcome

Term	Definition	Use keyword
youth crime-anti-social behaviour	including aggression; bullying and victimization; anti-social behaviour; conduct disorder	crime
anxiety		anxiety
stress		stress
drug abuse		drugs
depression		depression
eating disorders		diet
psychosis		psychosis
trauma		trauma
other (specify)	other mental health outcomes INCLUDING positive health outcomes (specify them) such as mood, feeling in control, self-esteem, satisfaction	othermental (specify)

Other outcome

Term	Definition	Use keyword
other outcome (specify)		otheroutcome

Additional keywords (page 2 of Keyword Strategy)

Type of Data Collection Methods Used

Term	Definition	Use keyword
quantitative	measures with predetermined categories of answer	quantitative
qualitative	methods that record and use participants' own description	qualitative

Frequency with which study measures variables

Term	Definition	Use keyword
cross sectional	sample's characteristics measured once	xsectionalF
longitudinal	sample's characteristics measured more than once	longitudinalF

Temporality

Term	Definition	Use keyword
prospective	study initiated before outcomes of interest occurred	prospective
retrospective	study initiated after outcomes of interest occurred	retrospective
One point in time	study measured a variety of variables at one point in time	onetime

Sample number

Term	Definition	Use keyword
sample number reported (specify)	if the final number of the people participating in the study is reported or can be calculated (specify number)	sample
sample number not reported		nosample
sample number not clear		unclearsample

Demographics

Term	Definition	Use keyword
Age reported	if the age range of people participating in the study is reported or can be calculated	age
Age not reported		noage
Sex reported	if authors describe the proportion of males and females participating in the study or if this can be calculated	sex
Sex not reported		nosex
class or socioeconomic status reported	if the authors describe the socio-economic classes in the study population, e.g. using occupational or educational classifications	class
class or socioeconomic status not reported		noclass
ethnic group reported	if the authors describe the ethnic make-up of the study sample	ethnic
ethnic group not reported		noethnic

Response rate details

Term	Definition	Use keyword
response rate reported	if the authors report the proportion of the original target population that is in their final sample, or if it is possible to calculate this	responserate
response rate not reported		noresponserate
response rate unclear		unclearresponserate
response rate not applicable	if the study does not aim to represent a target population e.g., in-depth, exploratory interview studies	naresponserate

Non-respondent details

Term	Definition	Use keyword
Non response details reported	if the authors report or reflect upon any characteristics of possible non responders NB look in methods and discussion as well as results sections	details
Non response details not reported		nodetails
Non response details unclear		uncleardetails
Non response details not applicable		nadetails

Drop out rate

Term	Definition	Use keyword
drop out rate reported		dropoutrate
drop out rate not reported	if the study is a longitudinal study and if the authors report the number of those recruited to the study who a) remain or b) are lost to the study at the last point at which their characteristics are measured	nodropoutrate
Drop out unclear		uncleardropoutrate
drop out rate not applicable	if the study is not a longitudinal study, i.e., if sample characteristics measured at only one point in time	nadropoutrate

Drop out details

Term	Definition	Use keyword
drop out details reported	if the study is a longitudinal study and if the authors report or reflect upon any characteristics of individuals lost to the study at the last point at which their characteristics are measured	dropoutdetails
drop out details not reported		nodropoutdetails
dropout details unclear		uncleardropoutdetails
drop out details not applicable	if the study is not a longitudinal study, i.e., if sample characteristics are measured at only one point in time	nadropoutdetails

APPENDIX 8 KEYWORD/DATA EXTRACTION STRATEGY

APPENDIX 8

Keyword/Data Extraction Strategy

Does the study measure **the effect of** a mode of travel or component of travel **on** children's cognitive, social or mental health status?

1. Document information

ProCite #: _____

Keyworder: CS GB

Keywords/Data extraction allocated by

- title
- abstract
- full report
- selection of report

Publication status of material

- published
- unpublished
- in press

Country

- England
- Wales
- Ireland
- Scotland
- other (specify)

Document purpose:

- for background section of review
- for analysis section of review
- exclude (specify criteria) _____

2. What kind of evidence is it?

Format of printed material

- report
- policy document
- guidelines
- conference program
- interview text
- book

- correspondence
- internal document
- mass media
- web page
- newsletter
- article
- resource
- thesis
- conference abstract
- conference paper
- published letter

Type of study

- developmental study
- survey
- cross-sectional study
- longitudinal study
- outcome evaluation-RCT
- outcome evaluation-trial design
- outcome evaluation-other design
- outcome evaluation-not stated
- bibliography
- book review
- case control study
- cohort study
- case study
- commentary
- economic evaluation
- glossary
- intervention description
- instrument design
- meta analysis
- methodology
- needs assessment
- process evaluation
- review
- secondary analysis
- secondary report-intervention
- secondary report-outcome evaluation
- secondary report-process evaluation
- systematic review

3. Who was under study?

Characteristics of the study population

- female
- male
- mixed gender
- children (0-10)
- young people (11-21)
- parents
- adults (22-54)
- older people (55+)

Perspective

- child's perspective
- parent's perspective
- perspective not stated
- perspective not applicable
- other perspective (specify)

4. Was the study actually about travel to school ?

Study setting

- travel to school
- other experience (specify)
- setting not stated

5. Was it mode of travel or component experiences?

Mode of travel

- bicycle
- bus
- car
- motorcycle
- train / Tube
- walk

Social context of travel

- driver
- passenger
- pedestrian
- alone
- accompanied by parent(s)
- accompanied by other adult
- accompanied by older child
- accompanied by sibling(s)

- accompanied by friend(s)
- accompanied by peer(s)
- responsible for self
- responsible for others
- child's choice
- parent's choice
- social context not applicable
- social context not stated
- other context experiences (specify)

6. What outcome was under study? (specify for all)

Cognitive outcome

- school/academic
- intelligence
- pure/complex cognitive
- other

Social outcome

- community relationships
- the family
- friendships
- social skills
- socio-moral understanding
- self-concept and identity
- other

Mental health outcome

- youth crime-anti-social behaviour
- anxiety
- stress
- drug abuse
- depression
- eating disorders
- psychosis
- trauma
- other
- other outcome (specify)

**ADDITIONAL KEYWORDS FOR
DeTR REVIEW**

ProCite# _____

Keyworder CS GB

Type of data collection methods used

(check all that apply)

- qualitative
- quantitative

**Frequency with which study measures
variables**

(check one only)

- cross sectional
- longitudinal

Temporality

(check all that apply)

- prospective
- retrospective
- one point in time (cross sectional)

Sample number

(select one only)

- sample number reported (specify) _____
- sample number not reported
- sample number not clear

Demographics

(select one option from EACH of age, sex, class,
ethnicity)

- age reported
- age not reported

- sex reported
- sex not reported

- class/SES reported
- class/SES not reported

- ethnic groups reported
- ethnic groups not reported

Response rate

(select one only)

- response rate reported
- response rate not reported
- response rate unclear
- response rate not applicable

Characteristics of non-respondents

(select one only)

- non-respondents' details reported
- non-respondents' details not reported
- non-respondents' details unclear
- non-respondents' details not applicable

Drop out rate for longitudinal studies

(select one)

- drop out rate reported
- drop out rate not reported
- drop out rate unclear
- drop out rate not applicable

Drop out details for longitudinal studies

(select one)

- drop out details reported
- drop out details not reported
- drop out details unclear
- drop out details not applicable

APPENDIX 9 STRUCTURED SUMMARIES OF INCLUDED STUDIES

Adler PA, Adler P (1994) The carpool: A socializing adjunct to the educational experience. *Sociology of Education*. 57(4): 200-210.

