



**SOCIAL FACTORS IN ROAD SAFETY
POLICY PAPER**

April 2012

Executive Summary

There is a significant body of evidence which shows how health is unequally distributed through society, especially between socioeconomic groups where the lower a person's social position, the more at risk they are of ill health. Reducing inequalities in health by addressing some of the social factors that cause them has become an explicit objective of many activities to improve health and reduce illness.

Action on reducing the social gradient of health is also a concern for the fields of road safety and injury prevention as a whole, given that there is a similar body of evidence showing how injury risk is unevenly distributed across society in a similar way to illness. Some research has shown that the difference in injury rates between the most affluent and most deprived groups has recently been increasing.

One of the outcome indicators to monitor the success of the recent Strategic Framework for Road Safety (DfT 2011) is a comparison of the number of fatalities and serious injuries between the 10% most and 10% least deprived areas.

Social causes of injuries and the range of interventions to address them can be highly complex, and the process by which different social factors increase the risk of injury is sometimes unclear, even when there is good evidence that shows the increased risk.

One way of examining how social factors influence injury is to study them on different ‘levels’ depending on how removed they are from an individual. For example, factors that influence injury risk might exist within

- national policies, such as economic strategies
- the conditions in which an individual lives and works
- the social and community networks between individuals
- an individual’s lifestyle

These wider social factors at higher levels should be seen as part of the overall burden of injury. Similarly, the factors that prevent effective interventions from being implemented also contribute to the overall number of injuries.

Why is there inequality in injury?

This paper looks at two broad groupings of social factors

- the road environment, habitation and local area
- social environment and deprivation

Exposure to danger is another factor which can vary between socioeconomic groups. For example, children in families in the lowest quarter of income cross 50% more roads than those families in the highest quarter.

There are several ways that deprivation and the social environment can influence injury risk.

A lack of money can impact on a family’s ability to invest in safety, either by purchasing products which could make their environment safer, or by replacing older products. This can also limit the effectiveness of legislative approaches to improving safety in lower socioeconomic groups, for example safety technology on new vehicles may be unaffordable for these groups.

Several researchers have commented on how family structure influences the risk of injury with children in both single parent families and large families being more at risk. Reduced parental supervision and family disturbances that upset the child were linked to an increased risk. The lack of support for some single parent families is another potential cause of increased injuries. Lone parents can find themselves in a ‘poverty trap’ where paid employment offered the best way to improve the standard of living for the family but the lack of affordable day care limited the employment opportunities. There are strong evaluation studies of programmes which reduced the frequency of injury to children in single parent families by offering support to mothers with young children.

Some road safety interventions have been criticised for not being targeted at the least affluent groups, for example, by using inappropriate ways to communicate safety messages.

The physical environment can greatly influence the number injuries and their severity.

This can be especially true in areas that were built before cars were commonplace and where layout and available space limits how much can be done to reengineer the road and make it safer. Victorian terraced houses which are typically found in the most deprived areas of the West Midlands are one example

Studies have found higher levels of street recreation amongst lower socioeconomic groups, due to the lack of garden space and parental concern that public areas such as parks are unsafe. Many parents believed that changing land use also limited the areas where children could play and that local parks had been converted into car parks.

Much of the available research is quite old; although many of the social factors that cause injury inequality also re-occur in the more recent research.

Addressing inequality in prevention work

The effects of wider social factors on injury have a large number of implications for road safety activities, although there can be considerable difficulties in addressing inequality and deprivation. There are relatively few published evaluations of programmes that have tried to reduce injury inequality.

However, road safety interventions can be designed to address the effects that inequality can have on injury risk, and can measure any changes as part of the evaluation.

In order to address inequalities in health, packages of measures may be more successful than single initiatives.

Community involvement in programmes is one way to empower individuals, groups or communities to change some of the wider influences to their health. This can ensure the relevance of the campaign and address some of the barriers to adopting safer behaviours.

Road safety interventions can attempt to change some of these wider determinants of safety. The 10 principles of effective safety education in schools developed by RoSPA and the PHSE Association identify effective ways of empowering young

people by involving them in real decisions to help them stay safe, and using active learning which draws on the learner’s personal experience.

This report has pointed out areas where there are links between road safety and public health activities, but there are more professions and sections of Local Government who can be engaged by road safety professionals to make sure road safety is considered as part of their policy process.

Policy statements

Based on this review of evidence, five broad policy recommendations have been made:

1. In order to continue the efforts to reduce the number of road casualties, the social factors that cause injury need to be tackled in a systematic way by organisations responsible for road safety.
2. Common approaches to improving the health, wellbeing *and* the safety of individuals and communities need to be identified. Developing closer ties and partnership working between road safety and health professionals could help to identify these approaches.
3. Ways of identifying the effects of local and national government policies on road traffic injury need to be developed in order to identify opportunities to improve and protect road safety within them.
4. Education interventions need to help individuals and communities to overcome the social factors which act as barriers to safer behaviours and empowering them to have more control over these factors is key.
5. Wider use of evaluation on road safety projects is essential to identify which ones are more successful at tackling inequalities.

Contents

1. Introduction	6
1.1 The aims of this policy paper.....	7
2. Inequality in Injury	8
2.1 The influence of wider social determinants of safety.....	10
3. The Influence of Socioeconomic Status on Injury Risk	13
3.1 Injury and individual-level measures of socioeconomic status.....	13
3.2 Injury and area indicators of socio-economic status	16
4 Why is there Inequality in Injury?	22
4.1 Exposure to risk	22
4.2 Financial issues.....	23
4.2.1 Safer products	24
4.2.2 Restricted planning	24
4.3 Illness and disability	24
4.4 Family issues	25
4.4.1 Family structure.....	25
4.4.2 Difficulties faced by single parents	25
4.4.3 Access to childcare	26
4.4.4 Difficulties faced by large families	27
4.4.5 Age of parent.....	27
4.4.6 Frequent moves	28
4.5 Ethnicity.....	28
4.6 Migrant groups	30
4.7 A disconnect with road safety ETP	30
4.8 Place	31
4.8.1 Access to facilities	31
5. Addressing Inequality in Prevention Work.....	33
5.1 Empowerment and community involvement	33
5.2 What should campaigns be trying to change?	35
5.2.1 Initiatives which have attempted to address wider determinants of injury	37
5.3 Facilitators and barriers to community involvement	39
5.3.1 Personnel issues	40
5.3.2 Planning issues	40
5.4 Lessons from Neighbourhood Road Safety Initiative	41
5.5 Building road safety into the wider agenda	43
6. Policy Statements.....	44
7. Conclusions.....	46
8. References.....	47
9. Glossary	53
10. Social Factors in Road Safety – an overview.....	55

1. Introduction

There is a significant body of evidence which shows how health and illness is unequally distributed through society, especially between socioeconomic groups where the lower a person's social position, the more at risk they are of ill health. One of the reasons behind this is the influence of many wider social determinants of health. Reducing inequalities in health by tackling these social determinants has become an important objective of many activities to improve health and reduce illness.

Research has shown that similar inequalities exist for injuries. One of the outcome indicators to monitor the success of the recent Strategic Framework for Road Safety (DfT 2011) is a comparison of the number of fatalities and serious injuries between the 10% most and least deprived areas.

This document sets out RoSPA's policy on injury inequality on the roads, and also a review of the social determinants of injury which contribute towards this inequality and how they can be tackled. These are the wider factors that influence the risk of people being involved in an accident and which individuals may or may not have an influence over. The phrase used by the eminent epidemiologist Geoffrey Rose to describe these factors is the '*causes of the causes*' of ill health (Marmot 2005).

The policy paper includes a review of the current evidence showing the gradient in the number of casualties from different areas and socioeconomic groups, as well as the literature which can explain some of the reasons why this gradient exists.

This literature identifies many factors which can not only lead to a greater risk of road injury, but which can also dampen the effectiveness of road safety interventions. Social factors can also contribute to the length and likelihood of recovery from injury, and also the extent of change to relationships and personal wellbeing issues resulting from an accident, however, this is outside of the scope of the current paper.

Many of the factors which cause injury and ill health are common to both outcomes. This may mean that interventions to address the social factors behind one can incorporate work to address the other. Road safety is a public health issue (WHO 2009) and a greater integration between road safety and public health, at all levels, would help to create both safer and healthier environments.

This policy paper also identifies ways of addressing injury inequality in prevention work and should, therefore, be of use to road safety practitioners who wish to design effective road safety activities or initiatives to tackle the issues identified.

In order to address these wider '*causes of causes*' of injury, much broader partnership working is required between road safety practitioners and with organisations and strands of local and national Government outside of what has historically been seen as road safety. Building road safety into everyone's priorities and policies is an inescapable step to reduce the social gradient in injury.

Most importantly, when working in communities which are relatively deprived, the community itself needs to be involved. They are the real experts in how road safety issues affect them in their day to day lives and what the barriers are to building the safer communities that they want. This policy paper looks at some of the problems to engaging communities and identifies some lessons from the recent Neighbourhood Road Safety Initiative.

1.1 The aims of this policy paper

The aim of this paper is to draw together some of the links between road safety and health inequalities by identifying some of the common social determinants.

This policy paper has two main objectives:

1. To review and compile information on the scale of injury inequality and the social factors that create the inequalities
2. To produce evidence and recommendations that will assist RoSPA and other road safety organisations to tackle the social factors that cause injury inequalities

A further objective is to help develop and strengthen the links between road safety professionals and public health professionals by identifying common ground. It is hoped that this will help to foster closer working.

2. Inequality in Injury

Identifying the causes of injury is essential in order to develop effective interventions to improve peoples' safety. Everyone is at risk of injury, but the burden of this risk is not equally spread and falls more on some than others. This is injury inequality.

As well as asking why some individuals are more at risk of injury than others, it is equally important to ask why some social groups or communities are more at risk. Understanding these inequalities is important to identify the ‘causes of the causes’ of injury.

Understanding the ‘causes of the causes’ have become an important focus for health professionals and organisations in the last few decades. For example, The World Health Organisation established a Commission on Social Determinants of Health in 2005 “*to marshal the evidence on what can be done to promote health equity, and to foster a global movement to achieve it*”. (WHO 2008)

Avoidable health inequalities are significant within national borders as well as internationally, and successive independent reviews into health inequality have identified this within the UK, as well as proposing action that can be taken to reduce them by tackling the wider social factors that influence health.

The first Department of Health working-group on health inequalities was established in 1977, led by Sir Douglas Black, resulting in a report called ‘Inequalities In Health’, published in 1980 (Black 1980).

The recommendations of The Black Report centred on improving health by reducing poverty, and also made several recommendations on the health of children. It highlighted the importance of co-ordinating government policy to tackle health inequalities between different departments such as housing, leisure and education.

The report identified that the difference in child mortality between the highest and lowest social class was most marked for accidental injuries. It suggested that the only long term solution to children being injured in traffic was to make sure that children had safe areas to play, away from traffic. A recommendation was to direct child accident prevention programmes at local authority planners, engineers and architects – reflecting the author’s concerns that the environmental factors that contributed towards inequality in injury were not being sufficiently addressed.

In 1998, an independent inquiry into inequalities in health was commissioned, and chaired by Sir Donald Acheson. The outcome was The Acheson Report containing evidence and a series of recommendations designed to reduce health inequalities (Acheson 1998).

General recommendations within the report were concerned with establishing better ways of monitoring health inequalities and evaluating the effectiveness of measures to tackle them. In particular, it recommended that all policies likely to have a direct or indirect effect on health should be evaluated in terms of their impact on health inequalities and that policies that have a negative impact be re-formulated.

The report also made recommendations about road transport, related to the influence that transport policy has on wider health outcomes other than injury. Issues covered included accessibility of public transport and the wider effects that high volumes of

traffic can have on an area, such as air and noise pollution, lower levels of walking and cycling, and from that a decreased potential for building or maintaining social networks.

More recently the Marmot Review (Marmot 2010) called for action on reducing the social gradient in health. It proposed six key policy objectives that required action to reduce health inequalities:

- Give every child the best start in life
- Enable all children, young people and adults to maximise their capabilities and have control over their lives
- Create fair employment and good work for all
- Ensure a healthy standard of living for all
- Create and develop healthy and sustainable places and communities
- Strengthen the role and impact of ill health prevention

It also stressed that these national policies will not work without effective local delivery systems that focus on health equity in *all* government policies, not just the ones which refer to health.

The recent Public Health White Paper ‘Healthy Lives, Healthy People’ (DH 2011a) responds to the Marmot Review and identifies ways to tackle the wider social factors that influence health in order to reduce health inequalities.

Action on reducing the social gradient of health is as much a concern for road safety and injury prevention as it is for the prevention of ill health, given that there is a significant and growing body of evidence showing how injury risk is unevenly distributed across society in a similar way to illness.

A literature review (Towner et al 2005) found that inequality is associated with injury risk in children under fourteen years old because of six key factors; *age, gender, social and economic factors, culture and ethnicity, place, and vulnerable groups*. The factors themselves may not be a direct cause of injury but are predictive of other direct contributors to injury, such as exposure to hazards, and the capacity or power to do something about avoiding or limiting them.

These six factors are interrelated to some extent, but this paper specifically looks at social and economic factors, and place.

2.1 The influence of wider social determinants of safety

Approaches to injury prevention in the past have looked at the immediate events before the injury, such as the focus on energy damage and identifying ways to mitigate its effects (Haddon 1973). These have led to highly successful interventions such as seat belts. However, injuries – like health and illness – can also be seen as having wider social determinants that are associated with a greater likelihood of their occurrence.

It is these differences in these wider social determinants between socioeconomic groups that largely contribute towards the differences seen in injury rates.

The process by which different social factors increase the risk of injury is sometimes unclear on current evidence, even when there is good evidence that shows the increased risk. Similarly, social and environmental causes of injury are highly inter-related and can also bring about other problems which in themselves also increase the risk of injuries. Separating out these effects is an intricate task.

Social determinants can have a long term effect on the risk of injury and it has been argued that a ‘life-course’ approach can be adopted in injury prevention (Hosking et al 2011). This approach looks at addressing these social determinants of injury at all stages of life, and that doing so can have a long term influence on injury risk.

Many of the social and environmental causes of injury are faced by everyone rather than being unique to particular groups within society, but their effect can be stronger or more acutely felt because of the various interactions between causes and an individual’s perceived or actual control over them.

Figure 1 shows the main influences on health modelled in a series of layers (Dahlgren and Whitehead 1991), each of which represents a general level at which safety promoting activities can be targeted. Changes at the upper levels have a positive or negative influence on the lower ones, and similarly influence can go the other way (for example through grassroots campaigns on specific issues).

