ROAD ACCIDENTS AND CHILDREN LIVING IN DISADVANTAGED AREAS:

A LITERATURE REVIEW

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EXECUTIVE SUMMARY

1. During 1997 there were 3,795 child casualties (aged 0-15 years) resulting from road accidents in Scotland, and of these 1,892 were child pedestrian casualties accounting for 46% of pedestrian casualties of all ages.

2. Child pedestrian casualty rates in Scotland were significantly higher than those in England and Wales, 53% higher for fatal and serious casualties.

3. Previous research has been undertaken to identify socio-economic and behavioural factors affecting children’s accident rates, including pedestrian activity. Many of the studies have focused on urban areas in Great Britain, although a significant amount of research has also been undertaken in other developed countries.

4. Some studies have demonstrated the higher incidence of child pedestrian accidents in deprived or disadvantaged areas. The Scottish Executive commissioned a detailed review of the research literature in order to explore reasons for this and to make recommendations for further research.

5. The main findings from the Literature Review are set out below. While the focus of the review has been children living in disadvantaged areas, it is difficult to separate the circumstances of the individual from the influences of the location in which they live. There are, however, certain conclusions that can be drawn from the literature reviewed which suggest why casualty rates amongst residents from areas classified as relatively deprived are significantly higher than those from relatively affluent areas.

- The risk of death for child pedestrians is highly class related.
- The decline in child death rates from injury over time has been less for children in the manual social classes than for children in the non-manual social classes and, as a consequence, the socio-economic mortality differentials have increased.
- Injuries to children from socio-economically disadvantaged families tend to be of greater severity. In addition, these children have a higher risk of physical injury in the first place.
- Children of single mothers have the highest death rates of all social groups and have injury rates twice those of children from 2-parent families. The risk of pedestrian injury is over 50% higher for the children of single mothers.
- Significant differences in child pedestrian injury rates based on ethnicity have been identified, particularly for younger ‘non-white’ children.
- Aggressive behaviour and overactivity of some children have been found to be associated with high accidental injury rates.
• Young teenagers are very knowledgeable about the locations, times and causes of pedestrian accidents. However, young children up to about 9 years old do not have the ability to recognise such locations as dangerous.

• The incidence of accidents involving children and vehicles moving at slow-speed while not on public roads may be significant in Scotland.

• On journeys to and from school deprived children are exposed to greater risk than more affluent children as they are less likely to travel to school by car or to be accompanied by an adult.

• The review concludes that, given the uncertainty of the effectiveness of educational initiatives in the child pedestrian field, emphasis has to be placed on driver education and behaviour such as the reduction in fatality figures associated with reduced driving speeds.

6. The review identified several new areas of research involving children in disadvantaged areas in Scotland that need to be considered in the future: -

• There is a need to further investigate different levels of exposure experienced by different road user groups. One such approach relates to that of the ‘innocent victim’ as defined by Haight (1973). Until more work is undertaken on exposure to accidents many of the conclusions from the other studies will remain speculative. Of particular interest would be a study of different socio-economic groups' accident exposure rates.

• There appears to be a major gap in the literature relating to a comparison of urban and rural risk factors for road traffic accidents. This is key to any further work on social in/exclusion. In particular, a study of different exposure rates and travel patterns is required. Also studies of the behavioural and travel patterns of children in urban compared to rural communities should be carried out.

• There is a need for more work on an individual’s comparative road traffic accident risk. Groups that might be investigated include children from lone parent families, children of certain ethnic backgrounds, children with perceptuo-motor deficiencies and also those children with restricted mobility. Principle in this comparative work should be the effect of social in/exclusion. Linked to this should be a study of the effects of different family and community support infrastructures.

• Existing research methodologies require to be updated to take account of changes in the environment/economy/social areas etc. to identify changes in traffic accident rates over time. Of particular interest would be a statistical/economic investigation on “closure trends” as targets are attempted.

• There is a need for further research into possible mechanisms for changing the attitudes of different groups of road users, relating to the issues of mobility, access and safety.
CHAPTER ONE  INTRODUCTION

1.1 The Government is committed to promoting social inclusion and equality of opportunity in Scotland. Part of this commitment is that every child, whatever his or her social or economic background, has the best possible start in life. Social exclusion can seriously undermine this aim through a combination of linked problems relating to unemployment levels, low incomes, poor housing, high crime environments, bad health and family breakdown. These problems can manifest themselves in the area of traffic accident rates to children and it is the purpose of this report to investigate such problems within the context of road accidents and children living in disadvantaged areas.

1.2 This report highlights the incidence of child road accident casualties in Scotland and investigates the underlying risk factors for children living in disadvantaged areas. A number of factors have been investigated such as the environment and physical features associated with child road traffic accidents, medical and health issues, the effects of social exclusion on the educational process, and psychological behaviour.

1.3 As well as providing the relevant traffic accident statistics, a comprehensive review of the existing literature in the above fields has been undertaken. Having summarised the findings of recent research a number of recommendations are made on suitable areas of further research with the emphasis on the issues of social exclusion.

1.4 In Chapter 2 a background to the review is given, including information on traffic accident figures and accident casualties for Scotland relative to other European and developed countries. Provided in Chapter 3 is information on the links between socio-economic factors and related areas including healthcare, education, the family, cultural aspects, the physical environment and geographic location. In Chapter 4 children’s perceptions of traffic risk and the formal training of children to be more aware of traffic risks are discussed. Chapter 5 investigated the risk factors of journeys associated with travel to and from school. Finally, in Chapter 6, summary findings are presented together with a review of the literature. Suggestions are made of suitable areas for further research.
CHAPTER TWO  BACKGROUND

2.1  In this chapter background data on the incidence of child traffic casualty rates in Scotland, and how these figures are related to other developed countries, is provided. Child pedestrian casualty figures are given together with a brief summary of the risk factors associated with child pedestrian casualty rates.

2.2  During 1997 there were 3,795 child casualties\(^1\) of road accidents in Scotland representing 17% of all casualties. Of the child casualties, 1,892 were pedestrians of which 15 died and 489 were seriously injured. The child pedestrian casualties made up 46% of all pedestrian casualties.

2.3  In Scotland child casualty rates (per head of population) increase with age (see Figure 2.1 below); the pedestrian casualty rate for younger children (0-4 years) was approximately a third of those for 5-15 year olds. Child pedestrian casualty rates in 1997 for fatal and serious injuries (combined) and for all severities were more than double the corresponding rates for pedestrian casualties of all ages. Child pedestrian casualty rates in Scotland were higher than those for England and Wales: 28% higher (fatalities), 53% higher for fatal and serious combined and 20% higher for all severities.

Figure 2.1  Pedestrian Casualty Rates in Scotland

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\(^1\) For the purpose of this report 'child casualty' will be taken to represent an individual under sixteen years of age. Of the 3,795 child casualties, 618 were aged 0-4 years, 1,866 were aged 5-11 years and 1,311 were aged 12-15 years.
2.4 In 1996, Scotland’s overall road death rate for all ages of 7.0 per 100,000 population was the fourth lowest of 26 comparison countries and was approximately 59% of the EC average (see Figure 2.2).

Figure 2.2 Fatality Rates For All Road Users


2.5 However, the pedestrian fatality rate for Scotland was 2.1 per 100,000 population which was worse than the EC average of 1.9 per 100,000 population (see Figure 2.3 below). Scotland ranked 15\textsuperscript{th} of the 26 countries surveyed for pedestrian casualties (The Scottish Office, 1998).


(1) Source: International Road Traffic and Accident Database (OECD). For Hungary, data are from Statistics of Road Traffic Accidents in Europe’ (UN/ECE).

(2) In accordance with the commonly agreed international definition, most countries define a fatality as being due to a road accident if death occurs within 30 days of the accident. The official road accident statistics of some countries however, limit the fatalities to those occurring within shorter periods after the accident. Numbers of deaths and death rates in the above table have been adjusted according to the factors used by the Economic Commission for Europe and the European Conference of Ministers of Transport to represent standardised 30-day deaths: Italy (7 days) +8%; France (6 days) +5.7%; Greece (3 days) +15%; Portugal (1 day) +30%.

(3) 1995 data

(4) All motor vehicles other than mopeds per 1,000

(5) Road deaths (except moped users) per 10,000 motor vehicles (except mopeds).

(6) EC figures excludes mopeds, and moped user deaths for those countries indicated by footnotes 4 & 5.