Aim of study: To investigate the types of interaction that take place within the carpool setting both between children and adults and among peer group members.

Kind of evidence: This published paper reported interviews with and observations of children (aged 4-10), their parents and other adults.

Completeness of data: Data reported anecdotally e.g. data on age and gender not formally reported but incidents reported such as "one 7-year old girl described" or "one 5-year old boy explained".

Sample: 40 interviews with parents; 23 interviews with children (aged 4-10) from middle-, upper-middle-, and upper class households. Informal talks with 15 teachers and administrators at several private schools.

Setting: Oklahoma, USA

Component of travel (if any): Social context of children as passengers' accompanied by parents, other adults, siblings and peers.

Mode of travel: Car-pool.

Outcomes: co-operation); the family: adult-child interaction; Friendships; Social skills: peer relationships, peer connectedness, socialising skills; Socio-moral understanding: sensitive and value laden topics; Self-concept & identity Social outcomes: Community relations (territoriality, clique formation,

Reported findings: Narrative results included: children derived status and authority from presence of own parents and use of their family's car; the setting offered parents an opportunity to engage in normative socialization; 'moderator' type adults interacted as regular participants in the automobile conversation; 'interventionist' type adults did not direct the conversation but responded to questions and enforced certain standards o limitations on their passengers; 'laissez faire' parents withdrew into their own thoughts; carpools often shared similar values and norms; when parental values were threatened carpools often dissolved; children often displayed friendship and cooperation across the normal boundaries of age and sex; cooperation was greater on way to rather than return from school; some children withdrew into solitary privacy; interactional dynamics varied with size of the group and there could be shifting cliques; some peer group influences on young previously sheltered children frightened parents; carpool unique in falling under combined influence of school, family, and peer group influences; conclusion that both the normative and interpretative models of socialization can coexist rather than compete.

Statement of results

Study used qualitative methods with only limited information on the sample.

Basile VC, Motta RW, Allison DB (1995) Antecedent exercise as a treatment for disruptive behavior: Testing hypothesized mechanisms of action. Behavioral on self concept mediated any exercise induced changes in rates of disruptive behaviour. 10(3): 119-140.

Kind of evidence: Article; longitudinal prospective; randomized controlled trial

Completeness of data : Original sample n=62; four participants dropped (aggression/ noncompliance/ refusal to participate, etc).
No data on social Interventions.

Aim of study: To evaluate the effects of antecedent physical exercise and a mastery task on behaviourally disturbed children's self concepts and rates of disruptive behaviour; whether changes class, ethnicity, response rate and non responder details

Sample: 62 – 4 = 58 children aged between 7 and 13 years with a behaviour disorder; 53 were male and 5 female.

Setting: Experimental 'laboratory' setting

Component of travel (if any): Exercise

Mode of travel: Walk

Outcomes: Self concept, disruptive behaviour

Reported findings: Physical exercise produced significantly less disruptive behaviour; the mastery exercise did not reduce disruptive behaviour; neither treatment effected self concept nor did self concept mediate changes in disruptive behaviour

Statement of results: Laboratory study so validity to natural environment unclear

Bickerstaff K, Shaw S (2000) An Evaluation of the Walking Bus at Pirehill School. The Centre for Alternative and Sustainable Transport, Staffordshire University. Report commissioned by the Staffordshire Walking Bus Partnership. CAST (Centre for Alternative and Sustainable Transport).

Aim of study: To undertake a qualitative and quantitative evaluation of a walking bus scheme.

Kind of evidence: Report; prospective longitudinal survey; pre and post implementation

Completeness of data: Response rate unclear and no data on non responders; drop out rate and details of drop outs not reported

Sample: 172 households sampled initially; 23 and 20 parents involved in pre and post measures respectively; child sample numbers unclear; child age 4-9 years; no data on sex, class, or ethnicity

Setting: Travel to school

Component of travel (if any)

Mode of travel: Walking bus with children accompanied by adults

Outcomes :

Cognitive: pedestrian skills, mental agility and alertness

Social: parental networks, family , friendships, social development, child independence, social exclusion, parental and child enjoyment

Mental health: bullying.

Reported findings: Parents believed that the walking bus had improved their children's road sense, social development and independence, awareness of the environment, and reduced the chance of being bullied on way to school. Parents believed that the walking bus would increase self concept, contact with friends and others and other aspects of social well being. Content analysis of children's drawings and child discussion groups indicated a greater awareness of their environment, ability to map progression of their journey, and greater social experience.

Statement of results: Few details on sample. Lack of independent outcome measures.

Bjoerklid P (1994) Children - traffic - environment. Architecture and Comportement/Architecture and Behaviour. 10(4): 399-405.

Aim of study: Ascertain how children and adults experience children's traffic environment and road safety

Kind of evidence: Article; developmental; cross sectional; one point of time; qualitative and quantitative

Completeness of data: No data on sex, social class, ethnicity, non response rate, non responder details and adult sample size.

Sample: 90 children aged 8,11 and 14 years, plus parents, teachers and national and regional officials

Setting: Not stated

Component of travel (if any): General "traffic".

Mode of travel: Traffic safety; environment; danger; rules; vision; exhaust and noise pollution

Outcomes: Anxiety of traffic environmental stress

Reported findings: Teachers concerned about danger of environment and that can not rely on children to behave safely, but that children need exposure to environments with traffic; parents torn between protecting children and their need to explore environment and to have stimulating experiences and to participate in activities which facilitate their development.; children anxious about pollution risk and limited freedom of mobility; teachers try to train children about dangers and to follow rules such as cycle helmet use.

Statement of results: Difficult to distinguish results and their interpretation.

Bolton RP (1974) The effects of increased racial desegregation through busing: Perceptions of the Metropolitan Nashville teachers and administrators. Dissertation Abstracts International. 34, (8-A, Pt 1).

Aim of study: To ascertain school staff's perceptions of the effects of busing policing to test assumption that complaints about the upheaval caused were due to resistances to racial desegregation

Kind of evidence: Conference abstract; cross sectional survey at one point in time

Completeness of data: Abstract provided unclear data on sample and no data on age, social class, response rate, or details of non responders

Sample: 234 teachers, 23 schools, number of administrators unclear

Setting: Travel to school

Component of travel (if any): Racial desegregation
Racial attitude and relationships

Mode of travel: Bus; passenger; desegregation

Outcomes : Coded under "Other context experiences" (Racial relationships between black and white students).

Reported findings: Black staff more positive than white staff; female staff more positive than male staff; all agreed that Public schools should be desegregated; whites wished for a return to neighborhood schools, blacks did not; all agreed that quality education had been improved for black children, but only blacks that that there had been improvement for all children; all except for male teachers thought that relations between the races had improved; schools which had less than 40% blacks were less positive about busing.

Statement of results: No control of extraneous variables that might explain reported statistical associations.

Craft DH (1983) Effect of prior exercise on cognitive performance tasks by hyperactive and normal young boys. *Perceptual and Motor Skills*.56(3): 979-982.

Aim of study: To investigate the effect of cycling exercise on cognitive performance.

Kind of evidence: Randomised controlled trial comparing exercise of different durations on subsequent cognitive performance.