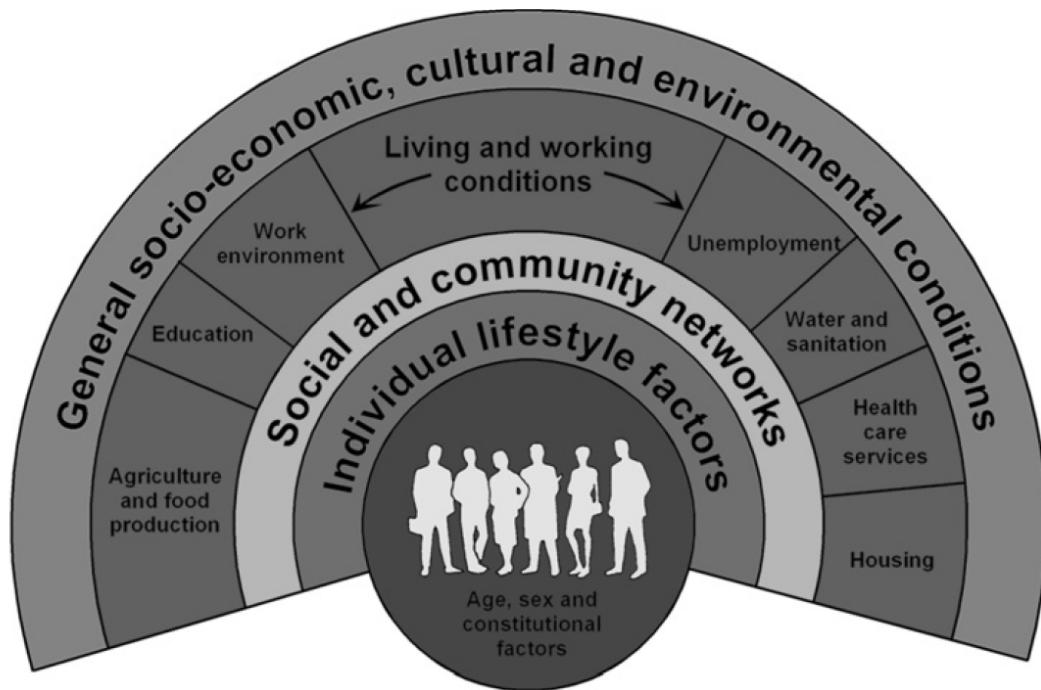


Figure 1: The Main Determinants of Health

Ideas from this diagram can be used to describe the main determinants of someone's safety.

The outside layer of the diagram refers to wider national policies, such as economic strategies, as these have a positive or negative influence on the health of a population despite often not explicitly being designed to do so. The economic situation can influence the number of road casualties, for example, as during a recession it has been argued that the mileage by the higher risk younger drivers reduces, leading to an overall reduction in road casualties (Wiklund et al 2011).

Other examples might be the observations that reducing levels of corruption within a country are necessary for tackling road safety problems (Teik Hua et al 2010) or, that the prioritisation of road safety on the political agenda has led to casualty reductions in Spain (Novoa et al 2011).

The second layer of the diagram encompasses issues such as an individual's living and working conditions, which are result of wider social policies. An example of action on this level might be the funding for road engineering schemes to design safer roads within a community or efforts by companies or regulators to create a working environment that emphasises the protection of employees and the public above an organisation's goal of production when trying to balance the two in a way to avoid a catastrophe.

The social and community networks level is the links between individuals, and within communities. This represents the positive influence that close-knit communities or families may be able to offer when dealing with safety or health problems. Conversely, isolated individuals may have less support around them to help deal with problems. Support between individuals can be either practical or simply someone close who can offer encouragement or help a friend work through problems and develop coping strategies.

Safe and unsafe individual lifestyle factors are well understood within road safety. Issues such as failure to wear a seatbelt, excessive speed or using a mobile phone whilst driving are all examples of individual factors which are linked with an increased likelihood of accident or injury. Road safety education or publicity campaigns are an example of activities targeted at changing individual life style factors.

Whilst the sum total of all road safety activity usually includes work at each of these levels, individual initiatives to improve safety are generally only targeted at one. This can have an impact on the success of road safety work - as improvements made at one level (e.g. the provision of traffic calming outside a school or defensive driver training at work) can be easily offset by changes at another (e.g. an increase in the use of the road outside the school or increased workloads and pressure).

Using this conceptual model, the wider social barriers at higher levels, which prevent safer behaviours, environments, and legislation, are seen as part of the overall burden to injury. The responsibility for individuals towards their safety should not be misinterpreted as a sole responsibility.

It has been argued that European countries with the lowest rates of injury are the same countries that treat safety as a societal responsibility (Sethi et al 2006), and that reducing inequalities in injuries requires an equitable social policy. Legislation and enforcement to ensure safer environments, such as road and house design and the use and availability of safety equipment, were identified as the results of these policies.

Many authors have argued that factors which prevent effective interventions from being widely implemented also contribute to the overall number of injuries (Robertson 1998, McClure et al 2010). Their role needs to be understood in order to identify the conditions for effective injury prevention activities.

3. The Influence of Socioeconomic Status on Injury Risk

The meaning of socioeconomic status used in this paper is taken from previous work on socioeconomic status and health and describes: “*the social and economic factors that influence what position(s) individuals and groups hold within the structure of society*” (Lynch and Kaplan 2000)

In order to understand how injury rates are influenced by social factors, research compares indicators of someone’s socioeconomic status with the risk of injury and then compares this risk between different socioeconomic groups.

There are a range of indicators of socioeconomic status which researchers can use, although often they act as a proxy indicator for wider and more complex social interactions.

3.1 Injury and individual-level measures of socioeconomic status

Often data can be collected which relates to an individual’s socioeconomic status, for example, someone’s occupation, income, education, or wealth. The injury rates in these groups can be compared to see if there are differences. Research that looks at child injury often uses their parents’ socioeconomic status as an indicator.

An example of this is research conducted using data on the number of child (0-15) fatalities from injury and poisoning in England and Wales (Roberts and Power 1996) between 1979 and 83¹. This was linked with the father’s social class (or mother’s social class if this was missing) and found that the rate for children in social class V was 3.5 times the rate for children in social class I (on average 84.7 cases of injury or poisoning per 100,000 children in social class I over a three year period compared to an average of 24.2 cases in social class V).

The research then compared the 1979-83 fatality rates with the fatality rates of children of the same age between 1989-92, and found that over the period they had fallen, but the rate for social class V had fallen less significantly than for children in social class I. This meant that the injury rate for children in social class V had risen to 5 times higher than in social class I (the comparison was an average of 82.9 cases of injury or poisoning per 100,000 children over a three year period to 16.5 in the highest social class).

Other social classes were included in the research, and the fatality rates were higher and reduction over time was lower for the lower social groups, showing a socio-economic gradient to the results.

Motor vehicle and pedestrian accidents were two of the leading causes of fatality amongst children in the data and the change in injury rate between 1979-83 and 1989-92 was compared for these causes. The relatively small numbers of child fatalities in each social class reduced the precision of the analysis; however the research also compared injury death rates between children whose parents did manual and non-manual work.

The rate of pedestrian fatalities fell for both groups between 1979-83 and 1989-92. For children with parents who had non manual occupations it fell from 6.6 to 3.8

¹ excluding 1981 where data was not available

fatalities per 100,000 children (a 42% decline), whereas for children with parents who had manual occupations the decline was from 16.5 to 11.3 (a 32% decline).

The decline in motor vehicle accidents was less steep, although the general trend was replicated between the two time periods. The fatality rate per 100,000 children whose parents did non-manual work fell from 12.1 to 8.0 (a 34% decline) and for children whose parents did manual work fell from 24.1 to 18.7 (a 23% decline).

A later paper in 2001 similarly found wide inequalities in injury rates to children (0-15) between the highest and lowest socio-economic groups in 2001 (Edwards et al 2006a). The paper used the parent's National Statistics Socio-Economic Classifications (NS-SEC) as an indicator of socio-economic group and so the differences between the highest and lowest groups between the two papers are not directly comparable.

The fatality rate of children of parents who had never worked or were long term unemployed was around 13 times higher than that of children of parents in higher managerial or professional occupations. Only 5% of children had parents who had never worked or were long term unemployed, but they accounted for 33% of the child fatalities from accidental injury and poisoning.

Figure 3 is a table from the paper that shows the number of child deaths from injury and poisoning between 2001-2003, as well as the fatality rate per 100,000 children

NS-SEC	Deaths 2001-2003	Rate per year per 100000 children (95% CI)
<i>1: Higher managerial/professional occupations</i>	85	1.9 (1.6 to 2.4)
<i>2: Lower managerial/professional occupations</i>	111	1.6 (1.3 to 1.9)
<i>3: Intermediate occupations</i>	59	2.9 (2.2 to 3.7)
<i>4: Small employers/own account workers</i>	105	2.9 (2.4 to 3.5)
<i>5: Lower supervisory/technical occupations</i>	91	2.7 (2.2 to 3.3)
<i>6: Semi-routine occupations</i>	148	4.0 (3.4 to 4.7)
<i>7: Routine occupations</i>	180	5.0 (4.3 to 5.8)
<i>8: Never worked/long term unemployed</i>	383	25.4 (22.9 to 28.1)
Total	1162	4.0 (3.8 to 4.2)

Figure 3: Child fatality rate from injury by parental occupation group, 2001-2003

Again, the research found that traffic injuries accounted for a significant proportion of the fatalities. Looking specifically at the differences in transport fatalities between NS-SEC 1 and 8 the research found that inequality was highly pronounced in many of these areas. Compared with children with parents from NS-SEC1, the number of fatalities per 100,000 children with parents in NS-SEC 8 was 20.6 times higher for pedestrian fatalities, 5.5 times higher for car occupant fatalities, and 27.5 times higher for cyclist fatalities.

A study based on a small sample of car occupant fatalities used the same NS-SEC information to look at differences between the injury rates between socio economic groups (Ward et al 2007). It found that the 40% of the population who could be categorised in the most affluent NS-SEC groups, accounted for only 22% of traffic

fatalities. Conversely, 13% of the population were in NS-SEC group 7 but accounted for 20% of the casualties.

The study also found that male car occupants aged between 20-64 years in NS-SEC groups 1 and 2 had a fatality rate of approximately 12 per 100,000 population but the rates for NS-SEC groups 3 to 7 were approximately double this.

It has to be noted that this relationship does not look at whether there is any influence of exposure on the fatality rates in each group, and it cannot be ruled out that NS-SEC groups 3 to 7 travel longer distances by car rather than being more at risk when they do travel. Understanding how these two factors influence the fatality rate per population between different groups is essential in order to design appropriate countermeasures that reduces the fatality rates. This is an area where more research is required, and fatality rates per passenger miles may help to reveal the role of exposure to risk.

3.2 Injury and area indicators of socio-economic status

A large quantity of research has linked an area measure of deprivation with recorded cases of injury. Area measures describe characteristics of an area (e.g. area post code, or electoral ward) and measures a specific characteristic of the area (such as the percentage of households below poverty-level income, or amount of unemployment), or more likely, a composite score of many of these indicators. The Index of Multiple Deprivation or the Townsend score are examples of composite indicators.

The strength of this research is that the area data is more readily available. However, it cannot be assumed that every individual or family within the area shares the typical characteristics of someone within it. This means that using an area indicator as a surrogate can be less reliable or miss important relationships.

Studies which use area indicators have found that higher levels of deprivation are associated with a higher fatal injury rate.

An example is a trend analysis of childhood (0-14) deaths from all injuries in Scotland between 1981 and 1995 (Morrison et al 1999). This study obtained the cause of death and residence from the registrar general for Scotland. An area indicator known as the Carstairs' deprivation score was used. This uses a scale of 1-7, where 1 refers to the most affluent areas and 7 the most deprived.

The study found that mortality dropped for all groups. However, as the average number of fatal injuries per 100,000 children from the two most affluent groups (a Carstairs score of 1 or 2) for 1981-83 compared with 1993-95 fell from 9.9 to 5.6, the same comparison for children within the two most deprived groups fell from 17 to 10.7.

Area indicators of socio-economic status have also been used to identify differences in injury morbidity.

A study (Kendrick 1993) looked at 573 injuries to child pedestrians (0-11) in the Greater Nottingham area between 1988 and 1990. This used police records from the STATS 19 form to identify casualties and then used a grid reference to map them against areas of deprivation in Nottingham. Areas of deprivation had been calculated by Nottingham County Council using low income, unemployment, lack of skills, poor housing, poor health, and family problems as indicators of an area's relative deprivation.

As most accidents involving young child pedestrians occur near home, it was assumed that the children lived in the same area in which the injury occurred, and with this assumption the child population in each area could be used to calculate the number of injuries per 1000 children.

The results comparing the number of injured with uninjured children are shown in Figure 4, and increasing levels of deprivation were associated with an increased incidence of child pedestrian injuries.

Deprivation	0-4 years		5-11 years	
	Accident	No Accident	Accident	No Accident
Below average	23	14,805	136	25,929
Moderate	20	4,472	82	7,966
Severe	32	4,198	188	6,795
Extreme	32	4,449	120	6,382

Figure 4 - Child Pedestrian accidents by age and level of deprivation in Greater Nottingham 1988-90

The research also found a strong correlation between the deprivation 'score' of an area and child pedestrian injury rate indicating an association between the level of deprivation and numbers of child pedestrian injuries².

There is also a socio-economic gradient to injury morbidity, and one study examining this used an area indicator of socio-economic status known as the Townsend score as a proxy measure of material deprivation (Hippisley-Cox et al 2002).

The study gathered data on injuries to children under 14 who were admitted to hospital in Trent between April 1992 and March 1997. The measures of injury were hospital admission rates for all injuries, long bone fracture, and long bone fracture requiring an operation³. In total the study identified 21,587 hospital admissions of unintentional injury for children aged 0-4 years and 35,042 admissions of children aged 5-14.

The electoral ward of each hospitalisation case was identified, and in both age groups there was a record in over 99.5% of all cases. This allowed the incidence rates for child injury in each ward to be calculated and compared after dividing the wards into quintiles based on their Townsend score.

The injury mechanism was also available in the hospital records for 92% of children aged 0-4 and 91.8% of children aged 5-14. This allowed transport injuries to be analysed separately.