(7) 1994 data

(8) 1993 data
2.6 The problem of child pedestrian road traffic accidents is multifaceted (Christie, 1995a). There are a number of different factors that are associated with the accident involvement of child pedestrians, some of which are highly related to socio-economic groupings. The demographic, social and economic factors that are most important in explaining child accident involvement include age, sex and physical capability of the child. In addition, their parents or adult carers marital status, their ethnic origin, their risk and responsibility scores and the number of children their parent or adult carer has to care for are also significant factors. Exposure in terms of street play, level of adult accompaniment on a school journey and extent of extra-mural activity are also important.
CHAPTER THREE  FACTORS ASSOCIATED WITH ROAD ACCIDENTS AND DISADVANTAGED AREAS

3.1 A number of areas were investigated which linked factors associated with traffic accident rates and those associated with children living in deprived households or from disadvantaged areas. It is important to distinguish between deprived households and disadvantaged areas in connection with the research reviewed. Deprived households may be located within disadvantaged areas, but this is not necessarily so. Similarly, disadvantaged areas are not necessarily composed entirely from deprived households. While research has indicated that injury rates for child pedestrians are higher for those living in disadvantaged areas, much of this increased risk can be explained by factors affecting the individual.

3.2 The research reviewed in this section covers behavioural and socio-economic factors relating to traffic accident risk, particularly for young people. The research has also identified relationships between social disadvantage and ill health, education problems, the dangers of the physical environment, family breakdown and behavioural problems. The relationships between these issues and accident rates for children are highlighted.

3.3 Research has addressed a number of areas in an attempt to determine the reasons why individuals, who are socially disadvantaged, are likely to experience higher accident rates. Regardless of whether research is concerned with deprived households or disadvantaged areas, road traffic accident rates are higher, particularly for children. Reasons why this is the case have suggested that children living in deprived households are at greater risk due to higher exposure rates as pedestrians, through less adult supervision in the traffic environment, and the fact that children are educationally disadvantaged with respect to understanding the issues of road safety.

3.4 Studies have also examined effects relating to the physical environment and geographic locations associated with disadvantaged areas. The number and positioning of roads, play-areas and schools within areas have been found to influence traffic accident rates. Traffic volumes, alternative transport modes, and driver behaviour may not be consistent across affluent and deprived areas, therefore explaining variation in accident rates. It is difficult, however, to separate household and area effects when attempting to determine why those who are disadvantaged are exposed to greater risk on Scotland’s roads.

SOCIO-ECONOMIC FACTORS FOR ALL INJURIES

3.5 This section reviews research covering the factors affecting all injuries including traffic injuries to child pedestrians. In the first instance, the influences of factors affecting the individual or the particular household in which they live are explored. Later in this section the impact of geographic area in terms of social disadvantage is explored.

Individual and Household Effects
3.6 There are differences between social characteristics at an individual basis and at the area level. Findings from the following studies indicate that both deprived households and disadvantaged areas give rise to increased accident risk for all injuries, although not necessarily to the same extent.

3.7 Roberts and Power (1996) examined whether the decline in child injury death rates between 1981 and 1991 varied by social class. Anonymised records of all child injury deaths were obtained from the Office of Population Censuses and Surveys. Death rates for children aged 0-15 years in England and Wales, from injury and poisoning, have fallen for all social classes (see Figure 3.1 below). The decline for children in Social Classes IV and V (21% and 2% respectively) is smaller than that for those in Social Classes I and II (32% and 37%). As a result of the differential decline in injury death rates, socio-economic mortality differentials have increased.

Figure 3.1 Mortality From Injury And Poisoning

Source: Roberts and Power (1996)

3.8 Between 1979-83 the injury death rate for children in Social Class V was 3.5 times that of children in Social Class I. For the 1989-92 period the injury death rate of children in Social Class V was 5 times that of children in Social Class I.

3.9 Alwash and McCarthy (1988) constructed a child injury severity scale with definitions of 3 levels of severity for 6 types of accident and tested its reliability. A sample of 402 young children attending the accident department of a west London hospital during one year was investigated. This study identified the ethnicity of the subjects that may introduce bias, as might the urban location when compared to all accident victims (see ACCIDENT RISK AND CULTURAL FACTORS below). A clear trend of greater severity of injuries to children of working class parents was found, therefore not only do children from socio-economically disadvantaged families have a higher risk of physical injury but also the injuries they experience are more severe.
3.10 A total of 42 empirical studies were reviewed by Laflamme et al, (1998) dealing with the determinants and characteristics of injuries to school pupils. Certain studies were concerned with measuring the effects of a number of socio-economic and family-related injury variables (Petridou et al, 1994; Bergstrom and Bjornstig, 1991). They revealed that a low level of parental education (on the part of the father), family disruption (single parenthood) and poor performance at school (on the part of the child) are strong correlates of school-injury experience. Results showed that having sustained a previous injury requiring medical attention is a significant positive predictor of a subsequent injury. Other variables studied (family size, birth order, height, and body-mass index) did not significantly predict injury-event occurrence. Social problems, chronic illness and stressful events in the family or school were not any higher for injured pupils.

3.11 With respect to road accidents in particular, research conducted at the household or individual level has indicated that the risk of death for child pedestrians is highly class related (Christie, 1995b). Mortality statistics indicate that children in the lowest socio-economic group are over 4 times more likely to be killed as pedestrians than their counterparts in the highest socio-economic group.

3.12 Motor vehicle accident fatalities involving child occupants, pedestrians and cyclists constituted 51% of all child deaths from injury and poisoning in 1979-83 and 44% of all such deaths in 1989-92. For motor vehicle accidents, death rates in Social Classes I and II declined by 30% and 39% respectively, compared with declines of 18% and 1% in Social Classes IV and V respectively.

Area Effects

3.13 Investigations into the importance of area-related factors were conducted by Abdalla (1997) and Abdalla et al, (1997a, 1997b), who found that the casualty rates amongst residents from areas classified as relatively deprived were significantly higher than those from relatively affluent areas. A database was created by merging road casualty information and census data for the former Lothian Region and the relationships between casualty rates and social deprivation indicators for the casualties’ zones of residence were investigated. Similarly, Erskine (1996) argues that those who benefit least from the motor vehicle seem disproportionately likely, given their relative exposure to risk, to die in road traffic accidents. The incidence of traffic injury in deprived urban areas is greater than in more prosperous areas. Social class correlates highly with mortality for all ages by all causes of death and that child pedestrian death rates correlate closely with all causes of child deaths. Social gradients in injury mortality exceed those for any other cause of death in young people (Jarvis, 1999), and the inequalities between social classes are even more extreme in relation to child pedestrian deaths than either all injury deaths or all causes of death.

3.14 A retrospective review of the hospital case notes, necropsy reports and records of coroners’ inquests was used to determine the causes of fatal childhood accidents involving head injury in Northern Region of England for 1979-86 (Sharples et al, 1990). Of the 255 children aged less than 16 years old who died with head injuries during 1979-86, 136 (53%) were playing at the time of the accident and 195 (76%) sustained head injuries in road traffic accidents. Of these, 135 were pedestrians, 35 cyclists and 25 were passengers in a vehicle. In
120 of the pedestrian accidents the primary cause, as determined by police investigation and inquest proceedings, was the unsafe behaviour of the child. Mortality was significantly related to social deprivation with most accidents occurring to children living in deprived areas, playing unsupervised near their home. Childhood mortality might be appreciably reduced if children at play were protected from traffic, particularly in socially deprived areas.

3.15 The incidence of child pedestrian injury, in certain instances, matches that of all types of injury to children with regard to social, behavioural and environmental factors. Further research would indicate if all injury rates for children could be used to predict child pedestrian injury rates. It would then be possible to identify any variation in expected and actual child pedestrian injury rates, and therefore investigate any underlying reasons why this may be the case.

3.16 **Conclusions –** The risk of death for child pedestrians is highly class-related. The decline in children’s death rates from injury over time has been less for children in the manual social classes than children in the non-manual classes. Therefore, socio-economic mortality differentials have increased. Injuries from socio-economically disadvantaged families tend to be of greater severity, in addition to those children having a higher risk of physical injury in the first place.