Completeness of data : This was an RCT conducted with randomly selected participants, randomly allocated to different durations of exercise prior to the application of validated measures of cognitive performance. As such its negative findings are potentially valid.

Sample: 7-10 year old boys. 31 hyperactive boys and 31 'normal' boys.

Setting: 10 elementary schools in New York Metropolitan area.

Component of travel (if any): The physical exercise component of cycling.

Mode of travel

Outcomes : Cognitive: Intelligence (Wechsler Intelligence Scale for Children, Illinois Test of Psycholinguistic; Abilities, Visual Sequential Memory); pure/complex cognitive

Reported findings: Pedalling an exercise bicycle at 18-20 kph for 1, 5 and 10 minutes did not affect cognitive performance.

Statement of results: Duration of exercise may be short for children in terms of arousal and cognitive performance. Laboratory study so validity to natural environment unclear

Cromer BA, Tarnowski KJ, Stein AM, Harton P, Thornton DJ (1990) The school breakfast program and cognition in adolescents. Journal of Developmental and Behavioral Pediatrics.

Aim of study: To compare the effect of government supplied breakfast with a very low calorie meal on metabolism, cognition and mood.

Kind of evidence: Published report of a randomised controlled trial

Completeness of data: Sample number, age, sex, class and ethnic group reported.

Response rate reported, but non-respondents' details, drop out rate and details of drop outs not reported.

Sample: Of 91 eligible males and females (mean age 14), 34 took part (18 in the intervention group and 16 in the comparison group).

Setting: Clinical research centre

Component of travel (if any): Nutrition prior to classes

Mode of travel: N/A

Outcomes: Receptive vocabulary, auditory-verbal learning, matching familiar figures, sustained attention or vigilance, anxiety, metabolic measures

Reported findings: The authors reported no significant difference in cognitive performance or state of mood in young people fed government breakfast compared with low calorie meal.

Statement of results: A randomised controlled trial, so control of extraneous variables

Davis A, Jones L (1996b) Environmental constraints on health: listening to children's views. Health Education Journal. 55: 363-374.

Aim of study: To explore children's views about transport, health and local environmental issues and to understand how far, in their view, these issues are interconnected.

Kind of evidence: Published report of focus groups and a semi-structured questionnaire.

Completeness of data: Sample number, age, sex and class reported. Ethnicity, response rates, non-responders' details not reported.

Sample: 138 children aged 9-11 and 13-14.

Setting: Four school in working class areas of Birmingham

Component of travel (if any): Travelling unaccompanied

Mode of travel: Walking and cycling

Outcomes: Parental restrictions, youth crime/anti-social behaviour, anxiety (fear of traffic and strangers), boredom, cycling as theft, barriers to travel to school, perceptions of adults as lazy.

Reported findings: Traffic danger and 'stranger danger' worked together to raise children's fears and these were compounded by adult concerns and by the restrictions adults place on their children's independent mobility. Traffic played a key role in determining how children used their local areas, restricting their ability to cycle and walk safely and resulting in parental efforts to set limits on their range from home, if the children were allowed out at all after school. Children were aware of the health promotion messages that walking and cycling were 'healthy' and that being active was important. But the 9-11 year olds in particular, made it clear that they felt unable to act on these messages in everyday life.

Statement of results: Focus groups conducted with 138 participants. Generalisability of results?

Edwards KA, Johnston R (1977) Increasing greeting and farewell responses in high school students by a bus driver. 1: 9-18.

Aim of study: To examine greeting and farewell responses of high school students under reinforcement, priming and extinction conditions by a bus driver.

Kind of evidence: Published report of a non-randomised controlled trial

Completeness of data : Sample number unclear, age, sex, class and ethnic group not reported.

Response rate, non-respondents' details, drop out rate and drop out details not reported.

Sample: 41 observations, but number of students on buses varied.

Setting: School bus

Component of travel (if any): Social experience with adults

Mode of travel: School bus

Outcomes: Social skills, friendly relationships between bus driver and students, ride rated favourably, peers rated favourably.

Reported findings: The bus driver whose greeting and farewell behaviours were systematically planned affected friendly behaviours from students and, according to the students' ratings, made the bus ride more pleasant for more of those students.

Statement of results: No random allocation to the different conditions. Little data on the sample.

Fite JO (1980) A study of the effects of the availability of an automobile and employment upon the academic achievement and absentee rate of high school students. Dissertation Abstracts International. 41(5-A): 1860.

Aim of study: Ascertain the effects of the availability of an automobile and employment upon the academic achievement and absentee rate of high school students

Kind of evidence: Thesis; cross sectional survey at one point of time;

Completeness of data: No data on sex, social class, ethnicity, response rate, or details of non responders

Sample: 282 high school students

Setting: Car use by students

Component of travel (if any)
Mode of travel: Car

Outcomes : School achievement; absentee rate

Reported findings: Availability of a car did not significantly effect academic grade; car ownership, car maintenance and student employment all significantly negatively effected grade; car availability, ownership and employment did not effect absenteeism; car maintenance significantly negatively effected absenteeism

Statement of results: Abstract only available, so unclear what variables if any controlled. Many statistical tests so possibility of misinterpretation of random error.

Foreman N, Foreman D, Cummings, A, Owens S (1990) Locomotion, active choice, and spatial memory in children. *Journal of General Psychology*. 117(2): 215-33.

Aim of study: (i) To examine the role of active locomotion in spatial memory; (ii) To assess the relative importance of choice autonomy and pedestrian locomotion.

Kind of evidence : Article; randomized controlled study; developmental prospective longitudinal study

Completeness of data : No data on social class, drop outs rates or details of drop outs, and response data or details of non responders for study (ii).

Sample: (i) 43 children 4-6 years old; (ii) 32 children 4-5 years old. Mixed sex.

Setting: Corner of a large room

Component of travel (if any): Spatial experiences

Mode of travel: Walk and pushchair; passenger and pedestrian; child or other's choice; alone or accompanied

Outcomes: Memory, spatial relations, spatial encoding

Reported findings: Children who had neither independent locomotor experience nor autonomous choice performed badly on the search task compared to children who made free choice by walking or actively directed their own route from a pushchair or led on foot by the experimenter or

Statement of results: Experimental study so easier to make inference of causal effect

Foreman N, Gillett R, Jones S (1994) Choice autonomy and memory for spatial locations in six-year-old children. *British Journal of Psychology*. 85(Pt 1): 17-27.

Aim of study: To examine the differences between across and within trial spatial memory and the effects of freedom of choice of experience on learning

Kind of evidence: Article; prospective quantitative outcome evaluation (randomised controlled trial)

Completeness of Data: No data on social class, ethnicity, response rate, or on non respondents

Sample: 28 mixed sex 6 year olds

Setting: Not travel to school (Unfamiliar room)

Component of travel (if any)

Mode of travel : Walk, wheelchair; pedestrian, passenger; choice and no choice

Outcomes: Memory

Reported findings: Significant training effect on across trial memory for free choice groups whether walking or transported compared to no free choice groups.

Statement of results: Laboratory study so validity to natural environment unclear

Foster LE, Ellis MJ (1974) Strategies of children during performance of a self-paced activity. *Perceptual and Motor Skills*. 38(3, Pt 2): 1211-1217.

Aim of study: To determine whether children exhibit, or can acquire, regular strategies for self-pacing when cycling.