One of the largest social gradients in the study was of child pedestrians under 15 years old and the rate of injury for children in the most deprived area was 3.54 times higher than the least.⁴

There was a similar but less steep gradient for child cyclist injuries under 15 years old, where there was an injury rate 1.61 times higher in the least affluent area than the most.⁵

There was no strong gradient for 'other' transport injuries.

² For children aged 0-4, $r=0.61$ (95% CI: 0.47 to 0.73). For children aged 5-11 $r=0.68$ (95% CI: 0.55 to 0.77). When $r=1$ there is perfect linear correlation between two variables and 0 indicates no linear relationship. When there is a negative figure there is an inverse relationship.

³ Three severities were used to identify whether the social gradient differs with severity. A definable injury that would almost certainly result in hospital admission was used to try and control for other confounding factors that can affect the likelihood of injuries being recorded, such as proximity to hospital or admission policy.

⁴ 95% CI: 2.95 to 4.54, adjusted to remove the effect of rurality, percentage males, percentage Asian, percentage black and distance from the nearest hospital

⁵ 95% CI: 1.42 to 1.82, adjusted for the same factors

A later England-wide study of hospital admission rates for children examined the variations by level of deprivation in an area and type of settlement (Edwards et al 2008).

The study gathered data from 663,542 admissions to hospitals between April 1999 and March 2004. Of these admissions, 7,840 were serious injuries⁶. Transport injuries accounted for 10% of the admissions and 31% of serious injuries.

This information was linked to the Index of Multiple Deprivation Score (IMD)⁷ of the lower super output area of residence, which was also taken from the patient records. Information from the census was also used to define area type which were; London including all boroughs, urban areas excluding London, town and fringe, and village.

The cases were divided up into deciles by the IMD score. The relative hospital admission rates for each decile were compared against the least deprived, as shown as Figure 5.

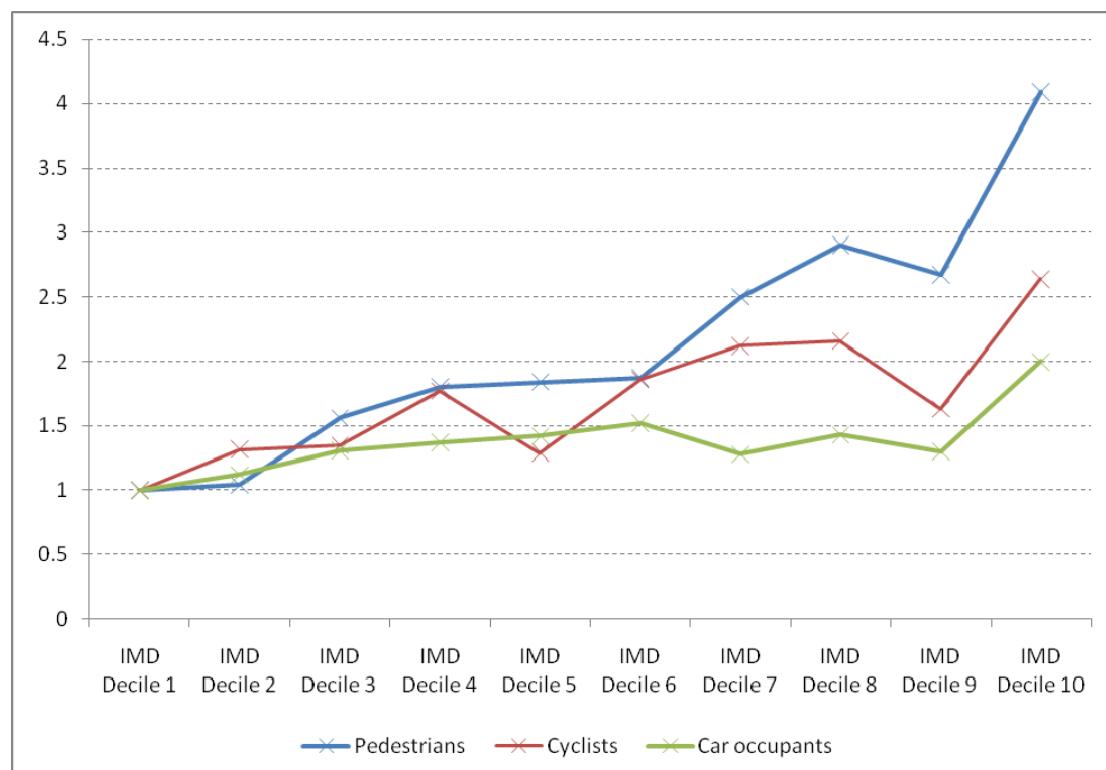


Figure 5 relative serious injury rate ratios in child by mode of transport and IMD decile between April 1999 – March 2004⁸

⁶ Serious here is defined differently to Road Casualties Great Britain which road safety practitioners may be familiar with. In this paper it refers to a smaller number of more severe cases which were sufficiently serious to almost certainly guarantee the patient would be admitted to hospital, for the reasons above.

⁷ This was re-calculated for the study to remove the measures of road traffic injury which usually would contribute to that score

⁸ 95th percentiles are not shown on the graph but are available in the original research; typically there is a large degree of overlap, especially between deciles close to each other. There is overlap between all of the deciles of car occupant fatalities.

Although predominant modes of transport are different in the different area types, there was some evidence that inequalities in cycling injury were greater in rural than urban areas.

Research has also looked into comparing the incidence of injury in adults (Lyons et al 2003). This study used hospital admissions for injury which were recorded in the Patient Episode Database for Wales (PEDW) which contains records for Welsh residents. In total 90,935 emergency hospital admissions were recorded between 1997 and 1999, which were linked to one of the electoral tracts in Wales. These were assigned a Townsend score as the indicator for socio-economic status, and ordered into quintiles based on this score.

In order to allow for wider comparisons, direct standardisation was used with World Health Organisation world standard population. This calculates the hypothetical rate of admission per 100,000 people that would have been seen in the quintile if it had the same age distribution as the standard population used.

The study demonstrated that more people from the most deprived fifth of areas were admitted to hospital.

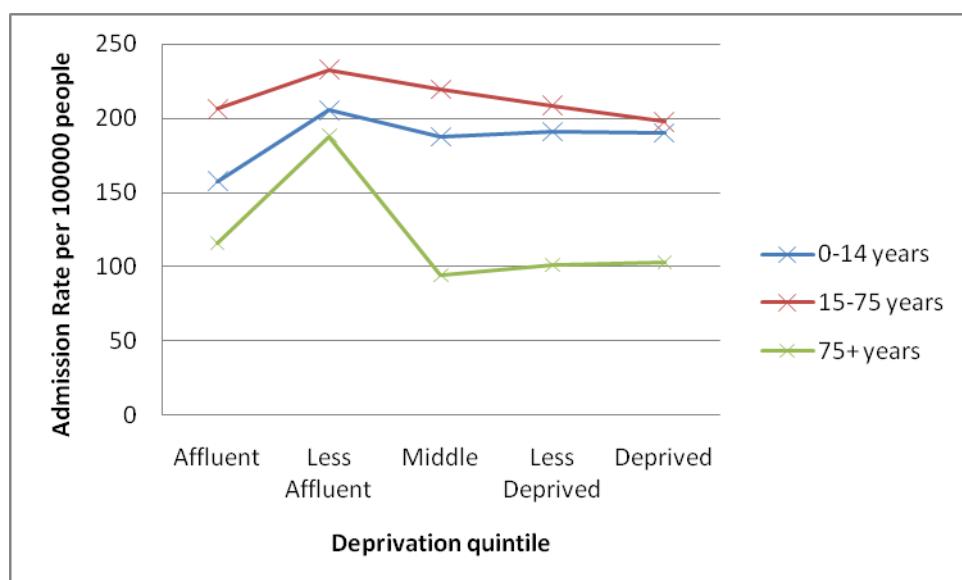


Figure 6: Standardised admission rates per 100000 people by age band for non-pedestrian RTAs in Wales, 1997-1999

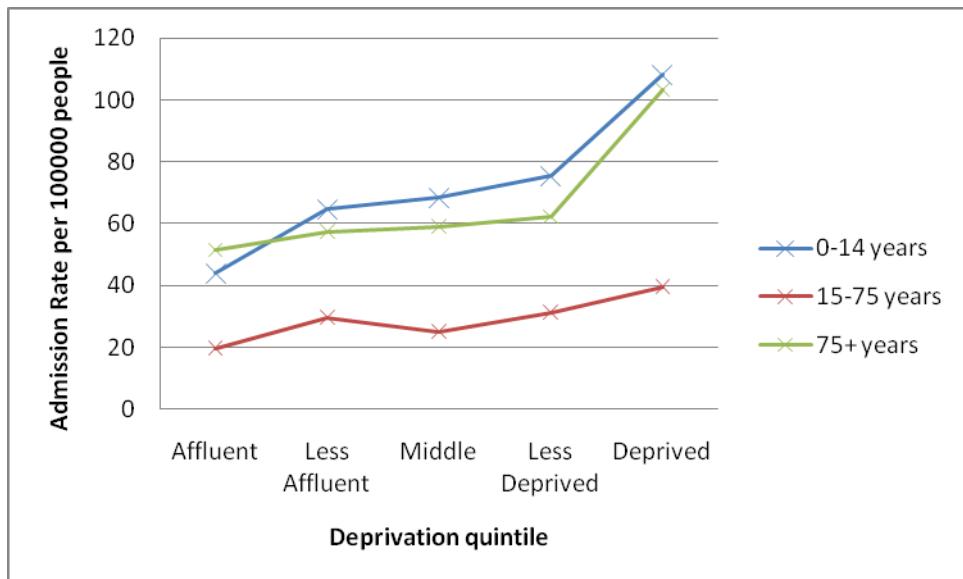


Figure 7: Standardised admission rates per 100000 people by age band for pedestrian RTAs in Wales, 1997-1999

A similar socio-economic gradient exists for child pedestrian injuries and pedestrian injuries of adults over 75. The gradient does not seem to exist of non pedestrian injuries, although as discussed the hospital admission data would not pick up exposure to risk or different transport types in the groups.

Research conducted for Transport for London compared traffic injuries reported to the police and recorded using STATS 19 between 1994 and 2004 with the index of Multiple Deprivation for the area that the casualty was from. (Edwards et al 2006b). The home post code from the STATS 19 record was used to identify in which Lower Super Output Area the casualty was resident. Postcodes from outside London were removed from the analysis, as were records where the post code was not complete, although it is not clear what percentage of records could not be matched.

This research identified that the same relationships between deprivation and child injury existed in London that was seen in previous research.

The research also found that this trend in pedestrian injury also exists for most adult road user groups. The adult pedestrian injury rate in London was nearly 2.9 times higher⁹ for people living in the 10% most deprived areas than for the 10% least deprived. This relationship existed both for all recorded injuries, as well as all recorded serious and fatal injuries.

The adult cycling injury rate was approximately 2.1 times higher¹⁰ for the most deprived decile compared to the least, and again this ratio was mirrored in the ratio of fatal to serious injuries.

There was less evidence of a relationship between deprivation and injuries of any severity for adult car occupants; the rate ratio between the highest and lowest deciles did not vary by a large amount with large degrees of overlap between the 95th

⁹ 95% CI: 2.3 to 3.6

¹⁰ 95% CI: 1.5 to 2.6

percentiles of all deciles. There was more of a suggestion that child car occupant injuries increased for the more deprived deciles.

The Department for Transport conducted an analysis of casualties in English STATS19 data using a similar methodology (Allen 2008). It found that there were valid postcodes available for 83 per cent of reported casualties, which could then be matched against the Index of Multiple Deprivation scores.

Lower Super Output Areas were ordered into deciles based on the IMD scores. The number of people living in the Lower Super Output area allowed casualty rates to be calculated for different types of road user in the deciles, and these are presented in figure 8.

IMD Decile	Casualty rate per 100,000 population						
	Pedestrian	Pedal cycle	Motorcycle	Car driver	Car passenger	Bus or coach	Total
1	70	29	32	162	94	19	422
2	57	30	42	157	77	14	392
3	48	28	42	166	74	12	386
4	42	26	41	170	73	9	376
5	36	24	41	179	71	8	373
6	32	22	38	175	67	6	356
7	29	22	37	178	62	6	347
8	26	20	35	175	63	4	336
9	24	20	34	167	60	4	322
10	21	20	30	162	53	3	297
Total	39	24	37	169	69	9	361

Figure 8: Number of STATS19 casualties per 100,000 population, by IMD decile and road user type: England 2007

Some further trends were noticed in this data and commented on by the author

Firstly, while the casualty rate for pedal cycles did show a gradient, when rural and urban cyclist injuries were analysed separately the difference between the most and least affluent deciles was predominantly caused by a sharp gradient in rural areas. There was very little gradient to the pedal cyclist casualty rates between deciles in urban areas.

Secondly, whilst the casualty rate for car drivers does not appear to have a gradient, the access to cars does. Data from the National Travel Survey identified that the least affluent decile had an average of 0.6 cars per household, whereas the most affluent had on average 1.6. This may indicate a systematic difference in exposure between groups, and also a higher rate per mile travelled in least affluent groups.

4 Why is there Inequality in Injury?

It's important to establish the reasons behind the socioeconomic inequalities in injury, and this paper focuses on two main areas.

- the road environment, habitation and local area
- social environment and deprivation

Similarly differences in exposure to risk between different social groups are examined as a potential explanation.

Quite notably, most of the research looks at the injury risk to children rather than adults.

Recent models of child pedestrian casualties and areas of social deprivation found that the increased number of pedestrian casualties in deprived areas is not solely due to the infrastructure or more dense development which is typically seen in deprived areas, but that there is also an effect from deprivation on injuries which is separate to the effects of the environment (Graham et al 2005).

Sadly, much of the evidence is quite dated, which means that it may not be directly applicable to the present day. However, quite often the older research identifies the same issues as more modern work. This review includes much of the older research to provide a full picture and the applicability of the research will be commented on in the discussion. The age of much of the research highlights the genuine need for more social epidemiology research in injury prevention.

Many of the papers identify personal characteristics as well as social characteristics which lead to an increase in injuries, but as the purpose of the report is to highlight social factors, these have been omitted.

As always when dealing with studies which identify a higher prevalence of certain situations in a population, it cannot and should not be assumed that the characteristics are true of every individual within the population.

Finally, much of the research – especially the early work on inequality and injury – does not differentiate between causes of injury. For quite specific accident types this could be a major issue, however road casualties would arguably count for a large proportion of the hospitalisations in the age groups identified – especially in the periods when some of the research was written. Whilst many of the social factors will underlie all types of injury, further research which looks at the role of social influences on the different direct causes of injury would help to produce a more detailed picture.