**FAMILY FACTORS AND ACCIDENT RISK**

3.17 Studies concerned with the impact of family factors on accident risk have tended to focus on the individual and their family structure. Few studies have sought to address these issues with reference to the relative affluence or deprivation of the area in which these households exist. A greater problem is that of correctly determining the underlying exposure to risk experienced by individuals in the studies. It is extremely difficult to establish the amount of exposure experienced by individuals from different socio-economic backgrounds. This is also the case when comparing exposure rates for people from geographic areas with different levels of deprivation or social disadvantage. In many cases it is not possible to separate the area effect from the household effect and therefore identifying risk exposure becomes even more problematic. The conclusions drawn from such studies should therefore be treated with caution.

3.18 Research indicates that for individuals living in deprived households family factors are linked to child pedestrian casualty rates and overall injury rates for children. Lone parenthood in particular is a risk factor for children.

3.19 Children of single mothers have injury rates twice those of children of 2-parent families (Roberts and Pless, 1995). The poverty, poor housing conditions and social isolation of lone mothers in Britain may explain this. Categories for poor housing conditions include shared accommodation, the type and quality of housing, temporary housing and frequent moves. Residential fires are the second leading cause of death in British children. The risk of death in a house, from fire, is higher for older houses, rented accommodation, mobile homes and homes without telephones or smoke detectors (Runyan et al, 1992). Single mothers and their children are over-represented in these types of accommodation.

3.20 The children of lone mothers have the highest death rates of all social groups (Judge and Benzeval, 1993) and lone parenthood is a risk factor for traffic injuries. The risk of
pedestrian injury is over 50% higher. One of the main factors affecting exposure rates is the alternative modes of transport on offer to children. Consistent with this is the finding that lack of access to a car is associated with a doubling of the risk of injury as a pedestrian. Lack of access to a car is most likely amongst poorer households. Households of single elderly people or single parents have particularly low rates of car use (18% and 31% respectively) and single elderly people and single parents are predominately women (Erskine, 1996). While children living in deprived households are exposed to greater accident risk there is evidence that an area effect is also evident.

3.21 As most deaths and serious injuries to pre-school children occur in the home, housing is an important factor in childhood accidents (Roberts and Pless, 1995). In the case of pedestrian injuries, children from homes without a play area are over 5 times more at risk than children from homes with a play area. Alwash and McCarthy (1988) identified that the higher accident rates in the home, involving children under 5 years of age, were strongly associated with overcrowding and tenure of housing.

3.22 The link between social deprivation and the high accident rate of child pedestrians, from lower socio-economic group families, may be explained in terms of increased exposure to hazardous environments (Christie, 1995b). Such environments may relate to the areas immediately surrounding individual households and further afield. Hazards may include busy roads with a lack of safe crossing sites, the location of schools within the community, availability and access to safe play-areas etc. Child-rearing practices of lower socio-economic group families often, by necessity, involve less supervision with less time spent in shared activities. Christie (1995b) has also suggested that children from lower socio-economic groups may be encouraged to take part in activities that involve greater physical risk where competitive drives find an outlet in unsupervised activities in unprotected environments.

3.23 Gregersen and Nolen (1994) also report that the freedom of movement of members of the voluntary traffic clubs to walk or cycle in traffic alone is lower than that of non-members. The children who are members of the traffic club also tend to spend less time in traffic environments than non-members Roberts (1993) notes that restrictions placed on children’s traffic exposure deny children their right to mobility and simply exacerbate socio-economic differentials in childhood mortality.

3.24 Roberts (1993) argues that the reduction in children’s traffic exposure is the reason for the fall in child pedestrian death rates in Britain over the last quarter of a century. While there has been a significant increase in road traffic volume over the last 30 years the child pedestrian death rate during this time has actually fallen. A study by Hillman et al, (1991) found that 80% of 7 and 8 year olds were allowed to travel to school unaccompanied in 1971, whereas the corresponding figure for 1990 was 9%. Scott et al, (1998) suggest that parental fears can limit children’s lives and experiences in a range of ways, thus increasing their dependence on adults, and cites Hillman’s findings as an example.

3.25 The majority of studies linking family factors and accident risk have investigated the individual at household level with few studies exploring at the area level. Findings from studies already cited indicate that the number of roads that children cross is a key determinant of the occurrence of child pedestrian injuries. Children from families with the lowest quarter of income cross 50% more roads than those in families in the highest income quarter (Judge
and Benzeval, 1993). This may be due to living in urban areas which themselves are more likely to be disadvantaged, or through lack of alternative travel modes.

3.26 The poverty, poor housing conditions and social isolation of lone mothers in Britain (see Roberts and Pless, 1995, above) are also likely to be indicative of the area in which lone parents often find themselves i.e. disadvantaged.

3.27 Conclusions – Children of single mothers have the highest death rates of all social groups and have injury rates twice those of children of 2-parent families. The risk of pedestrian injury is over 50% higher for the children of lone mothers. Children from single parent households have higher all injury rates and pedestrian injury rates than children from 2-parent families. However, these findings are often based on studies of urban areas and may not hold for rural areas where social and cultural influences may be different.

ACCIDENT RISK AND CULTURAL FACTORS

3.28 Studies concerned with accident risk and cultural factors have tended to concentrate on individuals at the household level, however, certain area effects may be inferred due to the establishment of ethnic communities in many instances within larger urban areas.

3.29 Alwash and McCarthy (1988) investigated the incidence of accidents in the home to children under 5 years old in a multi-racial population with a high level of social disadvantage. Census data from 1981 was used as a denominator to allow comparison between the incidence of accidents by ethnic groups and indicators of social disadvantage. Parents of 402 young children attending the accident department of a west London hospital during one year were interviewed and 4 ethnic groups were identified: British (183 children), Asian (127), Caribbean (61) and other (31). Attendance rates based on populations of electoral wards at the census showed no significant differences among the ethnic groups, but a strong gradient with social class and strong association with unemployment of the mother.

3.30 Studies into traffic accident rates, however, have found significant differences in accident risk rates based on ethnicity. Christie (1995a) found that ethnic origin came through as an important accident indicator especially for ‘non-white’ children aged less than 11 years old. Accident reports showed that, in some cases, the ‘non-white’ accident casualties had only recently arrived in the UK indicating possible problems in adapting to unfamiliar traffic environments. This may be due, in part, to area effects particularly if such individuals are resident in communities with a significant ethnic element. Other studies, however, have found immigration to be insignificant with respect to children’s traffic accidents (Abdalla, 1997).

3.31 A study by Lawson and Edwards (1991) indicated that Asian children are over-represented among pedestrian fatalities. Per head of population, those young pedestrians of Asian origin aged 0-9 years were over-represented in road accidents by a factor of 2. Like most other European countries, Great Britain does not collect information on the ethnic origins of casualties. However, given the high accident involvement of Asian children it would seem important to collect this information to help target remedial measures (Christie, 1995b).

3.32 The study by Roberts et al, (1995) (see above) also identified increased odds ratios of injury for child pedestrians by ethnic origin. This research was conducted in Auckland, New
Zealand and results revealed that Maori and Pacific Islander children had a risk of injury over twice that of children in the reference category.

3.33 Certain studies have identified ethnicity as a significant factor in determining child pedestrian accident rates. Such findings may relate to certain areas or particular ethnic groups and a more comprehensive investigation in Scotland is recommended.

3.34 Conclusions – Significant differences in child pedestrian injury rates based on ethnicity have been identified, particularly for younger ‘non-white’ children.

RISK FACTORS ASSOCIATED WITH THE PHYSICAL ENVIRONMENT

3.35 Research into risk factors associated with the physical environment has concentrated on area effects. Certain studies have, however, been able to derive information at the level of the individual and in many instances the findings relate to both households and areas.

Individual and Household Effects

3.36 The effects of the physical environment on pedestrian accident rates have mainly been studied at the area level, although valuable research has focussed on deprived households. Davis (1992) argues that there is a chain reaction to the threat posed by traffic. Perceived accident risk is a response to traffic and a trigger mechanism which influences many street-level activities such as social-support, children’s play and community identity. Perceived accident risk also impacts far more severely on vulnerable road-user behaviour than has been acknowledged. It can result in reductions and curtailments of activities if the risk is assessed to be too great. Restrictions, increasingly placed on children’s independent mobility, are key indicators of the degree of this perceived risk.