Kind of evidence: This published paper reported a longitudinal survey of boys' cycling behaviour on 4 occasions.

Completeness of data: Details recruitment (refused to participate etc.) not reported. Socio-demographic details not reported.

Sample: Six boys aged 9-10

Setting: Exercise cycle in a laboratory

Component of travel: Responsibility for self and physical exercise.

Mode of travel: Cycling

Outcomes: Pure/complex cognitive: self pacing of cycling behaviour.

Reported findings: Students clearly reduced the physiological stress of the ride on the second trial by increasing their total ride time.

Statement of results: Small sample (n=6). Laboratory study so validity to natural environment unclear

Herman JF, Kolker RG, Shaw ML (1982) Effects of motor activity on children's intentional and incidental memory for spatial locations. *Child Development*. 53(1): 239-44.

Aim of study: To examine the effects of motor involvement with an environment on memory in both intentional and incidental memory conditions.

Kind of evidence: Article, developmental longitudinal prospective study; quantitative

Completeness of data: No data on social class, ethnicity, response rate, or non responders, drop out rate, drop out details

Sample: 120 kindergarten and grade 3 children, mixed sex

Setting: Not travel to school (laboratory)

Component of travel (if any)

Mode of travel : Walk; passenger and pedestrian

Outcomes: Memory

Reported findings: Memory only increased for kindergarten age (not for grade 3) children and this was for both intentional and incidental memory

Statement of results: Experimental apparatus – specially constructed “model” town built in gym or school hall. Validity to natural environment unclear

Hofstetter CR, Hovell MF, Sallis JF (1990) Social learning correlates of exercise self-efficacy: early experiences with physical activity. Soc Sci Med. 31(10): 1169-76.

Aim of study: Ascertain if prior experiences with sport and exercise predict exercise self efficacy in adulthood

Kind of evidence: Article; survey; cross sectional; retrospective; quantitative

Completeness of data: No data on age, sex, social class, ethnicity; 43% response rate, no data on non responders

Sample: 2053; mixed gender; adults

Setting: Not specifically travel experiences

Component of travel (if any): Exercise

Mode of travel : Walk; experience of exercise

Outcomes : Self efficacy in adulthood

Reported findings: Early experiences reported to have no direct effect on self efficacy and only small indirect effects mediated by contemporary factors.

Statement of results: Study dependent on accuracy of recall of memories from childhood.

Howland J, Sargent J, Weitzman M, Mangione T, Ebert R, Mauceri M, Bond M (1989) Barriers to bicycle helmet use among children. Results of focus groups with fourth, fifth, and sixth graders. Am J Dis Child. 143(6): 741-744.

Aim of study: To ascertain social effects of bicycle helmet use as a barrier to helmet use

Kind of evidence: Article; developmental cross sectional study; qualitative; one point in time

Completeness of data: A convenience sample of three schools was selected. No details of why these 3 schools. Classroom teachers were asked to choose 10-15 bicycle-riding students (no details of method of selection and no mention of potential bias). Age reported but not other socio-demographic details.

Sample: 42 children and young people

Setting: Travel to school

Component of travel (if any)

Mode of travel: Bicycle, accompanied by peers, wearing helmets

Outcomes: How perceived socially

Reported findings: Children reported that they feared derision from wearing helmets yet respected those who did wear helmets

Qualifications / Methodological limitations: No reporting of social class, sex, ethnic group, convenience sample

Statement of results: Authors acknowledge their data not representative of larger population. In the focus groups reported, 12% of the participants owned helmets.

King R, Easthope G (1973) Social class and friendship choice in school. Research in Education. (9): 16-24.

Aim of study: Sociometric survey on social class and friendship including travel to school with best friend

Kind of evidence : Article; cross sectional survey at one point of time; quantitative

Completeness of data : No data on ethnicity, response rate, or details of non responders. Data on social class of friend , but not of respondent

Sample: 1646 year 2 secondary school students

Setting: Travel to school

Component of travel: Friendship

Mode of travel : All modes; accompanied by best friend

Outcomes: Friendships

Reported findings: Best friend: 81% also friend out of school, 55% lived nearby, 36% traveled together to school. So frequency of contact salient to friendship. Pupils tend to choose friends from those whom they come into contact with most frequently in school, and from those who share some of their salient characteristics, particularly sex and age, and to a lesser extent, school-work status. One social characteristic that does not appear to be an important criterion of friendship is social class.

Statement of results: Authors state problems with generalisability of data: "the study of one school leads only to knowledge of that one school; anything else is speculation".

Lee T, Rowe N (1994) Parents' and children's perceived risks of the journey to school. *Architecture and Comportement/Architecture and Behaviour*. 10(4): 379-389.

Aim of study: Examine (i) differences between mode of travel to school of 10-12 year olds and that taken by their parents, (ii) parental views of probability of risks to children travelling to school Vs. children's worries of risk Vs children's actual experiences.

Kind of evidence: Article; cross sectional survey; one point of time; quantitative

Completeness of data: No data on sex, social class, ethnicity, or details of non responders

Sample: 92 parent –child (10-12 year old) groups

Setting: Travel to school

Component of travel (if any)

Mode of travel: All modes; risks potentially encountered in travel to school

Outcomes: Anxiety about risks

Reported findings: No relationship between rank orderings of probability of risk by parents, worry of risk by children, and experience of risk by children. Bullying high on all 3 ranks. Major change in mode of travel to school between parents and children.

Statement of results: No mention of how (if) questionnaires were developed, tested and validated. Generalisability of results?

Lewis V, Dunbar G, Hill R (1998) Children's knowledge of danger, attentional skills and child/ parent communication: relationships with behaviour on the road - Road Safety research report no. 10. 2/14 Minster House: RS4 Publications.

Aim of study: Project had four aims:

- (i) to investigate empirically children's ability to perceive danger
- (ii) to explore empirically children's attentional skills
- (iii) to observe the behaviour of children and their interaction with adults in both real road settings and an artificial communication task
- (iv) to examine relationships between (i), (ii) and (iii) and the children's age, gender, road experience and their parent's educational level.

Kind of evidence: Report; cross-sectional study;
Although not key-worded, I would say study 'experimental'.

Completeness of data: Age, sex and class reported. Ethnicity and response rate NOT reported.

Sample: Sample=160; Age 4-10; mixed gender.

Setting: Travel to school and playing on street.

Component of travel (if any)

Mode of travel: Bicycle, bus, car, walk, passenger, driver, accompanied by other adult.

Outcomes: Cognitive: pure/complex cognitive.

Reported findings: *Study 1:* Awareness and salience of danger increases with age. If children are cued to danger, then regardless of age, they are able to identify certain situations as dangerous although the sensitivity with which they do increases with age. Children are cued to danger in either drawings or videos show greater awareness of danger with the other type of material two weeks or more later. No relationships found between awareness and understanding of danger and either gender or parental educational level. Children who walked to school or played regularly on the street showed awareness and understanding of danger earlier than children with less experience of traffic.

Study 2: Although performance increased with age, all age groups demonstrated some ability to identify danger in terms of some abstract feature of a situation rather than simply in terms of the presence of a concrete object. However, there was a suggestion that the younger children, compared to the older children, were more likely to base their judgement on the presence/absence of dangerous items than on whether the situation itself was dangerous or not. This was particularly evident in the road situations, which all ages found more difficult than the home or control situations. Girls identified more of the road dangers than the boys, and across all the conditions it was the girls with parents of higher educational level who identified most targets.