4.1 Exposure to risk

As well as factors which make accidents and injury more likely, the number of injuries is also determined by the exposure to risk, which can vary between socioeconomic groups.

Travel patterns and therefore exposure to risk can change over time. One study used data from the National Travel Survey found that between 1985 and 1992 the average distance walked by children aged 1-14 in a year fell by 20% and the average distance cycled fell by 26%. In contrast the distance travelled in a car increased by 40% (DiGuiseppi et al 1997). This reduction in children walking coincided with a reduction in the rate of child pedestrian fatalities per 100,000 people.

If the changes are different between social groups, (for instance, if children from financially better off families increasingly use the car for journeys) then the exposure to risk could account for increasingly divergent injury rates over time.

The number of roads crossed by child pedestrians is one measure of exposure to risk. For example, in one New Zealand study, children aged 5-9 in families in the lowest quarter of income cross 50% more roads than those with families in the highest quarter (Roberts et al 1994).

Car ownership might be another proxy to measure differences in exposure, and has been associated with the risk of being killed or seriously injured as a child pedestrian. In one case-control study conducted in New Zealand children who were selected randomly from the study region were around twice as likely to have access to a car as child pedestrians who were either killed or admitted to hospital following a traffic injury¹¹ (Roberts et al 1995).

Car ownership is typically lower in disadvantaged areas – and is used in some measures of an area’s deprivation, such as the Townsend score. A UK questionnaire study found that 84% of adults from socio-economic groups ABC1 had “access to a car” compared with 57% of adults from socio-economic groups DE. The study also found that children in disadvantaged groups are more likely to walk to school, and are less likely to be accompanied on the journey than children from higher groups (Christie 1995).

A DfT report examined data from 1999 about the travel patterns of children between 5 and 15 years old (Bly et al 2005). It compared children’s exposure to risk as pedestrians in Britain, France and the Netherlands but also examined at the differences in socio-economic groups using 4 categories (AB, C1, C2 and DE).

It reconfirmed that in Britain, fewer children in the higher AB group walked than the DE group. Looking at the length of the average walks the study found that children in the highest AB group spent on average 29 minutes per walk, and children in the DE group spent 12 minutes on average. The authors argued that children in lower socio-economic groups living in urban areas only need to walk shorter distances to get to their destination.

The report also looked at travel to and from school, and found that 35% of children in the AB SEG travel to school by car, compared to 12% of DE. The use of public transport is also higher in the AB SEG with 20% of children using it to get to school, compared with 12% of group DE. Again, this may be an indication that children in lower SEGs live closer to their school.

Risk from exposure is increased by factors such as volume and speed of traffic which are also important indicators of that risk (Stevenson et al 1995, Roberts et al 1995).

4.2 Financial issues

Finance can have an impact on a family’s ability to invest in safety, either by purchasing products which could make their environment safer, or by replacing older products. Families faced with limited finances and many immediate priorities will not be able to make the same investments in safety.

¹¹ The actual adjusted odds ratio was 1.97 (95% CI: 1.06 to 3.66)

In a commentary article on societal influences on childhood accidents, one author identified several overlooked financial factors which can impact on the effectiveness of safety campaigns (Klein 1980).

4.2.1 Safer products

The author argued that the ability to pay for recommended safety improvements was an overlooked issue that limits the effectiveness of approaches to improving safety that requires families to invest in safer equipment (Klein 1980).

Safer products built to higher safety standards are often more expensive and therefore not an option for a family with little disposable income. For example, whilst there are forthcoming regulations requiring new vehicles to be fitted with various safety technologies, it is initially the more affluent who benefit from them. Similarly many of the extra safety features on cars are optional, adding to the price of a vehicle.

Financial issues may prevent many people from removing some of the hazards identified by road safety professionals. For example, regular vehicle services or replacing tyres before they reach the minimum tread depth may be sound safety advice, but also impractical advice for those on a limited budget.

4.2.2 Restricted planning

It was also argued that the amount of forward planning that a family is able to do can also limit investment in safety. Some families, by financial necessity, have to focus on the immediate future and immediate challenges (Klein 1980).

4.3 Illness and disability

Several studies have concluded that illness or disability of a member of the family increases the risk of their children being injured. This was initially found in one of the earliest studies of road accidents and inequality (Backett and Johnston 1959), which used police records of 250 children injured in non fatal traffic accidents as pedestrians in Belfast, and compared them with a control group of who were selected from school health service records. The control group was not selected randomly¹², but was matched by age, gender, school and area of living.

It found that illness in the family was more common amongst the children who had been injured. The authors argued that the parents who were managing with an illness would be less able or have less time to care for their children.

More recent research has collected information on physical disability from parents whose children were involved in road accidents (Christie 1995) but found no significant relationship between disability and socioeconomic group in the sample.

¹² The risk with not using a randomised process is that it may have introduced a selection bias into the way that the controls were picked. This is where a researcher consciously or subconsciously selects individuals with certain characteristics, and it means that there may be a systematic difference between the controls selected and the whole population of potential controls that they were drawn from.

4.4 Family issues

Although families from all backgrounds are faced with problems that can break up a family or impact on a family's capacity to look after their children, the frequency and influence of this impact on safety can vary depending on other social circumstances.

4.4.1 Family structure

Several researchers have commented on how family structure influences the risk of injury. One article collected and reviewed 24 case studies of children who had made repeated visits to hospital. The authors identified family disturbance as a re-occurring issue in the cases that they had seen and commented that this resulted in children getting into an increased number of hazardous situations, both accidentally and deliberately (Husband and Hinton 1972).

The association between family problems and injuries was later identified in a larger cohort study of 16,000 children born in the UK in 1958 (Pless et al 1989). Information about a range of risk factors were collected from parents, teachers, and physicians when the children were 7, and the same survey was repeated when they were 11. It found that three measures of family disruption were associated with traffic injury, which were 'family problems' overcrowding of the home and children being removed from the family and placed in the care of the local authority

Other research linked 'atypical' marriage status with injury risk, and noted that this was more predominant in lower socio-economic groups (Christie 1995). In 56% of cases parents with 'atypical' status did not have a partner. It was argued that further research was required to see how 'atypical' marriage status affected child behaviour and amount of supervision.

Research has identified two common family groups which are associated with increased risks – single parent and large families.

4.4.2 Difficulties faced by single parents

There are several studies which found associations between all injuries and single parent families.

The Child Health and Educational Study (CHES) was a cohort of 17,588 children born one week in April 1970. This was used to gather information about the safety of children and at an interview 5 years after their child's birth parents were asked about a variety of medical, social and development topics, including self reported information on accidents and hospital visits (Wadsworth et al 1983).

The research found that children in step-families were more likely to have had a reported accident, or repeated accidents. This was also found in single-parent families although it was much less pronounced. Children in single parent or step-families were twice as likely to be admitted to hospital as children living with two natural parents.

The research did not directly compare the accident rates in children living with step parents to biological parents, as the only point that information about the family circumstances was collected was at the 5 year interview, whereas the accident could have occurred at any point within the five years.

The increased risk to children in single parent families was also identified in a novel case-control study, which tried to control for effects from the home environment or area of habitation, which might have confounded the relationship, by only selecting cases where an injury at school caused a child to be admitted to hospital (Petridou et al 1994).

Three matched controls¹³ were randomly identified as a comparison for each case from the same class register. The study found that children who were injured were around 5 times more likely to be from single parent families¹⁴.

A review of why children of single mothers were more at risk highlighted three interrelated social factors – poverty, poor housing, and social isolation (Roberts and Pless 1995). The authors identified three primary sources of income for single parent families: spousal maintenance, benefits and paid employment. The authors argued that of these, paid employment offered the best escape from the ‘poverty trap’. However, the lack of affordable or publically funded day care limited the employment opportunities of lone parents. They argue that provision of this day care would result in a reduction of childhood injury.

How social isolation increases the risk of injuries is unclear, but it is suggested that the lack of support has an impact on someone’s psychological health, which is established as causing maternal depression, which itself is established as increasing the risk of childhood injury. There are strong randomised controlled trials of programmes which reduced the frequency of injury to children in single parent families by offering support to mothers with young children (Johnson et al 1993).

4.4.3 Access to childcare

Some authors have identified that childcare can have positive academic and social benefits for children. (Bradley and Vandel 2007). These can be some of the social factors which are protective against injury although the relationship between child care and traffic injury has not been examined. Some research has looked at childcare and all injury.

A large cohort study in the UK used information from 18,114 children aged 9 months old and 13,718 children aged 3 years old and looked at whether the type of child care¹⁵ has an influence on the likelihood of injury (Pearce et al 2010). Overall it did not find an association between type of childcare and injuries, however it did find some trends when looking at different socioeconomic groups.

For children at 9 months old, it found that children of parents whose jobs were classified as ‘managerial and professional’ were less at risk of an injury when in formal child care compared to parental or informal child care. It also found that children of mothers who had achieved A-C grades at GCSE were also less at risk when in formal childcare compared to parental or informal child care.

This contrasts with parents who were classified as having ‘routine and manual’ jobs or whose mother’s had achieved D-G grades at GCSE, where children were at a greater risk of injury when in formal childcare compared to parental or informal child

¹³ Matched on age, school and gender

¹⁴ 95%CI 1.90 to 13.71

¹⁵ The study used three categories – formal childcare (provided through public, private or voluntary institutions such as nurseries or childminders), informal childcare (by relatives, friends or neighbours, often on an unpaid basis), and parental childcare.

care. The paper suggests that further research is required to understand these findings.

For children at 3 years, the study found that children in informal care whose parents were categorised as having ‘routine or manual’ jobs or who lived in the least affluent areas were more at risk of an injury than children who were looked after either formally or by their parents. There were no other significant findings for children at this age.

Similarly, a systematic review of eleven randomised controlled trials provided strong evidence that home visits are associated with a reduction in all categories of unintentional injuries (Roberts et al 1996), although research has not specifically looked at whether it has an influence on road traffic injury. Home visits are a component of early intervention programmes to support families in the early years of their child’s life in order to improve long term health. (Marmot 2010)

4.4.4 Difficulties faced by large families

Some studies have looked at whether children from large families are more at risk of injury. This is related to the issue of living in an overcrowded accommodation, which was one of the main predictors of injury found in a UK cohort study of childhood accidents (Pless et al 1989).

Families in lower socio-economic groups are more likely to live in crowded housing. A study in the UK (Christie 1995) determined the percentage of families in different socioeconomic groups living in crowded housing¹⁶ ss shown in Figure 9.

Socio-economic Group	“Un-crowded”	“Crowded”
ABC1	259 (97%)	7 (3%)
C2	166 (93%)	13(7%)
DE/other	163 (87%)	24(13%)

Figure 9: Data from a road safety survey on the number of families living in crowded and un-crowded accommodation

Based on this survey, several reasons why children from families with large numbers of children¹⁷ may be more at risk were suggested. Larger families may have less disposable income, and the parent may be less able to supervise all of the children. This was particularly the case if the parent was mainly preoccupied with looking after a very young child.

4.4.5 Age of parent

A large cohort study of injuries from all causes found that the mother’s age was associated with the risk of accidents. The children were grouped into three categories depending on maternal age; under 20, 20 to 29 and 30 and over. In the cohort, 51.6% of mothers under 20 reported that their children had had one accident before the age of 5, and 16% reported that their child had had more than one accident. This compared with 39.9% of parents over 30 reporting one accident and 10.1% reporting two or more.

Children of mothers under 20 at the birth were almost twice as likely to report that they visited the hospital as children of mothers over 30, and the comparison was 9.6% and 4.9% of mothers respectively. (Wadsworth et al 1983).

¹⁶ defined as more than 1.5 people per room

¹⁷ defined as 3 or more children

4.4.6 Frequent moves

The large cohort study previously compared the hospitalisation rates of children with the number times they had moved house (Wadsworth et al 1983). Children in families which move frequently are more at risk of being involved in an accident.

In the study, 5.4% of children who had not moved house had been admitted to hospital after an accident, this compared with 7.3% of children who had moved once, 8.8% of children who had moved twice, and 9.3% of children who had moved three times.

4.5 Ethnicity

Research has sometimes looked at inequalities in injury risk between different ethnic groups. Given the differing proportions of ethnic groups in different socio-economic groups, many studies have investigated the relationship between ethnicity and injury risk as a potential explanation for the social gradient in injury.

However, the relationship between ‘ethnicity’ and injury risk is complex, mainly because of the difficulties in defining or measuring ‘ethnicity’ in a meaningful way. Due to this, the current preference is for people to define their own ethnicity based on what is meaningful to them¹⁸.

Whilst there is clearly nothing inherently risky as categorising yourself as part of a specific ethnic groups, the social constructs around ethnicity and identity and the way that these interact with the wider social and physical environment can create differences in risk.

Definitions of ethnicity can vary dramatically between individuals and communities. Social constructs of ethnicity and external reactions to them can change over time and between locations, which may explain some of the potentially contradictory results between studies that look at ethnicity and injury rate.

For example, two studies in the mid 1990s independently found that Black Asian and Minority Ethnic children (BAME) are overrepresented in road accidents. One study identified children who had been injured on the road in five areas¹⁹ and compared them against a comparison group, finding that ‘non white’ children were roughly twice as likely to be injured (Christie 1995). Similarly, a study in Birmingham in the early 1990s found that per head of population, child pedestrians of Asian origin were twice as likely to be injured as non-Asian children (Lawson and Edwards 1991).

Conversely, a study examining child pedestrian injury rates in London by ethnic group and deprivation deciles several years later found that Asian children were at a lower risk of injury compared to non-Asian children (Steinbach et al 2007). The results of this study are presented in figure 10.

¹⁸ For example, for the purpose of the 2001 Census, the Office of National Statistics defined ‘ethnicity’ as: *Membership of an ethnic group is something that is subjectively meaningful to the person concerned, and this is the principal basis for ethnic categorisation in the United Kingdom. So, in ethnic group questions, we are unable to base ethnic identification upon objective, quantifiable information as we would, say, for age or gender. And this means that we should rather ask people which group they see themselves as belonging to* (ONS 2003).

