

WHAT CAN BE DONE ABOUT THE SOCIAL DETERMINANTS OF VIOLENCE AND UNINTENTIONAL INJURY?

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I Background

Figure 1¹

Distribution of global injury mortality by cause



Source: WHO Global Burden of Disease project, 2002, Version 1 (see Statistical Annex).

Injuries account for 9% of global mortality, constituting a major and growing global public health problem. Over 5 million people lost their lives due to injury in 2002 - equivalent figures for HIV, tuberculosis and malaria were 2.9 million, 1.6 million and just under 1 million respectively.² Eight of the 15 leading causes of death for people between the ages of 15 and 29 years³ are injury related. In addition to the 5 million injury related deaths, injuries resulting from traffic collisions, drowning, poisoning, falls or burns – and violence from assault, self-inflicted violence or acts of war cause harm

to millions more⁴. Global injury related deaths are projected to increase by approximately 40% by 2030⁵. If these projections hold, in 2030 three of the 15 leading causes of disability-adjusted life years (DALYs) will be injury related.⁶

¹ WHO Global burden of disease project, 2002, Version 1 from Peden et al 2004, op cit

² Projections of Global Mortality and Burden of Disease from 2002 to 2030

Mathers CD, Loncar D. PLoS Medicine Vol. 3, No. 11, e442 doi:10.1371/journal.pmed.0030442

³ WHO (2007) Preventing injuries and violence: a guide for ministries of health, Geneva, WHO http://www.who.int/violence_injury_prevention/publications/injury_policy_planning/prevention_moh/en/index.html

⁴ WHO (2007) Preventing injuries and violence: a guide for ministries of health, Geneva, WHO http://www.who.int/violence_injury_prevention/publications/injury_policy_planning/prevention_moh/en/index.html

⁵ Projections of Global Mortality and Burden of Disease from 2002 to 2030

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⁶ Projections of Global Mortality and Burden of Disease from 2002 to 2030

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Figure 1 breaks down the global injury burden by mechanism and presents the unintentional injury (accidents) and intentional injury (violence) outcomes we address in this chapter. Most of our focus will be on road traffic injuries as well as those arising from interpersonal forms of violence. We argue for the importance of addressing intentional and unintentional injury worldwide in terms of their social determinants; we outline some of the pathways by which inequalities of age, gender, ethnicity, region, and wealth impact on both the causes and consequences of injury, and rather than focussing on behaviour at an individual level, we set out some of the effective or promising strategies and interventions that have the potential to reduce injury and violence by acting on social determinants. Finally, we explore the kinds of data that are required to monitor and evaluate the strategies and interventions described.

Sources and limitations of evidence

The evidence in this chapter derives largely from peer reviewed scientific literature, in particular systematic reviews, as well as reports from governments and international agencies. We have drawn in particular on the Cochrane Injuries group⁷, a significant proportion of whose reviews deal with prevention, the emerging work of the Cochrane Health Equity Field and Campbell Equity Methods Group,⁸ the work of the EPPI centre in London⁹, and other sources of knowledge^{10, 11, 12} including the experience of those exposed to risk in disadvantaged areas. We consider no one scientific method to be higher up the evidential ladder in terms of contributing to our understanding, but have consistently ensured methodologies are appropriate to the questions asked. We would not use evidence from randomized controlled trials to ascertain societal acceptance of a particular intervention, or qualitative evidence to assess effectiveness or cost effectiveness at a population level.¹³

An important consideration in terms of the evidence drawn upon in this chapter is the imbalance between the global burden of injury which disproportionately impacts low- and middle-income countries, and the evidence base about social determinants of injury and interventions, which largely comes from high income

⁷ www.cochrane-injuries.lshtm.ac.uk

⁸ Tugwell P, Petticrew M, Robinson V, Kristjansson E, Maxwell L., (2006) Cochrane and Campbell Collaborations, and health equity. *The Lancet*, Volume 367, Issue 9517, Pages 1128-1130

⁹ <http://epi.ioe.ac.uk/cms/>

¹⁰ Daniel Yergin *The Prize: The Epic Quest for Oil, Money, and Power*. New York: Simon & Schuster, 1991. Reprint: Simon & Schuster, 1992

¹¹ Ann Oakley, *Gender and Planet Earth*, Polity Press, Bristol, 2002

¹² Rice C, Roberts H, Smith S.J, Bryce C. (1994) 'It's like teaching your child to swim in a pool full of alligators': lay voices and professional research on child accidents, in Popay J and Williams G (eds) *Researching the People's Health*, London, Routledge

¹³ Petticrew M and Roberts H (2003) Evidence, hierarchies and typologies: Horses for Courses, *Journal of Epidemiology and Community Health*, 57:527-529. <http://jech.bmj.com/cgi/content/abstract/57/7/527>

settings. Most reviews of evidence, including those which make strenuous efforts to seek studies worldwide, rely on studies carried out in wealthier nations and most of the reviewers in the Cochrane Collaboration, for instance, are from wealthier countries¹⁴. While the location of reviewers does not necessarily (or should not) determine the focus of reviews, Figure 3 suggests that this distribution, combined with poor data in many countries, skews the evidence base towards wealthier countries, although there is some suggestion that things are improving^{15 16}. The inequality in terms of a knowledge base around injury prevention may itself exacerbate injury differentials by restricting progress to settings with greater means.