Study 3: Children's ability to identify the cause of an outcome increased with age and improvement across the ages was most marked in children with greater experience of traffic. Children in all ages were significantly worse at identifying the cause of traffic accidents than the cause of accidents in the home or outcomes which did not involve an accident.

Study 4: In this study of the relationship between road behaviour and knowledge of danger, the relationship between uncued sorting and recklessness approached significance in the video version of the sorting task. Thus, children who spontaneously used danger as a sorting criterion crossed the road more recklessly.

Study 5: When the child leads, older children and their parents perform better than younger children; when the parent leads, there is no linear age effect with other factors related to better performance; no relationship found between parental sensitivity to the child's momentary knowledge and joint behaviour in the road environment; relationship found between non task focused utterances and recklessness of the child.

Study 6: age development through school years in the ability to switch and attend to a change in the environment. Children who take less time to make their first response following a context switch are more likely to show awareness of traffic.

Study 7: Children who were more distracted were more reckless in their road crossing behaviour, even controlling for age, impulsivity and parental control. Children who became more reflective following a distracting event performed the road crossing more safely than when they were sent to post a letter on their own.

Statement of results: Laboratory – experimental. Authors have attempted to assess how well the results of these laboratory tasks generalize to direct observations of road behaviour.

McNaughten D, Gabbard C (1993) Physical exertion and immediate mental performance of sixth-grade children. *Percept Mot Skills*. 77(3 Pt 2): 1155-9.

Aim of study: Ascertain effect of varying durations of physical exertion at different times of day on mathematical performance.

Kind of evidence: Article; randomized controlled trial

Completeness of data: No data on social class, ethnicity, non responder details, drop out rate, drop out details

Sample: 120 child (6th grade) volunteers

Setting: Naturalistic setting experiment

Component of travel (if any): Exercise

Mode of travel : Walk

Outcomes: Mathematics test

Reported findings: Exercise significantly related to better mathematical performance; 30 and 40 minute duration exercise produced better math's results at 11.50 am and 2.20pm but not at 8.30am. The results support arousal theory not the inverted U hypothesis; no gender effects found.

Statement of results: Primary inclusion criterion was individual performance in arithmetic. Also, subjects walked around the perimeter of a regulation basketball court at a monitored moderate intensity. Generalisability of results?

Milazzo PA (1976) Busing and socio-economic class: Effects of enforced contact on several cultural orientations of children from distinct socio-economic classes. Dissertation Abstracts International. 36(12-A): 8341.

Aim of study: To explore effects of pupil busing to achieve socio-economic balance in socio-economic culture

Kind of evidence: Conference abstract; cross sectional survey at one point in time

Completeness of data: Abstract provides no data on sample size, response rate, or details of non responders

Sample: Not stated

Setting: Travel to school

Component of travel (if any): Social context

Mode of travel: Bus

Outcomes: Participation with peers, self image, 'present time' orientation

Reported findings: Change in subjective culture orientation away from middle class values to low income values particularly for middle and upper class black children; low income children in mixed groups participated less with peers, had lower self image and were more 'present time' orientated.

Statement of results: Survey with no control of extraneous variables

Morrell G, Atkinson D (1977) Effects of breakfast program on school performance and attendance of elementary school children. Education 98(2): 111-116.

Aim of study: To compare the effects of two breakfasts on elementary school children in terms of school measures

Kind of evidence: Published report of randomised controlled trial (Solomon four group design)

Completeness of data: Sample number, age, sex, class and ethnic group all reported. Response rate and non-respondents' details not reported. Drop out rate unclear

Sample : 52 children (34 females, 18 males) in elementary school, kindergarten to 6th grade, who qualify for federally funded free school breakfast.

Setting: School

Component of travel : Nutrition prior to lessons

Mode of travel: Not applicable. Mode of travel not mentioned.

Outcomes: On-task behaviour; Repetitive manual task; Teacher rating of adaptation to school; Attitude to school; Attendance at school. Cognitive: attention-span. Intelligence: sub-components of the Weschler Intelligence Scale for Children (WISC).

Reported findings: There was no difference in performance or school attendance

Statement of results: A randomised controlled trial so control of extraneous variables.

Morrongiello BA, Bradley MD (1997) Sibling power: influence of older siblings' persuasive appeals on younger siblings' judgements about risk taking behaviours. *Inj Prev.* 3(1): 23-8.

Aim of study: To study the influence of older siblings' persuasive appeals on young children's decisions about engaging in behaviours that could threaten their physical safety

Kind of evidence: Article; longitudinal prospective survey

Completeness of data: No data on social class, ethnicity, non response rate, drop out rate, and details of non responders and drop outs

Sample: 40 families with average age of 8.1 years for child and 11.3 years for older sibling

Setting: Participants' family home

Component of travel: Social context of decision making

Mode of travel: Bicycle; sibling relationship

Outcomes: Perceptions of risk

Reported findings: Younger children significantly changed their perceptions of risk of certain paths of travel in terms of being more and less risky in response to persuasion by older siblings. Type of persuasion as well as number of arguments used; boys and girls equally successful at persuasion though boys more likely to use arguments based on fun and girls to use arguments based on safety.

Statement of results: No control over experimenter effects; stated perceptions of risk rather than actual behaviour of children.

O'Brien JE (1982) School consolidation, school size, travel time, student self-concept, and student achievement and their relationship to student participation and student satisfaction. *Dissertation Abstracts International*. 42 (7-A): 2955-2956.

Aim of study: Not stated.

Kind of evidence: The abstract of a thesis reported a cross sectional survey of young people about their travel to school, participation and satisfaction.

Completeness of data : Only the dissertation abstract was available for review, therefore no judgements can be used on the validity of these findings.

Sample : Junior class students – no demographic details

Setting: 8 high schools in Vermont, USA

Component of travel: Time spent travelling.

Mode of travel: Not stated

Outcomes: Students' participation

Reported findings:The time a student spends travelling to and from school is an important influence on the overall participation and the non-school related participation of the students in the study. The school related participation of the students did not prove to be greatly affected by travel time. Perceived abilities or self-image the most significant factor related to participation.

Statement of results: Abstract only available.

Reid RA (1994) The journey to school: The young commuter. Dissertation Abstracts International Section A: Humanities and Social Sciences. 54(9-A): 3398.

Aim of study: To examine the relationship between transportation (busing) and various aspects of students' social & academic achievements.

Kind of evidence: This abstract of a thesis reported a cross-sectional survey of high school students about their travel to school.

Completeness of data: The abstract available for review contained insufficient detail to support a judgement about the validity of the findings.

Sample: Not specified.

Setting: High school in Newfoundland, Canada

Component of travel:

Mode of travel:

Bus travel compared with other modes of travel.

Outcomes: Cognitive: School/academic: 'achievement'; 'achieving honours'; Other: 'learning environment'; comfort of bus ride, access, length of school day.

Reported findings: A longer school day, an uncomfortable bus ride, an unfulfilled desire to have access to a community high school and an inability to participate in extra curricular activities were factors found to be associated with poor academic achievement.

Statement of results: Consequential survey data with no controls so difficult to assess direction of any causal effects in any.