¹⁹ Bradford, Bristol, London, Merthyr Tydfil and Reading

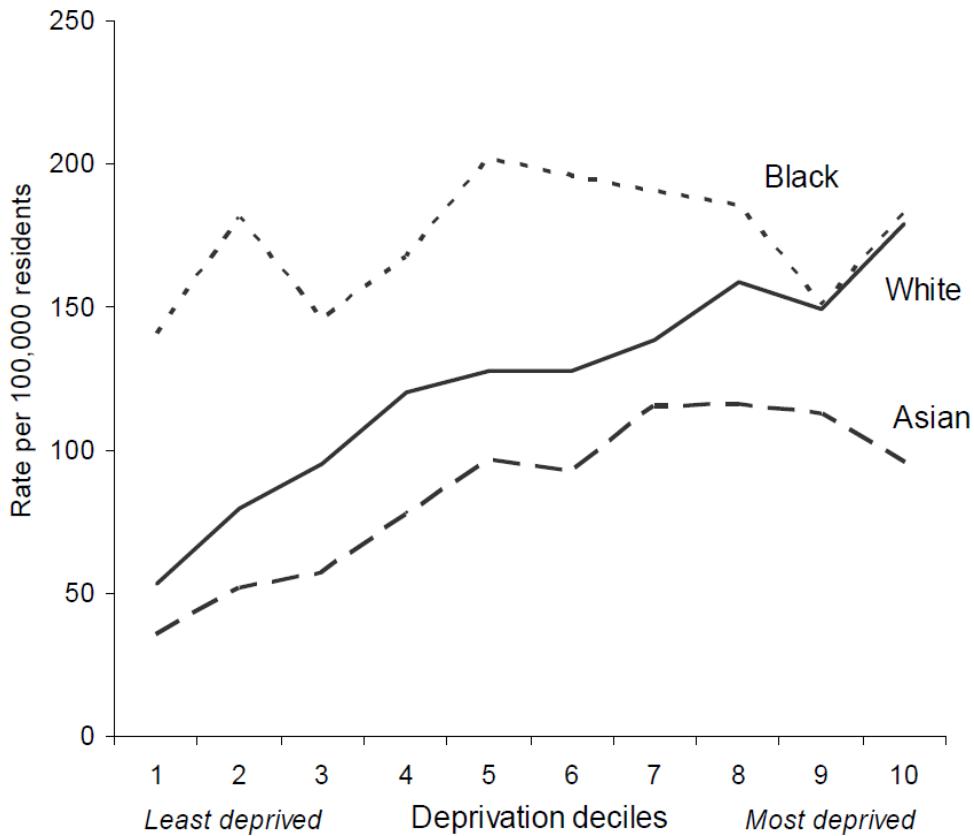


Figure 10: traffic injury rates in London by deprivation decile and ‘ethnicity’

Similar to the overall relationships between injury rates and deprivation, the pedestrian injury rates amongst ‘White’ and ‘Asian’ children increased with deprivation. However, the rate of injury of ‘Black’ child pedestrians did not change with any significance.

This relationship also existed for ‘White’ and ‘Asian’ adult pedestrians, and although there was slight evidence that ‘Black’ adult pedestrians in the most deprived decile were more at risk than those in the least, there was little evidence of a relationship between deprivation and pedestrian injury rate. The authors do highlight several methodology issues such as the accuracy and completion rate of the ‘ethnicity’ code in STATS 19, the uncertainties with extrapolating population data from the 2001 census. Broad terms such as ‘White’ ‘Asian’ and ‘Black’ are imperfect for measuring ethnicity and do not necessarily represent any real communities or ethnic identities.

Some researchers have noted that relatively few studies look at what causes differences in health between different ethnic groups in more depth and that further investigation in how cultural and environmental factors interact to create this increased risk are necessary (Bhopal 1997).

4.6 Migrant groups

Many studies have highlighted specific health difficulties typically faced by migrant populations, based on lower social service entitlements and reduced access to health care for political, administrative and cultural reasons (Bollini and Siem 1995).

It is argued that there is a ‘country of origin’ effect (Thomson and Tolmie 2001) where migrants from similar cultures to the UK do not find the road environment drastically different from their home countries and adapt quicker. Families of first, second, and latter generation migrants would be expected to be of lower risk.

There is some evidence that a ‘similar country of origin’ does not increase risk. A study in Canada found little difference between the traffic injury rates of Canadians and American, Scottish, Italian and English immigrants (Trovato 1992).

Linguistic barriers were also an issue, and in some studies the research method itself highlighted issues faced by road safety campaigns (Christie 1995). Several parents in the study from ethnic backgrounds had not been living in the UK for long, and in some of the interviews, the children had to act as a translator between the interviewer and parent.

4.7 A disconnect with road safety ETP

Several authors have highlighted that road safety ETP initiatives often failed to connect with parents in lower socio-economic groups. This could be either due to the message and medium chosen, or that interventions were not directed at these groups. The effect of this is to create an inequitable use of resources.

One author argues that the modes of communication chosen are often the ones which are used predominantly by the ‘middle class’ citing pamphlets, community campaigns, group discussions and school-originated check lists as examples. He argues that these are not typical sources of information for parents in lower socioeconomic groups (Klein 1980).

Although people across all social groups have a good level of road safety knowledge, the impact that this knowledge has on people’s lives can be variable, and depends on the other issues with which people have to contend. One study found that in deprived areas, road safety risks were often much further down people’s priorities when they felt there were more immediate factors to contend with, such as criminality, anti-social behaviour and neglected and derelict buildings (Lowe et al 2011a).

Some international evidence has found that initiatives designed for all might be predominantly utilised by the most affluent groups. One study looked at where walking buses had been set up in Auckland (Collins and Kearns 2005), and found that they were predominantly available in the most affluent areas where the risk of child injury was less likely. It could be argued that this demonstrates that the activity was not based around a population’s need for an injury prevention activity, leading to an inequitable use of resources.

Although parents from all backgrounds shared the same concerns over child safety, there were more impediments to parents volunteering in the most deprived areas, such as the lack of time, skills and resources or employment routines such as shift

work. The authors noted that responsibility for organising the only walking bus route in the most deprived area lay with teachers from the school.

4.8 Place

The physical environment can greatly influence the number of injuries, and their severity. This can be especially true in areas that were built before cars became much more common as in these areas the road may not have originally been designed for the range and number of road users. Similarly the layout and available space can limit how much can be done to reengineer the road and make it safer.

Research in the West Midlands found that high accident rates were associated with habitation in Victorian terraced houses (King 1987). The reasons for this were associated with the layout of long and straight streets which encouraged faster vehicle speeds. Similarly, areas which are predominantly made up of Victorian housing rarely have garages, which encourages on-street parking.

There has been debate over whether on-street parking increases or decreases the risk of being involved in an accident. Other research has reached the opposite conclusion (Christie 1995), finding that children were less likely to be injured on roads with on-street parking. It identified that living on arterial roads and through routes where there was less parked traffic, but higher traffic speeds and volumes, was a predictor of accident involvement.

Parents in deprived areas voice concerns about the speed and the volume of cars, as well as raising specific issues such as illegal joyriding, scooters and mini-motos (Christie et al 2010).

4.8.1 Access to facilities

Very early research in the UK into some of the social factors of road accidents involving children aged 5-14 found that the lack of protective environments²⁰ for children to play in was associated with the risk of an accident (Backett and Johnston 1959).

Studies have found higher levels of street recreation amongst lower socioeconomic groups, which was also less likely to be supervised (Christie 1995). Conversely, membership of out of school clubs was linked with less time playing in the street and fewer accidents. Leisure Services in Local Authorities can provide a key role in providing activities to reduce the time spent by children playing close to roads (Lowe et al 2011a).

As well as a lack of suitable activities for children outside of school, the lack of safe and accessible locations to play could also lead to children playing on or around roads.

A theme which emerged from focus groups conducted with parents in deprived areas was their anxiety about their children playing in the street. However, parents also felt there was little else for their children to do and that they could at least observe children in the street by the house. Parents also felt that children would prefer to go

²⁰ In the paper, if a child was either; without anywhere to play at home, or without local facilities for play, or did not use them if they existed, their play was regarded as "unprotected", other children were regarded as "protected". Children in both groups sometimes played on the roads, which is a significant difference between the era when the research was carried out, and now.

to clubs or other organised activities rather than play on the street but that there were either limited opportunities to do that, or that parents were not aware of them where they did exist (Christie et al 2010).

Many parents identified there was a lack of safe public space and regarded parks as ‘inaccessible’ due to both the people who used them, such as gangs or bullies, and the unsafe environment that this created due to dog mess and alcoholism. Discarded syringes were a concern to many parents.

Some parents were concerned about changing land use and that some parks had been turned into car parks.

The lack of garden space in housing built in less affluent areas is also a common theme in research on why children play in play in the street (King 1987, Lowe et al 2011a).

5. Addressing Inequality in Prevention Work

The effects of wider social factors on injury have large implications for road safety activities, although there can be considerable difficulties in addressing inequality and deprivation. Road safety education generally deals with preventing one of the results of inequality and deprivation rather than targeting the ‘upstream’ causes.

Whilst there is research which demonstrates how and why socioeconomic status contributes to the risk of injury, there are relatively few published evaluations of programmes that have tried to reduce injury inequality.

However, road safety interventions can be designed to address the effects that inequality can have on injury risk, and can measure any changes as part of the evaluation. Conversely, failure to consider the issues identified in this policy can increase injury inequality between the highest and lowest socioeconomic groups.

In order to address inequalities in health, packages of measures may be more successful than single initiatives. It has been suggested (Brussoni et al 2008) that the following are characteristics of successful initiatives for tackling inequalities in road traffic injuries:

- the use of multi-faceted approaches that include educational, engineering and enforcement strategies,
- engineering measures providing quantifiable cost-effective reductions in injuries,
- the inclusion of partners from multiple sectors and disciplines,
- the engagement and involvement of the community,
- local data to identify patterns in pedestrian injuries, to target interventions to areas of high risk and to enable evaluation,
- addressing barriers to physical activity through transport policies, making walking and cycling attractive alternatives,
- integrated guidance from different government departments, and
- flexibility at the local level allowing for the possible joint funding of initiatives between departments and agencies, as well as creative thinking encompassing a range of perspectives and experiences.

5.1 Empowerment and community involvement

The wider contextual factors set out in Figure 1 and explored in chapter 4 have a large influence on someone’s safety, however, they can also be a moderating factor that prevents people from adopting the ideal safe behaviours promoted by road safety campaigns.

As these wider factors can have a moderating effect on road safety education, it is important to address or acknowledge them when designing road safety education, training and publicity interventions.

If people do not see the advice from road safety interventions targeted at them as relevant, then they may discount the information. Similarly, they may find that attempts to adopt safer behaviours are limited by the social context that the campaign does not take into account.

One common theme in the literature on reducing the social gradient of health is community involvement in health programmes which empower individuals, groups or

communities to change some of the wider influences to their health. This can ensure the relevance of the campaign and address some of the barriers to adopting safer behaviours.

Internationally, the World Health Organisation has set out the importance of strengthening community action, which was one of the main strands of the Ottawa Charter on Health Promotion (WHO 1986).

“Health promotion works through concrete and effective community action in setting priorities, making decisions, planning strategies and implementing them to achieve better health. At the heart of this process is the empowerment of communities - their ownership and control of their own endeavours and destinies.

Community development draws on existing human and material resources in the community to enhance self-help and social support, and to develop flexible systems for strengthening public participation in and direction of health matters. This requires full and continuous access to information, learning opportunities for health, as well as funding support.”

Within the UK, one of the key messages from the Marmot Review (Marmot 2010) is that

“Effective local delivery requires effective participatory decision-making at local level. This can only happen by empowering individuals and local communities.”

Community involvement goes hand-in-hand with the idea of empowering that community by giving people more control over the factors that influence the health of the community or the safety of people within it. The word ‘empowerment’ is often deployed to mean different things, and it is likely that a definition would not capture all of these meanings. However in the broadest sense, it might be seen as “...the process by which disadvantaged people work together to increase control over events that determine their lives” (Werner 1988)

What is more important than a rigid definition is how people describe how the concept relates to themselves and action within communities

A series of focus groups commissioned to support the Marmot Review looked into these issues with participants from SEG D and E, and within each group there were several participants with experience in community involvement and volunteering (Opinion Leader 2009).

Although the phrase ‘empowerment’ is used widely in academic literature, participants felt that it was unfamiliar and off putting, and phrases such as ‘community action’, ‘community unity’ and ‘community enabling’ were often suggested instead.

There was a great deal of enthusiasm for finding community based solutions to some of the issues participants described, and the researchers identified several themes

- A desire to reconnect and recreate lines of communication within communities and across cultural groups

- A will to use this act of recognition and togetherness to initiate and build opportunities within communities e.g. by sharing skills or simply building confidence
- Aspirations in particular for solutions driven for and by the next generation (their children)
- The importance of change being delivered via a partnership between trained professionals but also importantly with those who have experience of the issues being addressed

It is important to separate the idea of being empowered to do something, and being made responsible for it. The worst case scenario is when an individual or community is made solely responsible for overcoming the effects of the wider determinants of health which they have very little power to change.

5.2 What should campaigns be trying to change?

The ultimate goal of road safety work is to prevent deaths and injuries. This is done by designing interventions that have an influence on factors that frequently cause injury.

For example, a road safety education campaign may be designed to change the attitudes of individual drivers towards speeding by providing them with information on the consequences.

The causal chain of this campaign²¹ is therefore based on the following steps,

- An increase in a driver’s knowledge about the consequences will change their attitudes towards speeding
- This change in attitudes will also change a driver’s behaviour, so that they will reduce their speed
- This reduction in speed will reduce the likelihood of an accident occurring.

As this policy paper has argued, social factors both underpin the likelihood of an accident occurring as well as moderating the effectiveness of the steps in this chain. Knowledge of their effect is an important part of understanding how to prevent road traffic injuries, as well as understanding their cause.

These wider influences should also be seen as contributing towards the burden of injury and as factors that road safety interventions can try to change and their effect can be considered in planning and implementing road safety interventions.

A conceptual system model for how these wider factors link together has been adapted from previous work on the causes of coronary heart disease (Marmot, 2000) and is presented in Figure 11. Elaborating on diagrams such as this or drawing systems maps may be useful when identifying the influence of social determinants of injury on road safety interventions. They can also help to identify the context that the intervention is taking place in.. An expanded list of determinants of safety is presented in Chapter 10 of this policy paper and may help when using this type of systems thinking approach.

²¹ Essentially chain of events following a road safety intervention that describe the process by how the intervention will decrease injuries. For more information see Hall and O’Day 1971 or Elvik 2003.