Area Effects

3.37 With regard to the physical environment explaining levels of accident risk, Al-Balbissi et al, (1990) provides evidence to support the hypothesis that a strong relationship exists between city planning and road safety for children. In the city of Zarqa in Jordan, for example, a significant relationship was found between the number of child pedestrian casualties and a number of physical and environmental factors. Such factors include population density, road density, green areas per elementary school and road patterns expressed as the number of four-leg intersections. From the models developed to explain the relationship between city planning and road safety for children, Al-Balbissi suggests that in order to achieve a reduction in child accidents school playgrounds should be open and available to children during the days when school is not in session. In addition it is also recommended that reducing the number of complex intersections would lead to a reduction in child pedestrian accidents. It can be argued that inherent in these factors are underlying socio-economic measures (such as lack of access to safe play areas, lack of suitable parental supervision etc.). However, this particular research did not address such matters. Whether the findings from this study would necessarily apply in other cultures is not clear.
3.38 Hine and Russell (1993) found that there is a trade-off between pedestrian mobility and safety, which is of direct relevance to the implementation of traffic calming schemes on more heavily trafficked roads. If pedestrians feel more secure and therefore cross the road more frequently, pedestrian casualties may not decrease and could even increase, although a reduction in their severity would still be expected. Although the particular street under investigation in the study was subject to relatively small variations in traffic conditions throughout the day, analysis of the data has none the less shown pedestrian mobility and crossing behaviour being substantially affected by traffic conditions and the resulting barrier effects.

3.39 Nearly 20% of all pedestrian accidents occur at or within 50 metres of a pedestrian crossing facility (Tight et al, 1989). One way to make these facilities safer may be by reducing the delay to pedestrians at signalised crossings. This might serve both to increase the numbers of pedestrians who use the crossings and to decrease the numbers who are encouraged to take risks because of frustration.

3.40 Christie (1995b) indicates that the layout of the residential environment influences the safety of child pedestrians. In places where there have been engineering interventions, which have helped restrict vehicular access, speed and flow, there have been reductions in accident rates. The Urban Safety Project involved the implementation of low-cost engineering measures in selected parts of 5 towns in England. Comparisons were made with the accident trend for a 5-year pre-scheme period with the implementation period and a 2-year post-scheme period. The results indicated that there were measurable savings in pedestrian accidents in 2 towns whilst general reductions were also found for those involving 2-wheeled road users. Unfortunately no explanation was given concerning the lack of savings in the other towns. A clear understanding of how this reduction in accident rates is distributed amongst the population of road users will give an improved insight into how such interventions are aiding the reduction in child pedestrian casualties.

3.41 More recently, Ross Silcock (1999) were commissioned by the Scottish Office to undertake research into the social and environmental impact of a range of traffic-calmed schemes on both trunk roads and urban roads in Scotland. In all cases the implementation of the traffic-calming measures has resulted in a reduction of speeds and accidents where quantitative measures have been taken. The results from the different schemes show variations in local culture and taste that impact on judgements about appropriate designs for traffic calming. The residents of some areas, for example, adapt more readily than others to traffic-calming measures. Others respond more readily to traditional enforcement via police or speed cameras. The perception of speed reduction appears to be accurately reflected. There also appears to be some correlation between the perceived magnitude of the reduction and the extent to which people are prepared to allow their children to walk or cycle more, or walk more themselves.

3.42 Adams (1995) suggests that drivers appear to compensate for the hazardous conditions they encounter by slowing down so that the accidents that they do have are much less serious than they otherwise might have been. While this ‘risk compensation’ may well relate to the physical environment, in which drivers find themselves (e.g. state of the roads, weather conditions etc.), further research is required to assess driver behaviour in situations dangerous to pedestrians, such as in the vicinity of children on their way to school.
3.43 An investigation to identify and assess the contribution of environmental risk factors for injury of child pedestrians by motor vehicles was conducted by Roberts et al. (1995). The environmental characteristics of sites of child pedestrian injury were compared with the environmental characteristics of selected comparison sites in Auckland, New Zealand. During the study period of 26 months, 190 cases of child pedestrians, aged less than 15 years old, who were killed or hospitalised were identified. Two control groups were also identified where 380 children were randomly sampled from the population allowing for the age and sex distributions. Comparison sites were identified with the same distances and directions from the homes of the relevant case child, and 2 control sites were selected for each injury site. The results indicated that the risk of injury to child pedestrians was strongly associated with increasing traffic volumes. High densities of kerb parking were also associated with increased risk as were sites with mean traffic speeds over 40 km/h. The risk of injury for children in the lowest socio-economic grouping was over twice that of children in the highest socio-economic stratum. Children from families without access to a car were also more at risk of injury. It is argued that reducing traffic volumes in urban areas, restricting kerb parking and reducing vehicle speeds will help to prevent child pedestrian injuries, particularly those living in the most socio-economically disadvantaged areas.

3.44 The distance from home to the scene of the accident was recorded in 235 cases in the study by Sharples et al. (1990) (see above). Most accidents occurred close to the child’s home, 79 (34%) occurring within 0.4km and 160 (68%) within 1.6km, and this was particularly so for pedestrian accidents, 80% of which occurred within 1.6km of the child’s home. Results from this study show that most of the fatal accidents involving head injury occurred to children living in deprived areas who were playing unsupervised close to home.

3.45 Abdalla et al. (1997) acknowledge that the deprivation index alone was used in their analysis to indicate the difference in casualty rates for residents from 2 different types of areas. Each of the 8 variables combined in this deprivation index could have had some influences. For example, it is argued that an overcrowded household is more likely to be in an overcrowded street associated with lack of safe play areas for children. Socialisation into social class values may affect the risk of accidents. Social Class (IV and V) might indicate the way children were brought up with habits and attitudes towards the road which are difficult to change without giving some level of affluence to make the disadvantaged behave more like the better-off. Access to a car is influenced by income, and car ownership is expected to be higher in affluent areas than in deprived areas. Abdalla (1997) also found that school-age children from affluent areas are more likely to travel by car in their journeys to and from school and would be more exposed to (non-pedestrian) accidents than children from deprived areas, which are themselves exposed to greater pedestrian risk.

3.46 A study by Brown and Lam (1994) found that 76% of Australian dwellings in urban areas are located on relatively quiet streets with a traffic flow of less than 2,000 vehicles per day. Attempts to reduce speed limits in residential areas from 60 km/h have had little impact in Australia as yet. The argument to restrict speed limits on residential streets is strengthened when it is noted that most of the streets involved carry very low volumes of traffic. Restricted speed limits on these streets would have no effect on urban network capacity and the total ‘travel delay’ to the community would be small. Again, the appropriateness of these findings to other cultures is not clear.
3.47 While considerable research into traffic casualty rates has been undertaken for urban areas a significant amount of Scotland’s road network is located in rural areas.

3.48 Although not relating to child pedestrian accidents, Tomlinson and Ross (1988) have identified traffic accident rates on single-track roads in an area of northern Scotland. They find that a high traffic accident rate is a significant characteristic of these roads and single-track roads result in accidents being attributed to very different causes from those on 2-lane roads. Further research in this area relating to different classes of road users and socio-economic factors would provide additional valuable information for the road network in Scotland as a whole.

3.49 Measuring deprivation in rural areas is likely to require the analysis of different factors used to determine urban deprivation. Gibb et al., (1998) suggests that rural conditions are different from urban ones and require a separate analysis taking account of uniquely rural forms of deprivation that arise from remoteness, transport costs, accessibility etc. It is also likely that the effects of social exclusion in remote or rural areas are likely to be different from those in urban areas. Different social and relationship issues are likely to exist within different community structures (Room (ed.), 1995).

3.50 While it is clear that the majority of child casualties on Scotland’s roads are caused by impacts with vehicles on public roads, research from Australia suggests that a considerable number of pedestrian casualties may result from slow-speed off-road accidents. This research may be particularly relevant to many of the rural areas of Scotland and it is recommended that any subsequent investigation into rural traffic accident rates should address this particular issue.

3.51 An important group of fatal accidents involve children and vehicles colliding off the highway. This accounted for 14% of accidental deaths from all causes in Victoria involving children less than 5 years of age between 1985 and 1995, and 12% of pedestrian deaths of all ages. Robinson and Nolan (1997) analysed data relating to the car and its driver, the child and the circumstances of the incident. Three types of incident were identified (driverless cars, child interacting with the vehicle and driver, and drivers who were unaware of the child’s proximity). These incidents were more common in rural areas compared with urban areas, usually occurring at the child’s home. The child was with or near an adult on all occasions. These findings suggest some countermeasures, including the separation of vehicle driveways from children’s play areas, and object vicinity ultrasonic devices for vehicles. The aim of this study was to identify factors associated with paediatric pedestrian fatal slow-speed vehicular incidents, with the objective of identifying possible preventive strategies.