Ressler WH, Toledo E (1997) A functional perspective on social marketing: insights from Israel's bicycle helmet campaign. *J Health Commun.* 2:145-56

Aim of study: To assess the extent that bicycle helmet wearing by children is an expressive (social, normative) function rather than due to utilitarian considerations of safety

Kind of evidence: Published article; cross sectional study

Completeness of data: No data on social class, ethnicity, non responder details, drop out rate, drop out details

Sample: 783 children (49 boys, 51 girls) aged 7 to 14 years from 27 different class rooms in a large central city, in four medium sized cities and two small towns.

Setting: Classroom

Component of travel: Helmet wearing

Mode of travel: Cycling

Outcomes: Projective measures evaluating helmet use; direct measures of helmet wearing, beliefs about helmet wearing, and number of persons they know who wear helmets

Results: Both those willing and unwilling to wear a helmet tended to describe helmet wearers as smart and safety conscious, but only helmet wearers tended to perceive this as fashionable. For those that thought everyone should wear a helmet, most would wear one themselves. Children who knew others who wore a helmet were more likely to wear one themselves and to recommend friends to do so and to believe that their friends would respond positively to them wearing a helmet. Experience of injury was not associated with willingness to wear a helmet, though those willing to wear a helmet were more likely to believe that helmets were important in preventing injury.

Statement of results: No controls, so difficult to assess direction of any causal effects.

Rivara FP, Booth CL, Bergman AB, Rogers LW, Weiss J (1991) Prevention of pedestrian injuries to children: effectiveness of a school training program. *Pediatrics*. 88(4): 770-5.

Aim of study: To evaluate the impact of a programme on pedestrian street crossing skills.

Kind of evidence: Article; longitudinal prospective outcome study (pre/post test)

Completeness of data: No data on numbers of children receiving the intervention and so response rate and drop out rate unclear and no details on non responders or drop outs.

Sample: Data reported on from 229 to 307 children, Kindergarten to Grade 4, mixed sex

Setting: Travel to school

Component of travel: Road safety skills

Mode of travel : Walk; pedestrian

Outcomes: Road safety and street crossing skills

Reported findings: Walking on side walk: no improvement after training; Stopping at curb: no improvement after training; Looking L-R-L before crossing: Significant improvement; Keep looking whilst crossing: Significant improvement

Statement of results: No control group, so other variables might account for changes over time

Sheehan DS (1978) Classroom climate in integrated language arts classrooms. Journal of Educational Research. 71(6): 349-354.

Aim of study: To ascertain predictors of classroom climate (including ethnic group and desegregation as in busing) on perceptions of classroom climate

Kind of evidence: Article, survey, cross sectional, quantitative; one point of time

Completeness of data: No data on response rate, no data on non responders

Sample: 84 teachers, 1568 children and young people

Setting: Travel to school

Component of travel (if any): N/A

Mode of travel

Bus, passenger, desegregation

Outcomes

Academic, classroom climate and cohesiveness and competitiveness, friction and dissatisfaction and difficulty

Reported findings

No significant effects reported for desegregation status

Statement of results: Survey data so difficult to assess direction of any causal effects

Simenova G (1980) A study of the effect of traffic noise at 60 dB(A) equivalent level on certain mental working capacity indicators in various age groups. *Folia Medica (Plovdiv)* 16: 24-29.

Aim of study: To study the influence exerted by traffic noise on mental work capacity among children.

Kind of evidence: Published report of a pre and post text

Completeness of data: Sample number and age reported. Sex, class and ethnic group not reported. Response rate, non-respondents' details, drop out rate and drop out details not reported.

Sample: 217 children aged 8-11

Setting: Laboratory

Component of travel: Traffic noise.

Mode of travel

Outcomes:

Reflex reaction latent time

Concentration and distraction of attention

Volume of visual information processing

Pulse rate

Visual-motor coordination of hand movements

Reported findings: 30 minutes exposure to traffic noise of 60 dB(A) lead to working capacity impairment among children. Younger children (8-9) were more sensitive to noise exposure.

Statement of results: No control group to control the effects of extraneous variables

Solstad KJ (1975) Pupils' views on school transportation. Scandinavian Journal of Educational Research. 19(2): 27-43.

Aim of study: Whether a school organization that forces children to travel long distances to and from school is contradictory to the aim of making school life enjoyable.

Kind of evidence: Article; cross sectional survey at one point in time

Completeness of data: Sample size not specific; no data on social class, ethnicity, drop out rate, or details of drop outs.

Sample: Approximately 1900 children grade 9; mixed sex

Setting: Travel to school

Component of travel: Children's experience of travel to school

Mode of travel: Bus, train, boat

Outcomes: Tired, fed up, bored, dread going to school, happiness, enjoyment; perception of academic achievement; physical discomfort.

Reported findings: Physical discomfort and feeling unwell reported by up to 12%; pupils with longer journeys felt worse apart from feeling cold; no clear findings for type of travel and discomfort; most pupils who had long journeys were negative about the journey; pupils travelling by school bus more positive about transport than those travelling by public transport; those travelling with friends more positive than those not; pupils experiencing discomfort less positive about journey; pupils do not become more favourable to the transport over time; longer journeys less favourable due to greater discomfort, loss of time and a further factor.

Statement of results: Little control of variables so statistical associations could be due to other factors.

Stapp WB, Cox DA, Zeph PT, Zimbelman KS (1983) The development, implementation, and evaluation of a transportation curriculum module for middle school-aged youth: International environmental education. *Journal of Environmental Education*. 14: 3-12.

Aim of study: The development, implementation, and evaluation of a transportation curriculum module for middle school-aged youth.

Kind of evidence: Longitudinal study; outcome evaluation-other design.

Completeness of data: Response rate not reported.

Sample: Sample n=100. Gender discussed but no reported fully. Age = 6^h grade and 7th grade (US).

Setting: Curriculum programme

Component of travel (if any)

Mode of travel: Bicycle, bus, car, motorcycle, walk.
Social context: driver, passenger, pedestrian.

“Other” context experiences: transportation awareness, environmental education; transportation problems in the community + related to youth.

Outcomes

Cognitive: (school/academic) = knowledge; (pure/complex cognitive) = skills development; (other cognitive) = critical thinking, problem solving.

Social: (other social) “social change”

Other: (other outcome) “Values”.

Reported findings: A pre/posttest instrument was used to determine if any shifts occurred in the learners’ attitudes, values, and skills. Results of the test instruments indicated a statistically significant shift in the experimental group in learner attitudes, values and skills.

Statement of results: School system was selected because of its interest in global education which might favour certain results. Generalisability of results to UK school-children?

Thomson JA, Whelan KM (1996) A community approach to road safety education using practical training methods: the Drumchapel Project. Road Safety Research Report No.3. Crown Copyright.

Aim of study: The aims of the project were:

- (1) To teach three pedestrian skills to 5-7 year old children, using practical training methods.
- (2) To arrange for training to be undertaken by local volunteers, recruited and trained by project staff.
- (3) To evaluate the effectiveness of the programme by assessing the extent to which it led to improvements in children's traffic judgements and behaviour.
- (4) To monitor the problems encountered in running such schemes and to consider the feasibility of introducing them on a wider scale.

Kind of evidence: Published report; Longitudinal study; Outcome evaluation with control group – other design

Completeness of data: Response rate reported: 88% of target population.

Sample: Slightly more than 750 children received training during the lifetime of the project; age 5-7 years; mixed gender.

Setting: Travel to school.

Component of travel (if any)

Mode of travel: Walk – pedestrian.