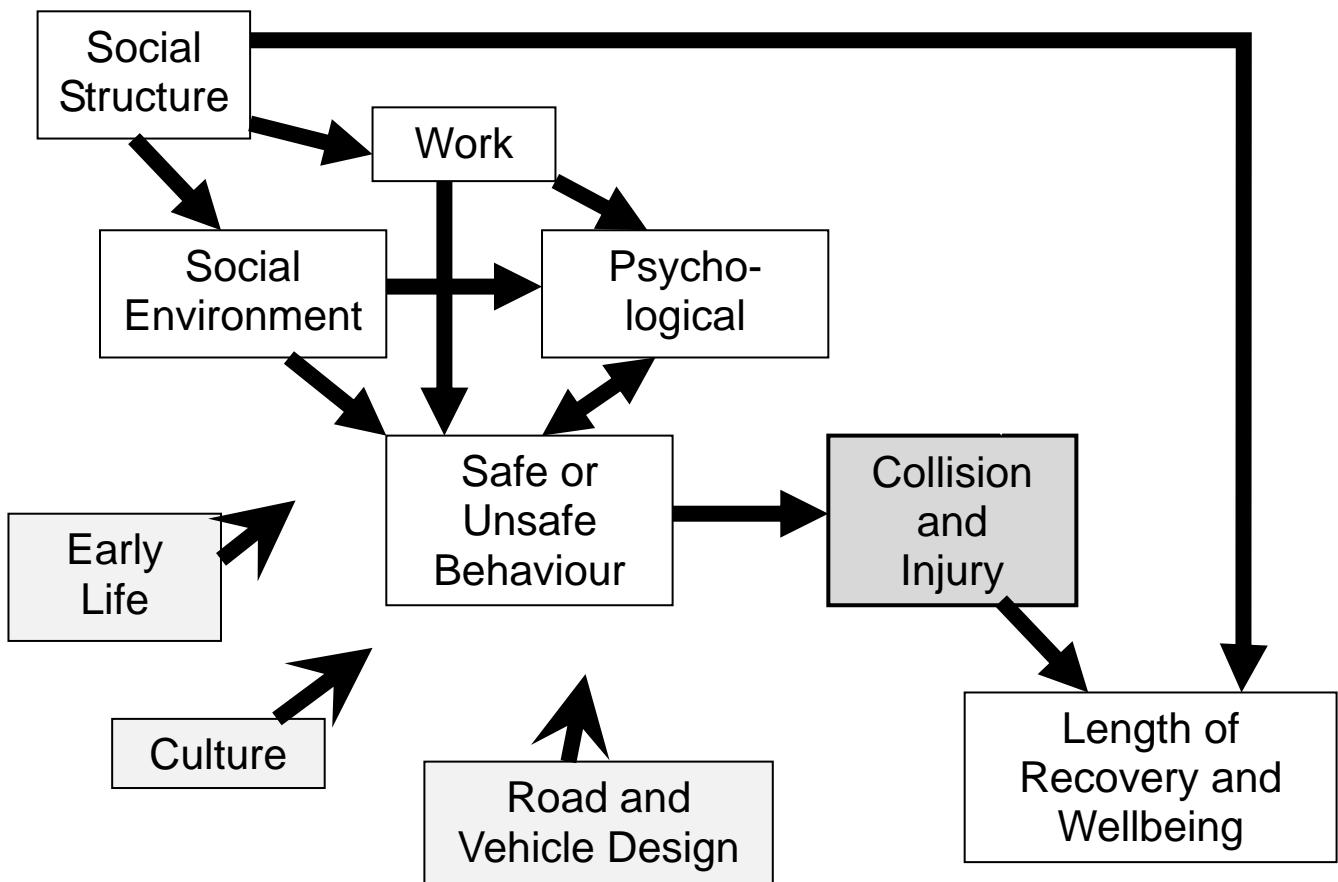


Figure 11 a conceptual model which links together the causes of injury

Whilst the evidence on the common or underpinning causes of accidents should be used to guide interventions, it is not necessarily true that understanding the problem means that the best solutions also become known. There is relatively little published evidence on what sort of interventions are required to tackle the social determinants of safety, and which will be most effective.

A ‘review of reviews’ looked at the evidence from systematic reviews of interventions designed to tackle the wider social determinants of health and health inequalities (Bambra et al 2010). The interventions included in the review addressed the outer two layers of the social determinants of health diagram shown in Figure 1 (on page 10). Several systematic reviews were found although in many areas there were gaps in evidence, and many of the reviews did not look at outcomes such as what effect the interventions had on health inequalities.

Very few of the studies looked at in the review were specifically about road safety; however, many of the interventions did try to address the wider social determinants of health, both within and outside of the workplace

Given the reciprocal link between unemployment and ill health, several of the reviews looked at assisting people to re-enter work following or during periods of ill health, and found that although the intervention improved employment outcomes, they found little impact on someone’s health within the time period observed.

Seven systematic reviews of workplace interventions were identified that looked at interventions to increase employee control (for example through engaging staff about ways to improve the work environment or restructure tasks). This found that there were consistently positive health effects when job control was increased (and vice versa), and changes to shift patterns could have positive impacts on health.

Another review of safety education (RoSPA 2008) led to the development of 10 principles of effective safety education in schools. These principles highlight the importance of empowering young people by involving them in real decisions to help them stay safe, and using active learning which draws on the learner's personal experience.²² In addition, the principles identify that effective safety education involves the whole school or community to help reinforce messages and to take steps themselves to keep children safe.

5.2.1 Initiatives which have attempted to address wider determinants of injury

There are some examples of initiatives which have tried to address social determinants of injury. These have often involved community engagement and building wider partnerships. Because of this, initiatives are typically structured along ‘horizontal’ rather than ‘vertical’ lines - in that they target all injuries or a wider specified range of injuries in a particular age group, rather than a single issue such as road safety or cycling in all age groups.

An early example of an initiative which was evaluated is the Safe Kids/Healthy Neighborhoods Injury Prevention Program in Harlem (Davidson et al 2004). This took place in an area where 39.5% of inhabitants lived below the poverty level, and where there was a comparatively high and worsening rate of severe injuries in school aged children (5-16 years old). Traffic injuries were a leading cause of severe injuries in the area.

On the basis of this trend, a Safe Kids/Healthy Neighborhoods Coalition was brought together, and 26 different organisations participated with shared objectives to

1. Renovate Central Harlem playgrounds
2. Involve children in safe, supervised activities that would teach them useful skills
3. Provide injury and violence prevention education
4. Provide safety equipment (such as bicycle helmets) at a reasonable cost.

The numbers of injuries were taken from the medical records of the two hospitals in the area, using an injury surveillance system that had been established in North Manhattan from 1983. The US census gave the population size in 1980 and 1990 and the population size in between these two years was estimated. This allowed injury rates to be calculated.

²² The ten principles and accompanying literature review are freely available to read on the RoSPA website at <http://www.rospa.com/safetyeducation/policy/ten-principles.aspx>

In the targeted age group, there was a 26% reduction in the injury rate during the three years following the intervention, compared with the six years before.²³ Comparing the same periods there was a 44% reduction in the rate of injuries which the intervention was designed to prevent.²⁴ However, in the comparison area there was a 30% reduction in the severe injury rates to all school age children.²⁵

Based on the idea of community participation, the World Health Organisation promoted the ‘Safe Communities’ model based around the idea that injury prevention must include community level programmes which involves community participation.

This has been the model used for community oriented injury prevention initiatives worldwide (WHO Safe Communities, 2012). By their nature, safe communities are designed to address different problems in different ways. However, there are currently seven indicators that communities have to fulfil to be designated as an International Safe Community:

1. An infrastructure based on partnership and collaborations, governed by a cross- sector group that is responsible for safety promotion in their community
2. Long-term, sustainable programs covering genders and all ages, environments, and situations
3. Programs that target high-risk groups and environments, and programs that promote safety for vulnerable groups
4. Programs that are based on the available evidence
5. Programs that document the frequency and causes of injuries
6. Evaluation measures to assess their programs, processes and the effects of change
7. Ongoing participation in national and international Safe Communities networks

A systematic review was conducted to estimate the effectiveness of the Safe Communities model (Spinks et al 2009) at reducing injuries. In order to be included in the review, a study should have evaluated initiatives fulfilling the WHO Criteria for safe communities, been aimed at a whole population within a community, or specifically targeted sub population, and measured changes in injury rates before and after the initiative. Studies which used self reported injuries were excluded from the review. A fuller description of the search method is available in the review itself.

Twenty one different evaluations were found, although there was a wide range of different approaches taken to community safety which are described in more detail in the review. In addition, there was difference in the length of follow up in the studies, ranging from 1 to 14 years.

The differences between interventions and evaluations made an overall estimate of effectiveness inappropriate. Whilst some of the safer community initiatives had a large effect at reducing the number of injuries, others did not. The authors suggested that this could be due to a failure in the model used, ineffective interventions within the initiatives, or a lack of intensity in the interventions that were part of the initiative.

Despite the disappointing findings from some of the studies, the Safe Community model should provide a good basis for wider community involvement, but with the

²³ It may be of interest to some readers that the actual relative risk was 0.74 with 95% CI 0.62 to 0.89

²⁴ The relative risk was 0.56 with 95% CI 0.45 to 0.71

²⁵ The relative risk was 0.70 with 95% CI 0.59 to 0.83

proviso that establishing Safe Community is not sufficient on its own to guarantee a reduction in injuries.

Similarly, there is potential to try and link one-off interventions with wider initiatives that can address social determinants. The RoSPA Young Drivers at Work Workshops (RoSPA 2010) are an example of a workplace intervention designed to address some of the social factors which influence the safety of young drivers who use the road for work. It can be used to encourage young drivers to become advocates for workplace safety and to improve some of the policies that an organisation already has in place. The workshop does this by getting young drivers to share examples of how they have changed some of the work pressures that influence the way they drive, improving communications with managers, and by providing information to an organisation about how driving for work policies on paper are actually used and interpreted by drivers and managers.²⁶

Evaluations of road safety interventions can also examine whether they are increasing or decreasing injury inequalities. Changes to the road environment by introducing traffic calming schemes are a road safety intervention which has been evaluated in this way, and have been shown to be effective at reducing the number of accidents across the social gradient (Jones et al 2005; Steinbach et al 2010).

5.3 Facilitators and barriers to community involvement

There are many barriers to community participation in road safety and in reality it may be a major challenge to get large numbers of participants from communities involved (Collins and Kearns 2005). A review of the barriers and facilitators to community participation in road safety initiatives was conducted (Howat et al 2001), which grouped barriers into two broad categories covering personnel and planning issues and are worth repeating here:

Personnel Issues

- A reduction in social capital
- Lack of time of community members
- Lack of leadership
- Lack of relevant skills and knowledge of community members

Planning issues

- Adherence to one approach or process
- Top down or bottom up planning
- Inappropriate program focus
- Inappropriate program evaluation
- Lack of funds and resources
- Lack of sustainability

²⁶ A guide to running this workshop is also available on the RoSPA website at <http://www.rospa.com/roadsafety/youngdriversatwork>

5.3.1 Personnel issues

A reduction in social capital – social capital describes the networks and trust within a community and between individuals that facilitates cooperation for mutual benefit. Improving social capital itself may be an outcome for community involvement. However, low levels of social capital initially in an individualistic society or community may mean that there is less will to work on projects for a common good. Pre-established community groups can be ideal partners, however some projects which have tried to engage community groups found that many had disbanded or only consisted of one or two people (Chapain and Freeman 2011)

Lack of time of community members – community members involved in projects may find their priorities or circumstances change. Without people who have adequate time to dedicate towards the project, components which rely on community engagement may not be delivered. People involved in projects need to feel that their time is not wasted, and programmes might initially be targeted at ‘easy wins’ in order to demonstrate what can be achieved by the approach.

Lack of leadership – community projects are usually dependent on local leadership to both instigate and sustain a project.

Lack of relevant skills and knowledge of community members – the partnership between road safety professionals and community members works both ways, with the road safety professionals helping to equip community members with the skills and knowledge about road safety.

5.3.2 Planning issues

Adherence to one approach or process – potentially there are a wide number of ways to engage and involve a community within a road safety project and how to do this best can vary between communities. Strict adherence to just one or two methods of trying to engage communities can be unsuccessful as flexible is required.

Top down or bottom up planning – processes which are entirely led by the community may fail to address the real problems or identify potential solutions which are likely to be effective if there is a lack of expert involvement. A top down process may fail to involve the community or address the issues that they feel are important. Most projects that include community involvement occur somewhere between those two extremes. Often there can be tension between the different stakeholders as the views of local businesses, residents, councillors and road safety professionals can vary dramatically.

Inappropriate programme focus – without using evidence or data on what causes crashes and what can be done to prevent them, programmes may target resources at a perceived problem rather than an actual problem. Where there is disagreement it may be advantageous to initially focus on areas where there is a wider acceptance for action (for example, the safety of child pedestrians).

Inappropriate programme evaluation – understanding what was successful or not about a programme is important and with large numbers of stakeholders it may be more difficult to establish a clear evaluation plan or clear aims and objectives against which the programme can be evaluated. Community involvement can include some control over the evaluation.

Lack of funds and resources – sometimes community projects may be set up using some short-term or one off funding from external stakeholders, but community projects can struggle if that money is then withdrawn. This also highlights the importance of good evaluation to justify further investment.

Lack of sustainability – similarly to lack of resources, interest in programs may also wane over time which has an impact on its continuation. Leadership and transfer of skills to community members and groups, as well as attempts to engage more people in a programme while it is running may help to sustain projects.

5.4 Lessons from Neighbourhood Road Safety Initiative

The largest attempt to target and reduce injury inequalities in England was the Department for Transport funded Neighbourhood Road Safety Initiative. Areas in 15 Local Authorities with high child pedestrian casualty rates were selected for funding to run a series of approved projects to address injury inequality between June 2003 and March 2006 (Christie et al 2010).

The approach taken to address inequalities varied between Local Authorities, and Figure 12 shows how much and what percentage of the funding was spent on different activities. Predominantly the funding was for engineering projects which were designed to create safer road environments.

Type of Intervention	Budget (£)	%
Engineering and traffic calming	5,347,000	48
Play schemes, including traffic calming in the vicinity	2,030,000	18
Education, training and publicity	1,510,500	13
Pedestrian/cyclist facilities – safer access	1,327,000	12
Home Zones	431,000	4
Automatic speed advice messages	341,200	3
Diversionary activities (clubs)	119,000	1
Car-seat schemes	85,000	1
Research/consultation	21,800	<1
	11,212,500	100

Figure 12 Total spend by intervention type by all authorities taking part in the NRSI

Separate to this spending, an evaluation of the NRSI took place in order to,

- Measure the impact of the NRSI on reducing road traffic casualties
- Measure the wider impacts of the intervention on quality of life in terms of mobility, accessibility, and safety
- Assess the role that local multi-agency partnerships have on reducing risk and improving quality of life for deprived communities; and
- Develop a more thorough understanding of the road safety problems of disadvantaged communities.