3.52 The child’s own home environs were the location of 22 of these incidents (79%), usually a driveway, garage or carport, including 3 on a family farm where they resided or regularly visited. Two incidents occurred in the driveway of a friend’s home, and the remaining 3 occurred on a pavement (sidewalk), local lane, or parking place. Although 17 of these incidents occurred in metropolitan regions and 11 in rural regions, they were more common for children resident in rural areas, with a 1985-1995 rate of 0.87 per 100,000 population in rural regions compared with 0.53 in metropolitan regions, a ratio of 1.6:1. Children from rural areas were more vulnerable in all 3 incident categories. There has been a gradual increase in the number of these fatal events in more recent years. Fourteen of the 28 (50%) drive-overs occurred between 1993 and 1995, 8 of them in 1995. Current medical
literature suggests that these are injuries for which there is little possible effective medical management, therefore the geographical setting of the accident, and the distance from accident site to hospital, is largely irrelevant. Strategies for reducing fatalities therefore need to focus on incident reduction.

3.53 **Conclusions** - A significant relationship was found between the number of child pedestrian casualties and a number of physical and environmental factors. For example, the layout of the residential environment influences the safety of child pedestrians. In places where there have been engineering interventions, which have helped restrict vehicular access, speed and flow, there have been reductions in accident rates. Research into the social and environmental impact of a range of traffic-calmed schemes in Scotland found that in all cases the implementation of the traffic-calming measures has resulted in a reduction of speeds and accidents. The results from the different schemes show variations in local culture and taste that impact on judgements about appropriate designs for traffic calming.

3.54 In addition, research from Australia has identified that a considerable number of pedestrian casualties may result from other types of traffic accident. Children from rural areas experienced a higher accident rate compared to children from urban areas. These findings may be particularly relevant to the situation in Scotland.

**SOCIAL DEPRIVATION AND LOCATIONAL FACTORS**

3.55 MacIntyre et al, (1993) found that despite the long history of research into the variations in morbidity and mortality in Britain with area, there has been relatively little investigation of the socio-economic or cultural features of areas which might influence health and the likelihood of death. It is suggested that over and above individual level attributes of deprivation, people of low socio-economic status may have poorer health because they tend to live in areas that in some ways are health damaging.

3.56 Blaxter (1990) examined various aspects of health (‘illness’, ‘psycho-social health’, ‘fitness’ and ‘disease/disability’) among men and women in non-manual and manual class groups living in different types of area. She found that ‘while the health of manual men and woman was almost always poorer than that of non-manual, it is clear that types of living area do make a difference’. Blaxter also confirmed the earlier findings of Townsend et al, (1988) that the type of local neighbourhood is associated more strongly with health than the larger region in which the neighbourhood is located.

3.57 Whatever the reasons for the limited research in socio-economic or cultural features of areas it is important to explore more systematically the ways in which different types of area differ. This will help identify those social or public health policies that might improve the health of those individuals in the worst areas, other than those relating to individual improvements in lifestyle (MacIntyre et al, 1993).

3.58 The excess mortality associated with residence in areas designated as deprived by census based indicators has been wholly explained by the concentration in those areas of people with adverse personal or household socio-economic factors. Sloggett and Joshi (1994) investigated the association between the level of social deprivation in electoral wards in
England and premature mortality among residents, before and after allowing for levels of personal deprivation. A longitudinal study of the Office of Population Censuses and Surveys using deprivation indices based on those of Townsend et al, (1988) and Carstairs and Morris (1991), indicates that future health policies need to target individual people as well as the places they live in. For men, the increased risks of death associated with living in deprived areas were entirely explained by the levels of personal disadvantage experienced by each individual. The deprivation effect was therefore entirely due to the concentration of disadvantaged men in the area. Individuals living in deprived areas that were not disadvantaged did not experience excess risk. However, disadvantaged people also live elsewhere and could be excluded in large numbers if interventions were planned purely on the basis of local, census based, deprivation scores.

3.59 Duncan et al, (1993) conducted a study identifying the importance of risk factors relating to the individual as opposed to the geographical area. While the sample group refers to adults it gives an indication of the importance of this issue in attempting to separate risk factors at the individual and area levels. The study used multi-level analysis of smoking and drinking behaviour recorded in a large-scale national survey and suggested that location, as expressed as regional differences, may be less important than has previously been implied.

3.60 Such findings may have important implications for understanding the underlying factors affecting RTA (Road Traffic Accident) casualties, and how these factors are distributed at the level of the individual casualty victim and at the wider area level.

3.61 On the issue of comparing family and neighbourhood risk factors, Reading et al, (1999) found that accidental injury rates for pre-school children were much higher in deprived urban neighbourhoods than in affluent areas. However, much of the variation in injury rates was accounted for by factors at the individual level. These include sex, young maternal age, number of elder siblings and distance from hospital, and, to a lesser extent, whether or not they lived in a deprived neighbourhood. Important findings from this study also indicate that in the case of more severe injuries, single parenthood is significant at the individual level and the effect of area deprivation is stronger.

3.62 **Conclusions** - There is conflicting evidence as to whether people of low socio-economic status have poorer health due to the areas in which they live being health damaging, or whether ill health and mortality is wholly explained by personal behavioural and socio-economic factors. The importance of this issue is now being addressed with a number of researchers focussing on the interaction of factors at the family and area levels.

**SOCIO-ECONOMIC FACTORS AND HEALTHCARE**

3.63 There is evidence that in addition to increased injury rates, including pedestrian casualty rates, children living in deprived areas or suffering from material disadvantage are liable to be over-represented in other health issues.

3.64 In a study by Cooper et al, (1998) an investigation was conducted to determine whether or not equity is achieved in the use of general practitioners, outpatient and inpatient services by children and young people according to their ethnic group and socio-economic
background. Secondary analysis of the British general household survey involved 20,473 young people between 0 and 19 years of age. The findings indicate that there were no significant class differences in the use of health services by children and young people and there was little evidence of variation in the use of health services according to housing tenure and parental work status.

3.65 However, while housing tenure was not associated with the use of general practitioner or outpatient services, the odds ratio of the use of inpatient services was increased by 40% for children and young people living in local authority accommodation when compared with those living in owner occupied housing. These findings support previous work showing that children and young people living in materially deprived conditions are more likely to be admitted to hospital. This may be due to the health effects of their physical environment (MacLure and Stewart, 1984), or that accidents occurring in the home environment that require hospital treatment are spatially patterned (Roberts et al, 1995; Roberts and Power, 1996).

3.66 Cooper et al, (1998) do not provide further information on the location of the local authority accommodation in their study and it is therefore not possible to determine whether the accommodation was located within relatively disadvantaged areas. Similarly, there is no evidence from this study to suggest that children living in local authority accommodation are necessarily living in deprived households. Further information on the accommodation in question would be required before such a conclusion could be made.

3.67 While these findings relate to the direct impact on health, other indirect effects may also exist, with equally important implications for social policy. For example, Davis (1992), concludes that road accidents form the tip of the morbidity ‘ iceberg’ which includes a far wider range of impacts on the health of the population than is generally acknowledged. Large sections of the population may curtail certain modes of travel due to their perceived accident risk. Life-enhancing forms of travel such as cycling and walking may be dismissed as viable options, particularly to those sections of the population such as women and children. Moreover, it is argued that traffic also severs communities and diminishes social support networks, therefore imposing substantial health costs. This may be particularly pertinent for health-vulnerable groups such as young children of school age and the elderly.

3.68 **Conclusions** - *Children and young people living in materially deprived conditions are more likely to be admitted to hospital than children living in more affluent conditions. In addition, indirect effects may also exist leading to wide-ranging health problems.*

**CHILDREN’S BEHAIOURAL FACTORS**

3.69 Child pedestrian injuries occur significantly more often in poorer neighbourhoods with restricted access to play space and proximity of housing to busy streets (Bagley, 1992). These injuries are related to psychological problems in children such as cognitive deficit, overactivity, conduct disorder and delinquency (Roberts and Brooks, 1987).