Other context experiences: "Pedestrian skill training".

Outcomes: Cognitive (Pure complex cognitive) "Traffic judgements" and "behaviour"

Reported findings: Substantial improvement in trained children compared to controls in choice of safe location to cross road, strategy for crossing by parked cars, and ability to deal with a range of intersections. Improvements maintained at 2 months post test. These results from local volunteers comparable to results from highly qualified staff

Statement of results: Nature of control group critical when many possible experimenter effects.

Tolmie AK, Thomson JA, Foot HC, McLaren B, Whelan KM (1998)
Problems of Attention and Visual Search in the Context of Child Pedestrian Behaviour.

020 Study 1 / 2. Relationship between child's age and understanding of needed features for safe road crossing.

020 Study 3. Effect of skills training on roadside tasks.

Aim of study

Overall aims of project:

- (1) To explore children's attunement to and understanding of traffic-relevant information and how this varies as a function of age.
- (2) To investigate the effects of increasing complexity; introducing distractors; and limiting the time available for processing.
- (3) To determine the extent to which children's performance on computer and video simulations of traffic environments mirrors their performance at the roadside.
- (4) To assess the extent to which intervention might be capable of promoting better and more stable search strategies and to examine whether these might lead to improved road crossing decisions.
- (5) To determine what type of intervention technique is most likely to be effective and, in particular, to assess the relative efficacy of peer collaboration versus adult-led interventions in promoting development.

Kind of evidence:

Study 1 / 2. developmental study; survey; longitudinal study.

Study 3. Longitudinal; outcome evaluation RCT.

Completeness of data:Both studies – response rates not reported.

Sample : Study 1: Five age groups of children adults, sample size not specified. Study 2: n= 90 mixed gender; children, young people and adults. Study 3: n=50 mixed gender; children (0-10).

Setting: Laboratory (experimental)

Component of travel:

Study 1 / 2: Walk/pedestrian

Study 3: Walk/pedestrian. Other context experiences skill training on safety.

Mode of travel : Walk/pedestrian (both studies)

Outcomes:

Study 1 / 2: Cognitive (pure/complex cognitive) "Perception of features relevant to crossing road safely".

Study 3: Cognitive (pure/complex cognitive) Road crossing safety skills

Reported findings:

Study 1:Marked age trends in what children attend to when viewing road crossing scenarios; when the task is not explicitly defined as road crossing, children shown no particular tuning to traffic relevant information; when there is a road crossing focus, older children centre increasingly on traffic relevant features and ignore non relevant information; younger children (5-7 years) find it difficult to distinguish traffic and non traffic information; all age groups similarly affected by increasing complexity and distraction which suggests

younger children's problems are in knowing what to attend to rather than processing of information.

Study 2: Marked age trends in children's attention to relevant versus irrelevant features; Older children give higher priority to relevant features; all age groups similarly affected by increased complexity and distractors; decreasing viewing time decreased the number of total features extracted but increased the proportion that were relevant; the results of the roadside task matched those of the video task so younger children performed no better in a realistic context.

Study 3: Adult guidance had clear benefits on identification and perceived relevance of features relevant to road crossing (compared to peer discussion and simple exposure) and this was attributable to adults drawing children's attention to key features and their significance; the improvements led to better performance at the roadside; benefits may have been limited by lack of integration of children's increased attention and understanding

Statement of results: The three studies contain different methodologies raising different issues of interpretation.

van Schagen IN, Brookhuis KA (1994) Training young cyclists to cope with dynamic traffic situations. *Accid Anal Prev.* 26: 223-30.

Aim of study: To compare two different training strategies for cyclists coping with traffic: (a) modeling, in which children watch, copy, and receive feedback; and (b) theoretical instruction prior to practice.

Kind of evidence: Randomised controlled trial

Completeness of data: Sample rate and age reported, but not social class or ethnicity. Response rate, non-respondents details, drop out rate and details of drop outs not reported.

Sample: Sample n+49 children, aged 8-9

Setting: Grade 5 in Swedish primary school

Component of travel :Experience of traffic

Mode of travel: Cycling

Outcomes : Knowledge of traffic priority rules, cycling behaviour in relation to other traffic

Reported findings: Theoretical lessons led to an improvement in knowledge of priority rules, but the added value of theoretical lessons is temporary. Both types of training had an equally positive effect on the performance of the basic behavioural strategy in traffic. After one month, there were no signs of deterioration in the performance. Neither of the two training approaches was successful in improving the priority decisions of the young cyclists.

Statement of results: This was a small study of only 49 children and the baseline measurements of the three groups differed.

Whitebread D, Neilson K (1998) Cognitive and metacognitive processes underlying the development of children's pedestrian skills. Road Safety Research Report No. 6. Department of the Environment, Transport and the Regions.

Aim of study: To assess the extent to which children aged 4-11 have developed fundamental pedestrian skills; individual differences in the development of these skills; the experiences, skills, and understanding associated with such individual differences

Kind of evidence

Developmental; survey; cross-sectional.

Completeness of data: Response rate not reported.

Sample: 10 adults; 180 children; mixed gender; children and young people and adults.

Setting: Travel to school

Component of travel: Pedestrian

Mode of travel: Pedestrian

Other context experiences "Pedestrian ability"

Outcomes :

Cognitive – school attainment – "Academic attainment"

Pure/complex cognitive: "Metacognition", "Impulsivity/reflectivity", "attention", "Awareness", "Control", "Visual search skills".

Reported findings: High variation in pedestrian skills with considerable overlap in skills both across and within age groups; improved skills related to patterns of behaviour of frequency and pattern of looking, frequency and sophistication in last minute checking procedures, speed of making crossing judgements; results suggest that: some minimal exposure to traffic is necessary but not sufficient and some unsupervised exposure in younger children can be negative; exposure to training and levels of academic achievement not relevant; being aware and in control of own cognitive strategies and visual search skills both significantly related to effective implementation of strategies; children with an impulsive cognitive style less effective in implementing strategies particularly for 4-8 year olds.

Statement of results: No controls, so direction of causal effects difficult to ascertain.

Yokoo Y, Mitani Y (1982) The effects of chronic exposure to train noise on the mental efficiency of elementary school children (report 2). Nippon Eiseigaku Zasshi. 37: 753-761.

Aim of study:

The effects of intermittent exposure to Shinkansen (New Super Limited Line) noise on mental efficiency were observed.

Kind of evidence: Cross-sectional experimental design.

Completeness of data

Abstract only available in English; full report on Japanese.

Sample [number, gender, age]

Sample n=275 ten to eleven year old children.

Setting: Schools

Component of travel: (if any) Train noise

Mode of travel: Context: one school accustomed to noise and one school not accustomed to noise

Outcomes:

Numerical value discrimination and addition problem were visually displayed.

Reported findings: Results indicate that a pattern of reduced mental efficiency occurs when there is intermittent noise after there has been chronic exposure to noise.

Statement of results: Methods section and data analysis in Japanese

Yoshida S (1996) Behavioral Consistency when Parents Drive Their Children to Preschool. *Kyoiku Shinrigaku Kenkyo/The Japanese Journal of Psychology*. 5: 382-389.

Aim of study: How drivers signal, park, escort their children across a street to a preschool, and depart was videotaped unobtrusively for 39 days, to test for consistency of driver behaviour and children's crossing behaviour.