To evaluate the effect on road casualties, data was gathered before, during and after the funding became available, and comparison areas were selected.

Surveys were run in communities, schools and partnerships along with focus groups which involved residents from the areas in order to understand the wider impacts of the initiative.

Although it was difficult to measure the change in the number of casualties due to the NRSI against the backdrop of both regional and national trends, statistical models were used to calculate the percentage change in casualties in NRSI areas compared to what would have been expected without the initiative. The overview statistics showing the change in the number of casualties are presented in Figure 13

Road user and age group	Data collection period	Percentage change in the number of casualties in the NRSI areas compared with what would have been expected without the initiative.	95% CI of percentage change
All road users			
All Ages	During	-7.2	-4.8 to -9.5
	After	-8.9	-5.9 to -11.7
Children (1-15)	During	-11.9	-5.9 to -17.4
	After	-15	-7.5 to -21.9
Young adults (16-24)	During	-5.5	-0.6 to -10.2
	After	-11	-5.1 to -16.5
Pedestrians			
All Ages	During	-7.2	-0.1 to -11.2
	After	-8.9	-0.2 to -13.9
Children (1-15)	During	-10.5	-2 to -18.2
	After	-13.5	-2.9 to -13.9
Young adults (16-24)	During	-4.8	9.9 to -17.5
	After	1.1	20.7 to -15.3
Car Occupants			
All Ages	During	-8.1	-5.2 to -10.9
	After	-9.8	-6.1 to -13.4
Children (1-15)	During	-17.7	-7.7 to -26.7
	After	-20.3	-7.2 to -31.5
Young adults (16-24)	During	-3.9	2 to -9.5
	After	-11.4	-4.4 to -17.9

*Figure 13 the change in casualties due to the NRSI
 (adapted from Table 4.2 in Christie et al 2010)*

The largest reductions seen were amongst child casualties, both as pedestrians and car occupants. This was seemed to be an effect which was sustained after the intervention, and that could be due to the intervention being predominantly permanent changes to the environment through road engineering such as traffic calming.

5.5 Building road safety into the wider agenda

The important role that many policy areas have on road injuries must be highlighted. Many policy areas which have an influence on the wider causes of road injuries are not traditionally regarded as being involved in road safety. (Lowe et al 2011b)

This report has pointed out policy areas where there are links between road safety and public health activities, but there are more professions and sections of Local Government who could be engaged by road safety professionals to make sure road safety is considered as part of their policy process.

For example, the role that Leisure Services have to play in providing safer and accessible areas for children to play is key in reducing how often children play on the street.

Environment and planning departments also make large decisions over land use. Local Planning agencies already must carry out a transport assessment for larger developments, but a series of smaller developments might have a cumulative effect in a way which may not be initially noticeable if each development is considered individually.

An example of a road safety project which attempted to build road safety into other agendas was the Streets Ahead on Safety project in Birmingham (Chapain and Freeman 2011) which set an objective to integrate road safety activity into the regeneration agenda. Although it was a road safety project many of the project's objectives were to improve some of the wider determinants of safety, for example

- To integrate road safety activity into the regeneration and other agendas and build partnerships for delivery
- To secure inclusive engagement and participation with a diverse community, and influencing local views about road safety
- To improve accessibility to jobs, services and leisure opportunities
- To improve the quality of life; a safer, vibrant, more stable community

One of the projects conclusions is that consideration needs to be paid towards the mechanisms and manner in which partnership working between agencies will be achieved.

Whilst there are examples of cross sector partnership working, through stakeholder forums for example, the road safety work of the forums or partnerships may not be represented within higher level strategies of the partnership agencies (Lowe et al 2011). The work of cross sector partnerships that focus on road safety should be built into these higher level strategies in order to give them greater credibility and secure engagement from partners who may not see road safety as a core issue.

6. Policy Statements

There are five key policy recommendations from the evidence presented in this paper.

1) In order to continue the efforts to reduce the number of road casualties, the social factors that cause injury need to be tackled in a systematic way by organisations responsible for road safety.

This paper has compiled the evidence of how injuries are distributed through society, and specifically between different socio economic groups. It has identified that in road safety, there is inequality in the risk of injury between different socioeconomic groups.

Successful initiatives are most likely to contain multiple components aimed at the wider social factors that cause injury as well as individuals. There is the need for action on these different levels to be joined up.

Adopting a ‘life course’ approach to injury prevention (Hosking et al 2011) can help practitioners consider when interventions should be targeted as well as what that intervention should be. This could help to move some focus away from the immediate factors before an injury and onto some of the wider social determinants.

2) Common approaches to improving the health, wellbeing and the safety of individuals and communities need to be identified. Developing closer ties and partnership working between road safety and health professionals could help to identify these approaches.

The focus within the field of public health on addressing inequalities in health is a similar endeavour to addressing inequalities in injury and it is highly likely that many current activities will be having an influence on both.

Preventing accidents has wide health and social benefits beyond reducing injuries and is part of creating healthier communities and improving wellbeing. Health, safety, and wellbeing are all related concepts and are resources that contribute towards the quality of life.

Similarly, transport policy has a much wider influence on many aspects of health (Metcalf and Higgins 2009) which must be considered in developing common approaches.

The review of social determinants of road traffic injury in this paper should help both road safety and public health practitioners identify links. Joint Strategic Needs Assessments and early intervention are two examples of areas where links could be made more explicit or injuries could be measured more widely as an outcome of health interventions.

3) Ways of identifying the effects of local and national government policies on road traffic injury need to be developed in order to identify opportunities to improve and protect road safety within them.

There are many wider social influences which affect the number of road traffic accidents and injuries, which are often outside of the influence of transport policy.

Already existing processes such as Health Impact Assessments (HIA) can be used to try to identify and mitigate any negative influences on road safety or to accentuate any positive effects from wider policy. It is noted that the routine use of HIA has been limited, although their use is advocated by organisations such as WHO.

The review of how social factors contribute towards accidents in this report should help to provide evidence within that process.

4) Education interventions need to help individuals and communities to overcome the social factors which act as barriers to safer behaviours, and empowering them to have more control over these factors is key.

Road safety education is a commonly used intervention to prevent accidents, although its effect might be limited if it is not sensitive to the relationships and circumstances of those at whom it is targeted.

Road safety education can help individuals take action to reduce the effect of the social factors that influences their road use. Using approaches which can enhance wellbeing and resilience underpins this.

5) Wider use of evaluation on road safety projects is essential to identify which ones are more successful at tackling inequalities.

There is much more published research identifying the road safety problems caused by different social factors, than identifying ways of solving it. Action on tackling inequalities in injury needs to be underpinned by solid research and evaluation of interventions.

Project evaluations could also look at using indicators related to reducing injury inequalities between socioeconomic groups. Surveillance of traffic fatalities can be used to monitor any national progress at reducing the overall gradient in mortality between socio economic groups, although different outcome indicators may need to be chosen on a local level.

Further evaluation will also help to identify the relevance of different social factors in road safety and the context that successful interventions operate in. This is important to building the evidence base in many areas of this policy.

7. Conclusions

This policy paper and review of the literature has helped to establish the links between wider social factors and injury on the road, and will hopefully act as an impetus for more action to address them.

Many of these social factors have an influence on wider health and wellbeing, or are influenced by areas of local and national government and organisations who may not have historically dealt with road safety, and so closer working between those fields is essential.

There is a role for further research on social factors, and particularly for evaluation to identify road safety interventions that are both effective at reducing injuries and can be widely applied. Although involving individuals and communities in addressing inequalities is a common theme in literature, there is less shared understanding in what such a scheme looks like, how to set one up, and how to engage the whole community rather than a small section of it.

Many recent Government policies could provide ways of closer working between public health and road safety professionals to address the social determinants of injury and ill health, and to evaluate the effect that they are having on road casualties. Some examples of these links in England are:

- The move of some functions of public health into local authorities provides more opportunities for collaboration and stronger arguments for change. The response from some of the Local Authorities who have been early to set up Health and Wellbeing Boards is that they provide a good opportunity to address health inequalities and to tackle the wider determinants of health (NHS Future Forum 2011).
- Road safety awareness has been identified as a use for the public health budget which will be held by Local Authorities (DH 2011b).
- The number of killed and seriously injured casualties on England’s roads is an outcome indicator in the Public Health Outcomes Framework for England, 2013-2016 (DH 2012).
- The Strategic Framework for Road Safety encourages road safety practitioners to make links with other local agendas such as public health (DfT 2011).

Both safety and health promotion initiatives aimed at age groups or areas, rather than specific issues can also provide platforms for closer working in future.

Identifying current activities that could or already do address injury inequality and making the link explicit is the first step to making sure that road safety gets wider consideration by all those who can have an influence on it and to encourage wider partners to take action to prevent traffic injuries.

8. References

- Acheson (1997) *Independent inquiry into inequalities in health* (The Acheson Report), The Stationery Office
- Allen, P., (2008) *Road casualties and deprivation*, published in *Road Casualties Great Britain: 2007 Annual Report*, TSO
- Backett, E., and Johnston, A., (1959) *Social Patterns of Road Accidents to Children*, Br Med J. 14; 1(5119): 409–413.
- Bambra, C., Gibson, M., Sowden, A., Wright, K., Whitehead, M., Petticrew, M., (2010) *Tackling the wider social determinants of health and health inequalities: evidence from systematic reviews* J Epidemiol Community Health 64:284-291
- Bhopal, R., (1997) *Is research into ethnicity and health racist, unsound, or important science?* BMJ ; 314 : 1751
- Bollini, P., and Siem, H., (1995) *No real progress towards equity: Health of migrants and ethnic minorities on the eve of the year 2000* Social Science & Medicine Volume 41, Issue 6, September 1995, Pages 819-828
- Bradley, R., and Vandel, D. L., (2007) *Child Care and the Well-being of Children*, Arch Pediatr Adolesc Med. 161(7):669-676
- Brussoni, M., Towner, E., Christie, N., and Ward, H., (2008) *Evaluation of the Department for Transport Neighbourhood Road Safety Initiative Literature review Deprivation and Road Traffic Injury Risk: Vulnerable Groups*
- Black (1980) *Inequalities in health: report of a research working group (The Black Report)* Department for Health and Social Security
- Bly, P., Jones, K., and Christie, N., (2005) *Child Pedestrian Exposure and Accidents – Further Analyses of Data from a European Comparative Study* MVA Limited Road Safety Research Report No. 56 Department for Transport: London
- Chapain, C., and Freeman, T., (2011) *Evaluation of Streets Ahead on Safety Project: Final Report*
- Christie, N., (1995) *The high-risk child pedestrian: socio-economic and environmental factors in their accidents*. TRL Research Report PR117
- Christie, N., Ward, H., Kimberlee, R., Lyons, R., Towner, E., Hayes, M., Robertson, S., Rana, S., and Brussoni, M., (2010) *Road Traffic Injury Risk in Disadvantaged Communities: Evaluation of the Neighbourhood Road Safety Initiative* Department for Transport: London
- Collins, D., and Kearns, R., (2005) *Geographies of inequality: Child pedestrian injury and walking school buses in Auckland*, New Zealand Social Science & Medicine 60:61–69
- Dahlgren, G., & Whitehead, M., (1991) *Policies and strategies to promote social equity in health* Background document to WHO – Strategy paper for Europe

- Davidson, L., Durkin, M., Kuhn, L., O'Connor, P., Barlow, B., Heagarty, M., (1994) *The Impact of the Safe Kids/Healthy Neighborhoods Injury Prevention Program in Harlem, 1988 through 1991*, American Journal of Public Health 84:580-589
- DfT (2011) *Strategic Framework for Road Safety*, TSO
- DH (2011a) *Healthy Lives, Healthy People: Our strategy for public health in England*, TSO
- DH (2011b) *Healthy Lives, Healthy People: consultation on the funding and commissioning routes for public health*, TSO
- DH (2012) *Healthy lives, healthy people: Improving outcomes and supporting transparency. A public health outcomes framework for England, 2013-2016*, TSO
- DiGuiseppi, C., Roberts, I., Li, L., (1997) *Influence of changing travel patterns on child death rates from injury: trend analysis* BMJ; 314 : 710
- Edwards, P., Green, J., Roberts, I., and Lutchmun, S., (2006a) *Deaths from injury in children and employment status in family: analysis of trends in class specific death rates* BMJ, doi:10.1136/bmj.38875.757488.4F
- Edwards P, Green J, Roberts I, Grundy C, and Lachowycz K (2006b) *Deprivation and Road Safety in London: A report to the London Road Safety Unit*. London: LSHTM.
- Edwards, P., Green, J., Lachowycz, K., Grundy, C., Roberts, I., (2008) *Serious injuries in children: variation by area deprivation and settlement type* Arch Dis Child 93:485-489
- Elvik, R., (2003) *Assessing the validity of road safety evaluation studies by analysing causal chains* Accident Analysis and Prevention. Volume 35, Issue 5, Pages 741-748
- Graham, D., Glaister, S., and Anderson, R., (2005) *The effects of area deprivation on the incidence of child and adult pedestrian casualties in England* Accident Analysis & Prevention Volume 37, Issue 1, Pages 125-135
- Hall, W. K., O'Day, J., (1971) *Causal chain approaches to the evaluation of highway safety countermeasures*. Journal of Safety Research, 3, 9-20
- Haddon, W (1973) *Energy damage and the ten countermeasure strategies*, J Trauma. 13(4):321-31
- Hippisley-Cox, J., Groom, L., Kendrick, D., Coupland, C., Webber, E., and Savelyich, Boki., (2002) *Cross sectional survey of socioeconomic variations in severity and mechanism of childhood injuries in Trent 1992-7* BMJ. May 11; 324(7346): 1132
- Hosking, J., Ameratunga, S., Morton, S, Blank, D., *A life course approach to injury prevention: a "lens and telescope" conceptual model* BMC Public Health 2011, 11:695
- Howat, P., Cross, D., Iredell, H., Stevenson, M., Gibbs, S., Officer, J., and Dillon, J., (2001) *Community participation in road safety: barriers and enablers*, Journal of Community Health, Vol. 26, No. 4,