3.70 Bijur et al, (1986) analysed social and behavioural characteristics of 11,966 British children aged 5 years old and their mother's reports of accidental injuries between birth and age 5 years. Aggressive behaviour was associated with all accidental injuries after allowing for
psychological variables including social class crowding; mother’s psychological distress, age, and marital status; and child’s sex. Overactivity was associated only with injuries not resulting in hospitalisation after control of the covariates. The findings support the inference that aggression and overactivity are independently associated with accidents. Klein (1980), however, hypothesised that children of lower socio-class families have increased accident experience because of accessibility to unsafe household products, poor housing and crowding, and not because of aggressive or overactive behaviour. Christie (1995b, see above) also suggests that increased exposure to hazardous environments by children from lower socio-economic group families results in a higher pedestrian accident rate for these children.

3.71 The study by Bijur et al, (1986) found that the peak age of occurrence of accidental injuries was between 2 and 4 years of age and that boys had 30% more injuries than girls. The relative risk of injuries among children with scores on the aggression scale at or above the 90th percentile compared with children with scores below the 25th percentile was 1.6 (95% CI=1.5, 1.7), reflecting 60% more injuries in children with high aggression scores. The relative risk of injuries for high-scoring overactive children compared with low scorers on this scale was 1.5 (95% CI=1.4, 1.5).

3.72 The magnitude of the child behavioural associations with accidents was consistent with and, in many cases, greater than the magnitude of the associations with non-behavioural characteristics. For example, the unadjusted relative risk of accidents resulting in hospitalisation in Social Class IV (semi-skilled) or V (unskilled manual labour) versus Social Class I, II or III (non-manual labour) was 1.5.

3.73 Conclusions – Aggressive behaviour and overactivity have been found to be associated with all accidental injuries for children. However, with respect to child pedestrian accidents in particular, it has been suggested that environmental influences are more significant than behavioural factors.

DEPRIVATION FACTORS AND EDUCATION

3.74 Educational performance by children can be monitored and problems can be identified. In certain instances this information will relate to problems of disadvantage and can also have implications for formal road safety training.

3.75 Many problems which manifest themselves in the educational system, such as low attainment, under-achievement and disruption, are connected to patterns of disadvantage and inequality in society as a whole (Dyson, 1997). It is argued that poverty, unemployment, lack of opportunity, poor health and healthcare, criminality and a whole range of other sources of stress on families and children are reflected in the difficulties which these children bring to, and present in, their schools.

3.76 There are many schools where the consequences of social and economic disadvantage and inequality manifest themselves directly and forcibly in educational problems. Schools in inner-city areas and in economically depressed communities are examples. As children usually attend schools in their vicinity this would indicate that they also live in such deprived communities. It is clear that within such communities there will be a considerable number of
deprived households and children from these households that attend school. There is a need to understand how social and economic stresses in the schools’ environments interact with the characteristics of the schools themselves to generate the problems of learning and behaviour.

3.77 There is evidence of a difference in the underlying socio-economic structure relating to education and training aimed specifically at reducing traffic accident risk. The problem of traffic safety among children and the effectiveness of voluntary traffic clubs has been investigated in studies both within the United Kingdom and elsewhere in the world. Firth (1973) concluded that although children’s knowledge of appropriate safe behaviour increased after exposure to educational material, their actual behaviour was not affected. Rothengatter (1984), however, found that training under normal traffic conditions supplemented with audio-visual presentations in school achieved major improvements in the road crossing behaviour of children.

3.78 A number of studies have shown differences between members and non-members of traffic clubs with respect to socio-economic circumstances. In November 1995 the Scottish Road Safety Campaign (SRSC) launched the Children’s Traffic Club in Scotland (CTCS). An invitation to join the Club was sent to all children in Scotland on about their third birthday by their local Health Board. Bryan-Brown and Harland (1999) found that the CTCS was taken up by 62 per cent of eligible children, 71 per cent of children in higher income families and 53 per cent of children in lower income families.

3.79 Safety gains identified by Bryan-Brown and Harland since the Traffic Club started in Scotland are -

- More parents and carers have taught their child to hold hands when crossing the road.
- More parents and carers have shown their child how to cross a road.
- More parents and carers have taught their child road safety by going through books with them.
- More children know that they need to think before crossing a road.
- More parents and carers always get their child out of a car on the pavement side.
- Parents and carers are more likely to use protected crossings, such as zebras or pelicans, if they exist on the child’s route to school.
- Among children who go out in the dark, a higher proportion wear conspicuous clothing of some type, and a higher proportion wear reflective clothing.

3.80 The 62% uptake of CTCS material is a higher rate than any observed in previous British evaluations. Although the take-up rate did vary with socio-economic status the proportion of members actually using the books did not vary. Carers in low-income families were no more and no less likely to use the books than carers in high income families.
The comparison with the data from the 13 counties in England (see West et al, 1993, below) suggests that the Scottish Club has been at least as effective as the Traffic Club in the Eastern Region. The Eastern Region study was carried out on children in 13 counties in England who were interviewed just prior to the start of the introduction of a major traffic club scheme. Their responses were compared to interviews conducted one year later and with a control group (West et al, 1993). There was no evidence that the response to the Traffic Club was different for the various socio-economic groups or by male and female children. Results indicated that children from non-manual socio-economic backgrounds did considerably better than those from manual backgrounds in terms of knowledge of road safety and were less likely to be left to play or ride bikes unsupervised in the streets. The parents of children who become members of these traffic clubs tend to be more highly educated than parents of non-members, and more of them live in their own houses.

A reasonable conclusion from such findings is that the members of such clubs ought to have a lower accident risk than non-members Gregersen and Nolen, 1994). This assumption is supported by non-traffic related accident data. In addition, the expectations from the club ought to be a reduction of the accident risk, which would lead to an even larger difference with the members having significantly lower risk than the children who are non-members. The results from this particular study, however, are unclear (Chapter 4 of this review provides a more detailed account of the impact of organised traffic clubs.)

There are various results in the study, such as the use of safety equipment and number of parents teaching and training the children, supporting the hypothesis that safety effects are achieved by the traffic club. On the other hand, the results from the comparison of accident risk between members and non-members suggest that the overall effects of the traffic club are insignificant.

Conclusions - For schoolchildren, social and economic disadvantage manifest themselves in educational problems such as low attainment, under-achievement and disruption. Education and training, provided by the CTCS, aimed specifically at reducing traffic accident risk, has produced greater safety gains in Scotland than a number of similar schemes elsewhere in the world.
CHAPTER FOUR  TRAFFIC RISK - CHILDREN’S PERCEPTIONS AND TRAINING MEASURES

4.1 In this chapter a group of studies related to children’s perceptions of traffic accident risk are reviewed. In addition, consideration is given to studies that have investigated the impact of formal road and traffic training as provided by those traffic clubs that exist in different countries. Much of the findings in this chapter will also relate to the final section of the previous chapter, DEPRIVATION FACTORS AND EDUCATION.

CHILDREN’S PERCEPTIONS OF TRAFFIC RISK

4.2 Parents’ ideas about what is likely to frighten or threaten their children may not be the same things which children themselves find scary (Scott et al, 1998). The social world of children is divided into safe and dangerous places which has consequences for their use of space, where they are allowed to go and the places they themselves feel safe in, frightened or excited by.

4.3 Certain studies have simulated children’s exposure to road traffic and have attempted to gauge the underlying factors affecting their perceptions. An investigation by Stevenson (1996) found that the child's self-reported ‘habitual exposure’ data is a valid measure of his or her actual exposure in the road environment. A large case-control study carried out in the metropolitan area of Perth, Western Australia, found that certain exposure variables such as the number and duration of walking trips were underestimated by the children. The number of roads crossed was also underestimated, however overall findings from the study indicate high levels of concordance between perceived exposure and actual exposure when all variables were accounted for.

4.4 A study by System Three (1998), for The Scottish Office, explored whether there were any discrepancies between young teenagers' perceptions of the circumstances of road accidents and the reality. The findings indicate that young teenagers are very knowledgeable about the locations, times and causes of pedestrian accidents. The study, based in Scotland, identified the urban setting as the most likely place for accidents to happen and in particular on journeys to and from school, situations identified with greater rates of exposure.