Kind of evidence :Experimental

Completeness of data

Sample :Data were analysed for 17 pairs of drivers and children, observed more than ten times under identical conditions.
Preschool.

Setting: Preschool

Component of travel (if any)

Being driven to school.

Mode of travel [mode, social context, choice]

Behaviour surrounding driving/being driven to school.

Outcomes :Behaviour; behavioural consistency, "schemas".

Reported findings: A variety of individual differences and inter-behavioural differences in consistency were detected, and in general drivers were more consistent than children

Statement of results: Main text in Japanese

APPENDIX 10 DETAILED MAP OF INCLUDED STUDIES: MODE OR COMPONENT OF TRAVEL BY COUNTRY, OUTCOME AND TYPE OF STUDY

Report	Mode of travel/ components of experience	Country	Outcomes				Type of study
			Social	Cognitive	Mental health	Other	
<i>(1) Mode of travel to school (e.g. walking, cycling, car, bus, train, motorcycle), where both 'mode of travel' and 'to school' is explicit.</i>							
Adler and Adler (1984)	Car; with parents, siblings and peers (car-pooling)	USA	Community relationships, family relationships, identity, friendship, social skills, socio-moral understanding				Longitudinal survey
Bickerstaff and Shaw (2000)	Walking/ car, alone and accompanied to school	England	Community relationships (parental networks), family relationships, friendships, social skills, (child independence, social exclusion)		Youth crime (bullying), other (mothers' enjoyment, children's enjoyment)	Distance, health and exercise, safety/ road sense, environmental issues, time and convenience, school management.	Longitudinal study
Bolton (1974)	Bus (desegregation)	USA	Community relationships				Cross sectional survey
King and Easthope (1973)	With friends	England	friendship				Cross-sectional survey

Lewis <i>et al.</i> (1998)	Walking/ cycling/ bus/ car to school	England		Complex cognitive skills			Cross sectional survey
Milazzo (1976)	Bus	USA	Community relationships				Cross sectional survey
O'Brien (1982)	Travel time to school	USA			(satisfaction)	participation	Cross sectional survey
Reid (1994)	Bus	Canada	('drop out rate'; 'ability to participate in extra curricular activities')	Academic (achievement, 'learning environment')		Comfort of bus ride, access, length of school day	Cross sectional survey
Sheehan (1978)	Bus	USA	Other (classroom climate, competitiveness, cohesiveness)	Academic (achievement) .	Other (friction, dissatisfaction, difficulty)		Cross sectional survey
Solstad (1975)	Bus, train, boat	Norway			Stress (tired, fed up, bored, dread going) other (perception of academic achievement, enjoyment, physical discomfort)	Physical discomfort	Cross sectional survey
Thompson and Whelan (1997)	walking	Scotland		Complex cognitive skills (traffic judgement and behaviour)			Longitudinal study

Whitebread and Neilson (1998)	Walking, pedestrian ability	England		Academic, Complex cognitive skills (metacognition, impulsivity/reflectivity, attention, awareness, control, visual search skills)			Cross sectional survey
Yoshida (1996)	Car/ walking; with parents	Japan		Complex cognitive skills (children's crossing behaviour)			Longitudinal survey
(2) Children or young people i.e. under age 18 AND mode of travel <i>suitable</i> for travel to school (as in 1 above) and CMHCSD(inclusion criteria 2 minus 2 studies) states.							
Fite (1980)	Car, driving	USA		Academic (achievement)		Absentee rate	Cross sectional survey
Rivara <i>et al.</i> (1991)	Walking – skills training	USA		Complex cognitive skills (street crossing skills)			Pre and post test
Stapp <i>et al.</i> (1983)	Bicycle, bus, car, motorcycle, walk	USA	Other (social change)	Academic (knowledge); complex cognitive skills (skill development) other (thinking, problem solving)		'values'	Pre-and post test outcome evaluation

Tolmie <i>et al.</i> (study 1) (1998)	walking	Scotland		Complex cognitive skills (perception of features relevant to crossing road)			Longitudinal study
Tolmie <i>et al.</i> (study 2) (1998)	walking			Complex cognitive skills (road crossing skills)			Randomised controlled trial
(3a) Physical activity component of travel							
Basile <i>et al.</i> (1995)	walking	USA	Self-concept and identify		(Disruptive behaviour)		Longitudinal study
Craft (1983)	cycling	USA		Intelligence, pure/complex cognitive			Longitudinal study
Foster and Ellis (1974)	cycling	USA		Complex cognitive (pacing of cycling behaviour)			Longitudinal study
Hofstetter <i>et al.</i> (1990)	walking	USA	Self-concept and identity (self efficacy in adulthood)				Cross sectional survey
Van Schagen and Brookhuis (1994)	cycling	Netherlands		Academic, complex cognitive (priority decisions, behaviour elements) other (knowledge of traffic priority)			Longitudinal study

(3b) Environmental risk and stress component							
Bjoerklid (1994)	Traffic safety/ traffic environment, danger, vision, noise and exhaust	Sweden		Anxiety			Cross sectional survey
Davis and Jones (1996b)	Cycling, walking	England	The family (parental restriction), self-concept and identity (image, peer group pressure)		Anxiety (fear of traffic, fear of strangers, boredom)	Barriers to travel to school. Perception of adults as lazy	Cross sectional survey
Lee and Rowe (1994)	Cycling, bus, car, walking	Scotland			anxiety		Cross sectional survey
McNaughten and Gabbard (1993)	walking	USA		Academic			Longitudinal study
Simeonova (1980)	Traffic noise	Bulgaria		Complex cognitive (concentration and distraction of attention, mental working capacity, latent time, volume of visual information processing, visual-motor coordination of hand movements)		Pulse rate	Longitudinal survey

Yokoo and Mitani (1982)	Noise of trains and traffic	Japan		Cognitive (mental efficiency, numerical value discrimination, addition problem)			Cross sectional survey
(3c) Dietary component of travel							
Cromer <i>et al.</i> (1990)	Breakfast programme	USA		Intellegnce, complex cognitive (attentional vigilance)	Anxiety	(impulsivity, anthropometric measures, metabolic measures)	Longitudinal study
Morrell and Atkinson (1977)	Breakfast programme	USA		Intellegnce, complex cognitive skills (task perseverance/ attention span) other (on task behaviour, teacher rating scale of positive adaptation)		Attendance, attitude to school	Randomised controlled trial
(3d) Social component of travel							
Morrongiello and Bradley (1997)	Cycling and sibling relationships	Canada		Other (decision making)		Risk perception	Longitudinal study

(3e) Other adults - Social component of travel							
Edwards and Johnston (1977)	Bus, 'greetings and farewells'	USA	Social skills				Longitudinal study
(3f) Cognitive experience component of travel							
Foreman <i>et al.</i> (1994)	Walking, wheelchair	England		Complex cognitive (memory)			Randomised controlled trial
Foreman <i>et al.</i> (1990)	pushchair			Complex cognitive (memory, spatial relations, spatial encoding)			Longitudinal study
Herman <i>et al.</i> (1982)	walking	USA		Complex cognitive (memory)			Longitudinal study
(3h) Peers - Social component of travel							
Howland <i>et al.</i> (1989)	Cycling – wearing a cycle helmet	USA	Self concept and identity				Cross sectional survey
Ressler and Toledo (1997)	Cycling – wearing a cycle helmet	Israel	Self concept and identity (social acceptability and appearance)			'fashionable'	Cross sectional survey