- Husband, P., and Hinton, P., (1972) *Families of Children with Repeated Accidents* Arch Dis Child.; 47(253): 396–400.
- Johnson, Z., Howell, F., Molloy, B., (1993) *Community mothers' programme: randomised controlled trial of non-professional intervention in parenting* BMJ 306: 1449-52
- Jones, S., Lyons, R., John, A., and Palmer, S., (2005) *Traffic calming policy can reduce inequalities in child pedestrian injuries: database study*. Inj Prev. 11(3):152-6.
- Kendrick, D., (1993) *Prevention of pedestrian accidents*, Archives of Disease in Childhood 68: 669-672
- King, D.M., (1987) *Child Pedestrian Accidents in Inner Areas: patterns and treatment*, PTRC Summer Annual Meeting, Seminar D, University of Bath
- Klein, D., (1980) *Societal influences on childhood accidents*, Accident Analysis & Prevention Volume 12, Issue 4, Pages 275-281
- Lawson, S., and Edwards, P., (1991) *The involvement of ethnic minorities in road accidents: data from three studies of young pedestrian casualties* Traffic Engineering and Control Volume: 32 p. 12-19,
- Lowe, C., Whitfield, G., Sutton, L., Hardin, J., (2011a) *Road user safety and disadvantage* Road Safety Research Report No. 123 Department for Transport: London
- Lowe, C., Whitfield, G., Sutton, L., Hardin, J., (2011b) *Road user safety and disadvantage – Appendix 4: Partnership Working* Road Safety Research Report No. 123 Department for Transport: London
- Lynch, J., and Kaplan, G., (2000) *Socioeconomic Position*, published in *Social Epidemiology*, ed Berkman, L and Kawachi, I Oxford University Press
- Lyons, R., Jones, S., Deacon, T., and Heaven, M., (2003) *Socioeconomic variation in injury in children and older people: a population based study* Injury Prevention 9:33–37
- Marmot, M. (2000) *Multilevel Approaches to Understanding Social Determinants*, published in *Social Epidemiology*, ed Berkman, L and Kawachi, I Oxford University Press
- Marmot, M (2005) *Historical perspective: the social determinants of disease – some blossoms* Epidemiologic Perspectives & Innovations, 2:4
- Marmot, M. (2010) *Fair Society, Healthy Lives (The Marmot Review): Strategic Review of Health Inequalities in England post-2010*
- McClure, R.J., Davis, E., Yorkston, E., Nilsen, P., Schluter, P., Bugeja, L., (2010) *Special issues in injury prevention research: developing the science of program implementation*. Injury; 41 Suppl 1 S16-9.

- Metcalfe, O., and Higgins, C., *Healthy Public Policy: Is health impact assessment the cornerstone?* Public Health, 2009, 123(4): 296-301
- Morrison, A., Stone, D., Redpath, A., Campbell, H., and Norrie, J. (1999) *Trend analysis of socioeconomic differentials in deaths from injury in childhood in Scotland, 1981-95*; BMJ ;318:567-8
- NHS Future Forum (2011) *Summary report on proposed changes to the NHS*
Professor Steve Field – Chairman, DoH
- Novoa, A., Perez, K., Santamaría-Rubio, E., Marí-Dell'Olmo, M., Cozar, R., Ferrando, J., Peiró, R., Tobías, A., Zori, P., and Borrel, C., (2011) *Road safety in the political agenda: the impact on road traffic injuries* Epidemiol Community Health; 65:218-225
- ONS (2003) *Ethnic group statistics: A guide for the collection and classification of ethnicity data* Office of National Statistics
- Opinion Leader (2009) *Qualitative Research to Support the Strategic Review on Health Inequalities in England Post 2010: A report of qualitative findings from focus groups with deprived groups prepared for the National Social Marketing Centre and UCL*
- Pearce, A., Li, L., Abbas, J., Ferguson, B., Graham, H., Law, C., (2010) *Does childcare influence socioeconomic inequalities in unintentional injury? Findings from the UK Millennium Cohort Study* J Epidemiol Community Health 64:161-166
- Petridou, E., Kouri, N., Trichopoulos, D., Revinthi, K., Skalkidis, Y., and Tong, D., (1994) *School injuries in Athens: socioeconomic and family risk factors.* J Epidemiol Community Health. 48(5): 490–491
- Pless, B., Peckham, C., Power, C., (1989) *Predicting traffic injuries in childhood: A cohort analysis* Journal of Pediatrics Volume 115, Issue 6, Pages 932-938
- Roberts, I., Keal, M., and Frith, W., (1994) *Pedestrian exposure and the risk of child pedestrian injury.* JPaediatr Child Health 30:220-3.
- Roberts, I., and Pless, B., (1995) *For Debate: Social policy as a cause of childhood accidents: the children of lone mothers* BMJ 311 : 925
- Roberts, I., Norton, R., Jackson, R., Dunn, R., Hassall, I., (1995) *Effect of environmental factors on risk of injury of child pedestrians by motor vehicles: a case-control study* BMJ 310:91-4
- Roberts, I., and Power, C., (1996) *Does the decline in child injury mortality vary by social class? A comparison of class specific mortality in 1981 and 1991*, BMJ; 313 : 784
- Roberts, I., Kramer, M., Suissa, S., (1996) *Does home visiting prevent childhood injury? A systematic review of randomised controlled trials*, BMJ 312 : 29
- Robertson, L (1998) *Causal Webs, Preventive Brooms and Housekeepers* Social Science and Medicine Vol. 46, No. 1, pp. 53-58
- RoSPA (2008) *A Review of Safety Education: Principles for effective practice*

RoSPA (2010) *Young Drivers at Work: Activity Guide and Facilitators Notes*

Sethi, D., Racioppi, F., Baumgarten, I., Bertollini, R., (2006) *Reducing inequalities from injuries in Europe*, The Lancet 368:2243-50

Schulz, A., and Northridge, M., (2004) *Social Determinants of Health: Implications for Environmental Health Promotion*, Health Education and Behaviour, Vol 31 (4) 455-471

Spinks A, Turner C, Nixon J, McClure RJ. (2009) *The 'WHO Safe Communities' model for the prevention of injury in whole populations*, Cochrane Database of Systematic Reviews 2009, Issue 3. Art.No.: CD004445. DOI: 10.1002/14651858.CD004445.pub3

Steinbach, R., Edwards, P., Green, J., and Grundy, C., (2007) *Road Safety of London's Black and Asian Minority Ethnic Groups: A report to the London Road Safety Unit*. London: LSHTM.

Steinbach, R., Grundy, C., Edwards, P., Wilkinson, P., Green, J., (2010) *The impact of 20 mph traffic speed zones on inequalities in road casualties in London* J Epidemiol Community Health doi:10.1136/jech.2010.112193

Teik Hua, L., Noland, R., Evans, A., (2010), *The direct and indirect effects of corruption on motor vehicle crash deaths*, Analysis & Prevention Volume 42, Issue 6, November 2010, Pages 1934-1942

Thomson, J., and Tolmie, A., (2001) *Road accident involvement of children from ethnic minorities*. Road Safety Research Report, 19

Towner, E., Dowswell, T., Errington, G., Burkes, M., and Towner, J. (2005) *Injuries in children aged 0–14 years and inequalities: A report prepared for the Health Development Agency Community Child Health*, Department of Child Health University of Newcastle upon Tyne,

Trovato, F., (1992) *Violent and accidental mortality among four immigrant groups in Canada, 1970-1972* Biodemography and Social Biology, Volume 39, Issue 1 & 2, pages 82 - 101

Wadsworth, J., Burnell, I., Taylor, B., Butler, N., (1983) *Family type and accidents in preschool children* J Epidemiol Community Health.37(2):100-4.

Ward, H., Lyons, R., Christie, N., Thoreau, R. and Macey, S. (2007) *Fatal Injuries to Car Occupants: Analysis of Health and Population Data*. Road Safety Research Report No. 77. London: Department for Transport

WHO (1986) *Ottawa Charter for Health Promotion*, First International Conference on Health Promotion, Ottawa - WHO/HPR/HEP/95.1

WHO (2008) *Closing the gap in a generation: Health equity through action on the social determinants of health* Commission on the Social Determinants of Health

WHO (2009) *Global status report on road safety: time for action*. Geneva

WHO Safe Communities (accessed March 2012) <http://www.phs.ki.se/csp/>

Werner, D., (1988) *Empowerment and Health*, Contact. Christian medical Commission, 102:1-9

Wiklund, M., Simonsson, L., Forsman, Å., Hallberg, Ö., and Johansson, Ö., (2011) *Traffic safety and the economic situation. Model approaches and a literature survey* VTI SE-581 95 Linköping Sweden

9. Glossary

Carstairs’ deprivation score – a measure of an area’s deprivation and disadvantage used in Scotland. It is a combination of an area’s low social class, lack of car ownership, overcrowding and male unemployment.

Confidence Intervals – when a sample is taken from a larger population, we are usually interested in what the characteristics of the sample, such as the mean value, tell us about that population. However, the mean value of the sample may be different to larger population because of chance when drawing the sample. The role of chance has to be estimated in order to generalise the findings of the sample back to the whole population. Confidence intervals give a measure of the role of chance by showing the probability of getting an observation at least as far from the mean. Most typically the 95% confidence intervals are shown, and the true value of the population mean would lie within this range in 19 out of every 20 samples.

Decile – when a series of numbers or values (for example relating to the characteristics of individuals or areas) is split up into 10 equal sized groups, a decile is the term given to one of those groups.

Deprivation – in an area this refers to an absence of a resource which may be expected in other areas and the absence of which can impact on health, safety, or quality of life for example.

Education, Training and Publicity (ETP) – road safety campaigns designed to ultimately influence road users to adopt safety behaviours.

Health Impact Assessment (HIA) – process used to analyse a proposed or existing policy or strategy to identify the impact that it may have on health and with a view to modifying the policy to improve the effect that it has on health.

Health and Wellbeing Boards – The Department of Health describe Health and Wellbeing Boards as “*a forum to bring together elected councilors, local authority officers, patient representatives and clinical commissioning groups to develop shared understanding of local need, develop joint local priorities, and encourage commissioners to work in a more integrated and joined up manner.*”

Index of Multiple Deprivation (IMD) – a measure of an area’s deprivation and disadvantage. It is a combination of a wide range of measures such as income deprivation, employment deprivation, health deprivation and disability, education, skills and training, barriers to housing and services, Crime, and the living environment

Joint Strategic Needs Assessment (JSNA) – this is the process that identifies current and future health and wellbeing needs in light of existing services in order to inform future service planning to improve health. It can also refer to the document resulting from that process.

Lower Super Output Area (LSOA) – England and Wales are divided up into 34,378 Lower Super Output Areas based on the 2001 Census data. They have a minimum size of 1,000 residents and 400 households, but on average contain 1,500 residents.

Marmot Review – an independent review into health inequalities in England. More information can be found on the Marmot Review website
<http://www.marmotreview.org/>

Neighbourhood Road Safety Initiative (NRSI) – a short term initiative funded by the Department for Transport and to reduce road injury inequalities and encompassed a range of smaller activities in deprived areas across England. A final evaluation report has been published (Christie et al 2010)

National Statistics Socio-Economic Classifications (NS-SEC) – a method of classifying the socioeconomic status of individuals (or families) using occupation.

Quintile - when a series of numbers or values (for example relating to the characteristics of individuals or areas) is split up into 5 equal sized groups, a quintile is the term given to one of those groups.

Social Cause/Determinant/Factor – used interchangeably in this report. The World Health Organisation defines the social determinants of health as “*the conditions in which people are born, grow, live, work and age, including the health system. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels, which are themselves influenced by policy choices. The social determinants of health are mostly responsible for health inequities - the unfair and avoidable differences in health status seen within and between countries.*”

Socioeconomic Group or Status – in this paper, the working definition has been taken from (Lynch and Kaplan 2000) and means “*the social and economic factors that influence what position(s) individuals and groups hold within the structure of society*”

Townsend Score - a measure of an area's deprivation and disadvantage. It combines measures of economic activity, non-car ownership, as a percentage of all households, non-home ownership as a percentage of all households and household overcrowding.

10. Social Factors in Road Safety – an overview

Socio-economic, cultural, and environmental conditions	Living and working conditions	Social and community networks	Individual factors
Socio-economic <ul style="list-style-type: none"> Historical conditions Economic circumstance Law and regulations relating to safety Human rights Social and cultural institutions Transport policy 	Local Environment <ul style="list-style-type: none"> Location of local shops and schools Quality of local schools Availability of local play areas for children Availability of public transport Design of the local roads Amount and speed of traffic Perception of risk 	Local community <ul style="list-style-type: none"> Civic participation Number and quality of local social networks Local community activities Availability of support from within the local community Local charities and social enterprises 	Safety <ul style="list-style-type: none"> Thrill seeking Perceived social norms Perceived peer influence Intentions Individual behaviours – speed, drink driving, distractions, seatbelt wearing
Historic distribution of resources within society <ul style="list-style-type: none"> Distribution of material wealth Distribution of employment opportunities Distribution of educational opportunities Distribution of political influence 	Housing <ul style="list-style-type: none"> Space and overcrowding Garden size On road and off road parking 	Family <ul style="list-style-type: none"> Location Availability of support from family members Disposable income Relationships Positive and negative life events 	Wellbeing <ul style="list-style-type: none"> Stress/anxiety Self esteem Emotional wellbeing Life satisfaction Motivation Self belief Resilience
Cultural <ul style="list-style-type: none"> Norms around social roles Norms around families Norms around ethnicity Norms around transport use Patterns of road use Reasons for road use 	Employment <ul style="list-style-type: none"> Safety culture at work Work balance between protection and production Salary Occupational benefits Unemployment	Work <ul style="list-style-type: none"> Scheduling – flexibility of schedule and performing the work, frequency of consecutive rest-days, Communication with superiors Seniority within organisation Staff relations Work pressures and stress Control over work Influence over occupational risk factors 	Health <ul style="list-style-type: none"> Physical activity Personal health
Natural environment <ul style="list-style-type: none"> Climate Weather Temperature Hours of daylight 	Comprehensiveness of social services <ul style="list-style-type: none"> Local road safety education – targeting and type of campaign Welfare Early intervention Local enforcement Engineering of local roads Health services 	Journey <ul style="list-style-type: none"> Frequency Type of transport used Exposure to risk during journey 	Demographics <ul style="list-style-type: none"> Age Gender

Adapted from Schulz and Northridge (2004).