4.5 Connelly et al, (1998) conducted a series of trials to determine the threshold point at which school children would no longer cross in front of traffic approaching from their right. The study was conducted in New Zealand with 3 gender-balanced groups of school children (5-6 years, 8-9 years, and 11-12 years of age). The children participated in individual pre-tests of vision, hearing and time to walk across a 12-metre wide urban street and back again. The results indicated that, overall distance gap thresholds remained constant regardless of vehicle approach speeds. Almost two-thirds of the children reported using distance to judge gaps, which was found to be the least adequate strategy in terms of proportion of resultant safe decisions.

4.6 Another study investigated the ability of children between 5 and 11 years old to select safe places to cross the street (Ampofo-Boateng and Thomson, 1991). Schoolchildren aged 5, 7, 9 and 11 years of age were selected from schools in Glasgow to take part in a variety of
different experiments. The experiments took place both within the child’s school and in real traffic environments in the general vicinity of the school. The children were presented with situations that were either extremely safe or manifestly dangerous and were asked to correctly identify these. In other cases they were asked to choose for themselves routes across the road that they thought would be safe. The findings revealed that 5 and 7 year-olds exhibited very poor skill in identifying dangerous road-crossing sites. They also showed an unwillingness to make detours when planning their own routes, even where the direct route was manifestly dangerous. Nine-year-olds showed a higher level of ability than the younger age groups and 11-year-olds showed good skill in these judgements. These results suggest that young children up to about 9 years old must often be at considerable risk, as they do not have the ability to recognise a location as dangerous.

**TRAINING CHILDREN TO BE AWARE OF TRAFFIC RISK**

4.7 Formal traffic risk training for children such as that discussed by Gregersen and Nolen (1994) (see above) may lead to less teaching and training than the children would have had if they had not become members of organised traffic clubs. Parents may shift the responsibility of training children onto the traffic club, resulting in each member child receiving less training overall than a non-member child. The results from this particular study are unclear with regard to the impact of formal training on reducing accident risk for children in the traffic environment. The most reasonable conclusion, according to Gregersen and Nolen, is that the traffic club does not have any effect in reducing accident risk.

4.8 The findings of Connelly et al. (1998) reveal that pre-adolescent school-age children, particularly those aged below 10 years, have relatively poor skills at reliably setting safe distance gap thresholds, and thus do not consistently make safe crossing decisions. These findings indicate that current approaches to training young children safely to cross the road are not sufficient, on their own, to ensure children’s safety. Children cannot be relied upon to make safe last-moment decisions, regardless of their age. Furthermore, they suggest that rather than placing the primary responsibility on the children to make better decisions, especially given the ineffectiveness of educational initiatives in the child pedestrian field, efforts should be directed toward reducing vehicle approach speeds. Generally it appears that drivers are unprepared for the unpredictable behaviour of child pedestrians and need to be more responsible in law for their actions (Towner et al. 1993, p.13).

4.9 A study by Demetre et al. (1992) found that young children make relatively few dangerous decisions in tasks that involve the use of estimates of traffic gaps. These results are contrary to those found by Connelly et al. (1988). Experiments were conducted in the traffic environment and involved children from Primary 1 and 2 classes in a school in central Edinburgh. In addition, university students and research staff were also included for one experimental situation. The findings suggest that young children’s over-representation in accident statistics cannot be attributed to a general developmental phenomenon regarding timing. It is possible that some children are selectively at risk for accidents because of certain perceptuo-motor deficits. Identifying such populations and assessing the extent to which their numbers contribute to the overall accident rates of young children is an issue in need of investigation.
The findings suggest that children as young as 5 and 6 years of age are not markedly different from adults in their ability to make sensible decisions about traffic gaps. Though direct comparisons revealed the children to be generally less skilled than adults as road users, the children were able in some measure to compensate for their deficiencies. It would seem highly unlikely that young children’s greater vulnerability as pedestrians can be directly attributed to a general developmental deficiency in the extraction of temporal information. Similarly, Christie (1995b) found no evidence to suggest that the accident risk of children from different socio-economic groups is related to developmental factors.

In Demetre’s study the general conservative tendencies of the children as reflected in the incidence of missed crossing opportunities, the use of a conservative criterion of gap acceptance and selective reduction of dual-lane crossings, all seem to point to strategic behaviour. It is conceivable that the use of such criteria may result in unnecessary delays in getting across a road, with subsequent feelings of frustration leading to making impulsive decisions. It is possible that under conditions in which the child is more motivated to cross the road, frustration and impulsiveness occasioned by delayed crossing may well result in dangerous behaviour.

The findings of Ampofo-Boateng and Thomson (1991) (see above) appear to have a bearing on the uncertainty concerning how best to train children to deal with features such as parked cars and junctions. In some countries children are encouraged to cross at junctions on the assumption that vehicle speeds are lower there. In other countries children are discouraged from using them because of their complexity. Similarly, children may be advised to cross well away from parked cars, or they may be taught to treat the edge of parked cars as a kerb that effectively reduces the width of the road.

Towner et al, (1993) and Avery and Jackson (1993) argue that there are ways in which modified driver behaviour might reduce child pedestrian casualties. These include vehicle drivers always being on the lookout for children particularly near schools, playgrounds and where children are playing. Drivers should also anticipate unexpected and impulsive behaviour on the part of children. In addition, reducing their speed in all residential areas, keeping within speed limits and slowing down near schools, shops, playgrounds or where children are playing, and giving way to pedestrians at road junctions are further safety measures that should be implemented by vehicle drivers (Avery and Jackson, 1993 p.27). Emphasis has to be placed on driver education such as the reduction in fatality figures associated with lower driving speeds. There is a 50% chance that a child hit by car travelling at 30mph will be killed whereas this fatality rate drops to 5% for a child hit by a car travelling at 20mph.

Conclusions. While young teenagers are very knowledgeable about the causes of pedestrian accidents, younger children aged up to 9 years old exhibit poor skills in identifying dangerous road-crossing sites. It has been suggested that, as well as improving children’s road-crossing skills, emphasis has to be placed on driver education. This is particularly relevant to reducing speeds in environments where children may be encountered such as near schools and where children are playing.
CHAPTER FIVE RISK FACTORS OF JOURNEYS FOR SCHOOLCHILDREN

5.1 Several studies have examined the importance of the journey to and from school for children with respect to casualty rates. A considerable amount of information has been gathered from individual schoolchildren through surveys and observational studies. It is possible to identify various risk factors associated with the study sample. Problems, however, do exist as risk factors and exposure rates vary with location.

5.2 A qualitative study by Tight (1987) concluded that children are vulnerable on journeys on their way to and from school. In an investigation of 5 towns in England, he found that the percentage of child pedestrian accidents occurring on such journeys ranged from 19% in one town to 33% in another. Tight also found that the numbers of school children who walk to school varies significantly between places as well, ranging from 47% in one town to 85% in another. Exposure to injury risk varies with different social, economic and environmental conditions (Towner et al, 1994).

5.3 An examination of how risk factors to schoolchildren vary with sex, age and affluence was conducted by Towner et al, in 1994. The 24 comprehensive, middle and special schools in Newcastle upon Tyne were issued with self-completion questionnaires, with 4,637 being completed by the pupils. Private schools were not included in the survey but 95% of Newcastle’s children attend state schools. Whilst there was no data regarding location of these schools relative to different socio-economic areas, the study would have covered a significant range of affluent and deprived areas within the city.

5.4 The survey questionnaire was developed to measure children’s exposure to causes of fatal and serious injuries and of less severe but common injuries. By applying a measure of exposure to injury risk for schoolchildren aged 11 to 14 years, it was discovered that, in general, boys were exposed to greater risk than girls in journeys to places to play outdoors and they took longer trips in doing so. Boys were also less likely to travel by public transport or by car, and for trips to school, boys were more likely to travel on their own. In the time period immediately prior to the study, boys were nearly twice as likely as girls to have ridden a bicycle in the previous week.

5.5 For trips to school, younger pupils were less exposed to traffic than older pupils. Their journeys were shorter and less likely to take more than 30 minutes, and they were less likely to walk and more likely to travel by car or school bus. Younger pupils, therefore, were more likely not to have to cross any roads on their way to school. For all pupils journey times were longer on the way home, with more pupils walking home and more roads were crossed.

5.6 Research conducted by Carole Millar Research (1998), on behalf of The Scottish Office, investigated the nature and circumstances surrounding road traffic accidents involving pedestrians aged 12 to 15 years of age in Scotland. It was found that this age group was involved in a higher proportion of traffic accidents on journeys to or from school compared to children aged 5 to 11 years of age. For the 5 to 11 year olds, 24% of traffic accidents occurred on a school journey compared with 38% for 12 to 15 year olds.
5.7 Towner et al, (1994) assessed the affluence of a pupil’s household by the ownership of a car and telephone, with households owning both being considered as affluent. Households with only one or neither were considered deprived. Using this crude measure of affluence, deprived children were exposed to greater risk than affluent children and were less likely to travel to school by car or to be accompanied by an adult. While affluent pupils had longer journey times, in many other respects the deprived pupils were more exposed to risk. Fewer of the deprived pupils had travelled by car in the previous 2 days compared with affluent pupils. In addition deprived pupils were less likely to use a seat belt in the back of vehicles than the more affluent children.

5.8 An important problem identified with this type of study was that, due to the methodologies used, no information could be derived for those schoolchildren who were absent through sickness or truancy. Both these groups may have risk profiles different from the study group. Towner et al, (1994) recommend further research in this area to investigate whether persistent truants, for example, have a different exposure to injury risk than pupils who attend school.

5.9 Conclusions. On journeys to school, children's exposure to injury risk varies with different social, economic and environmental conditions. Younger children have lower exposure levels to traffic than older children and a higher proportion of traffic accidents occur to older children on journeys to or from school. Children from deprived areas are exposed to greater risk than affluent children on journeys to or from school.
CHAPTER SIX  SUMMARY FINDINGS AND RECOMMENDED AREAS OF FURTHER RESEARCH

6.1 In developing strategies to tackle Scotland’s road accident problem, particular consideration needs to be given to issues of national and international concern, and to those problems which are more serious in Scotland than elsewhere (Halden and Harland, 1997). The main issues identified in this review are summarised below and areas suitable for further research are suggested.

SUMMARY FINDINGS

6.2 The main findings from the Literature Review are as follows:

- In many instances it is difficult to separate the household effects from the area effects when determining the underlying factors affecting road traffic accident rates.
- Children and young people living in materially deprived conditions are more likely to be admitted to hospital than children living in more affluent conditions.
- For school-children, social and economic disadvantage manifest themselves in educational problems such as low attainment, under-achievement and disruption.
- The overall long-term benefits of organised Traffic Clubs have still to be established. The Children’s Traffic Club in Scotland has produced greater safety gains than a number of similar schemes elsewhere in the world, however the take-up rate did vary with socio-economic status.
- The risk of death for child pedestrians is highly class related.
- The decline in children’s death rates from injury over time has been less for children from the manual social classes than for children from in the non-manual social classes, and as a result the socio-economic mortality differentials have increased.
- Injuries to children from socio-economically disadvantaged families tend to be of greater severity. In addition, these children have a higher risk of physical injury in the first place.
- Children of single mothers have the highest death rates of all social groups and have injury rates twice those of children of 2-parent families. The risk of pedestrian injury is over 50% higher for the children of lone mothers.
- Significant differences in child pedestrian injury rates based on ethnicity have been identified particularly for younger ‘non-white’ children.
- Restrictions placed on children’s traffic exposure denies children their right to mobility and simply exacerbate socio-economic differentials in childhood mortality.
• The implementation of traffic-calming measures, investigated in Scotland, has resulted in a reduction of speeds and accidents where quantitative measures have been taken. Additional schemes targeted at disadvantaged areas should not only reduce accident rates but also address some of the problems of social exclusion.

• There is conflicting evidence as to whether people of low socio-economic status have poorer health due to the areas in which they live being health damaging, or whether ill health and mortality is wholly explained by personal behavioural and socio-economic factors.

• Aggressive behaviour and overactivity have been found to be associated with increased accidental injuries in the child population.

• Young teenagers are very knowledgeable about the locations, times and causes of pedestrian accidents. However, young children up to about 9 years old do not have the ability to recognise such locations as dangerous.

• Pre-adolescent school-age children have relatively poor skills at reliably setting safe distance gap thresholds in the traffic environment.

• Given the uncertainty of the effectiveness of educational initiatives in the child pedestrian field, emphasis has to be placed on driver education such as the reduction in fatality figures associated with reduced driving speeds.

• The incidence of other types of traffic accidents involving children may be significant in Scotland.

• On journeys to and from school deprived children are exposed to greater risk than more affluent children and are less likely to travel to school by car or to be accompanied by an adult.

CONCLUSIONS

6.3 On the basis of available evidence it appears that children from disadvantaged areas are exposed to greater levels of accident risk through a combination of factors. Lack of parental supervision and access to a car result in journeys to and from school being more hazardous for deprived children than those from affluent areas. Safe access to supervised and/or safe play areas is also generally denied to those children living in disadvantaged areas.

6.4 In addition to increased exposure to the traffic environment for children from disadvantaged areas, there is also evidence that such children exhibit different behaviour patterns that may also contribute to higher accident rates. Such risk-taking behaviours in combination with higher exposure rates inevitably result in children from deprived areas being over-represented in traffic casualty statistics.

6.5 While the emphasis of this Literature Review has been to establish the factors affecting traffic accident rates involving disadvantaged children in particular, the onus is on the
population as a whole to minimise the dangers on our roads for all children, regardless of socio-economic background.

FURTHER RESEARCH

6.6 Areas requiring research have been identified based on the findings of the literature review above. The following have been identified as either enhancing existing research or are pertinent to road accidents and children living in disadvantaged areas in Scotland.

1. To fully and validly understand the implications of social exclusion as outlined in Chapter 3, there is a need to further investigate different levels of exposure experienced by different road user groups. Until more work is undertaken on exposure to accidents, many of the conclusions from the other studies will remain speculative. Since there is little knowledge of the risk of accidents to particular groups there should be interest in a study of different socio-economic groups’ accident exposure rates. One approach relates to that of the ‘innocent victim’ as defined by Haight (1973). This type of study would involve an analysis by postcode of drivers involved in accidents and attributing the blame.

2. Throughout the review of the literature a major gap in informative research has emerged relating to a comparison of urban and rural risk factors for road traffic accidents. This is especially clear from the sections in Chapter 3 on SOCIAL DEPRIVATION AND LOCATIONAL FACTORS and RISK FACTORS ASSOCIATED WITH THE PHYSICAL ENVIRONMENT. This is particularly key to any further work on social in/exclusion. In particular, a study of different exposure rates and travel patterns is required. Also studies of the behavioural and travel patterns of children in urban compared to rural communities should be carried out. This would inevitably involve case studies of accidents in urban and rural areas and would take the form of interviewing/questionnaires to determine the attitudes, travel patterns and exposure to accidents of people resident in these areas.

3. From the sections SOCIO-ECONOMIC FACTORS FOR ALL INJURIES and FAMILY FACTORS AND ACCIDENT RISK in Chapter 3, it is clear that there is a need for more work on an individual’s comparative road traffic accident risk. This theme is also explored in Chapter 4. Groups that could be investigated include children from lone parent families, children of certain ethnic backgrounds, children with perceptuo-motor deficiencies and also those children with restricted mobility. Principal in this comparative work should be the effect of social in/exclusion. Linked to this should be a study of the effect of different family and community support infrastructures. This would require an inter-disciplinary approach, combining work from child psychologists, health providers and statisticians. A longitudinal study of accidents, combined with interviewing for those involved, would be the type of study envisaged.

4. Given the implications of the work reviewed in Chapter 3, existing research methodologies require to be updated to take account of changes in the environment, the economy and social factors to identify changes in traffic accident rates over time. Of particular interest would be a statistical/economic investigation on “closure trends” as targets are attempted. The understanding and monitoring of these trends would improve the management and resourcing of projects. This research would be mainly
desk bound analysis of the STATS 19 records and a review of trends in socio-economic positioning of those at risk.

5. There is a need for further research into possible mechanisms for changing the attitudes of different groups of road users. Issues relating to mobility, access and safety have become clear from the review of work conducted in the section *DEPRIVATION FACTORS AND EDUCATION* in Chapter 3, as well as Chapter 4 and Chapter 5. Unless these attitudes which may be deep-rooted are changed then the effectiveness of engineering, legal, and educational initiatives will be seriously constrained. This work would be based on case studies and involve psychologists, sociologists and statisticians.

6.7 As part of a research project being conducted at Napier University by staff in the School of Mathematical and Physical Sciences and the Built Environment, in conjunction with the Transport Research Institute, issues 1 and 2 will be addressed. Funding is currently being sought for this project’s continuance.
REFERENCES