Figure 3: Number of People Actively Involved in Cochrane Collaborative Review Groups

Year	Total Number of People	People in Low- and Middle-Income Countries
2000	5,437	309
2002	7,728	553
2003	9,279	758
2004	11,517	1,078

Data used in this table are from [12].
DOI: 10.1371/journal.pmed.0020107.t001

Source: [Is Evidence-Based Medicine Relevant to the Developing World?](#) Chinnock P, Siegfried N, Clarke M *PLoS Medicine* Vol. 2, No. 5, e107 doi:10.1371/journal.pmed.0020107

This chapter is not an encyclopaedic approach to what is known about injury and violence and its prevention. Rather, we focus our attention on social determinants of injury in a general sense, and within this we concentrate on identifying entry points by which the causal pathways linking social determinants and injury outcomes may be interrupted. To further clarify our analysis we develop illustrative examples using three particular determinants of injury: alcohol, housing and neighbourhoods, vehicles and roads.

Science is about reducing bias, but none of us is entirely free of bias, explicit or implicit, often expressed as values or principles. We wish to be explicit that this chapter is underpinned by a particular set of values – that inequalities in health are unjust, and that each of us has an equal right to health and well-being irrespective of age, sex, geographical region, ethnicity or social class. Over and above this expression of our value position, it should be added that the underlying rationale for the Commission on Social Determinants and Health has been that reducing inequalities is an important approach to improve global

¹⁴ Chinnock P, Siegfried N, Clarke M (2005) Is Evidence-Based Medicine Relevant to the Developing World? *PLoS Med* 2(5): e107 doi:10.1371/journal.pmed.0020107

¹⁵ Waters E, Doyle J. Systematic reviews of public health in developing countries are in train. *BMJ* 2004;328: 585

¹⁶ Murray CJL, Lopez AD, Wibulpolprasert S. Monitoring global health: time for new solutions. *BMJ* 2004;329: 1096-100. (6 November.)

health, and that data shows societies that are more equal are healthier than those that are not¹⁷.

Inequalities and the determinants of injury

Violence and unintentional injury are a significant locus of inequality¹⁸

¹⁹. In terms of economic inequalities, both intentional and unintentional injuries are unevenly distributed between rich and poor nations, and within those nations, between rich and poor individuals. In many cases, other inequalities come into play, including differences relating to gender, age and ethnicity and differences in access to, and costs of treatment which impact on morbidity and mortality²⁰.

Figure 2: Road Traffic Deaths Worldwide by Sex and Age Group, 2002²¹

Number of deaths, in thousands

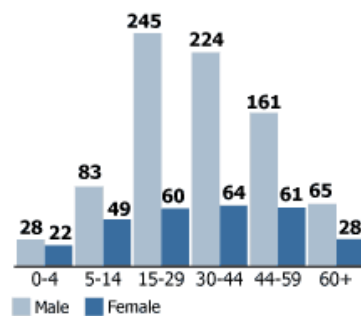


Figure 2 for instance, demonstrates differences by age and sex in road traffic deaths worldwide. This graphically illustrates the impact on younger adult males, with attendant implications for societal economic impact due to the aggregate effect of productive life years lost. While a distribution affecting younger adult males is a powerful and relatively consistent feature of many fatal injury outcomes, females are much more often represented in a variety of non-fatal injury outcomes including intimate partner violence and sexual violence.

¹⁷ Wilkinson, R.G., Pickett, K.E. (2006) Income inequality and population health: a review and explanation of the evidence. Soc Sci Med 62: 1768-1784
http://www.ncbi.nlm.nih.gov/sites/entrez?cmd=Retrieve&db=pubmed&dopt=Abstract&list_uids=16226363

¹⁸ Krug, E, Dahlberg L, Mercy J, Zwi A, Lozano R (2002) World Report on Violence and Health, Geneva, WHO

¹⁹ Peden M Scurfield R, Sleet D, Mohan D, Hyder A, Jarawan E and Mathers C (2004) World report on road traffic injury prevention, Geneva, World Health Organisation.

²⁰ WHO (2004). World report on road traffic injury prevention. WHO, Geneva.
http://www.who.int/world-health-day/2004/infomaterials/world_report/en/

²¹ WHO (2002) Global burden of disease project, Version 1.

There are also very stark inequalities in relation to socio-economic factors. Even in a relatively wealthy setting such as England and Wales, a child from the lowest social class is 16 times more likely to die in a house fire than one from a wealthy family.^{22, 23} Around 90% of global road traffic deaths are in low- and middle-income countries²⁴. The poor get hurt more often than the rich, as they are more likely to be exposed to the risks posed by vehicles when they are walking or cycling, and when they are inside rather than outside vehicles, they are less likely to be in well-maintained machines. By 2020, deaths from road accidents are expected to continue to fall in many richer nations (although this is likely to be at the price of reductions in the freedom of children, for instance, to occupy public space safely) but to rise in poorer ones.²⁵ The differentials in progress in reducing road traffic fatality rates that broadly split out across high-income versus low- and middle-income countries echo steep inequalities gradients elsewhere and show that things do not have to be the way that they are²⁶.

On the one hand, inequalities in health in terms of social factors serve as a reminder of the social injustices which mean that length and quality of life are subject to powerful determinants. On the other, steep inequalities gradients show that things do not have to be the way that they are²⁷. If it is possible for the best off to be at lower risk of exposure to accidental and non-accidental injury, then there are lessons there for all.

II Pathways between determinants and injuries

Just as the vector – agent - host model has been useful in looking at ways in which pathways may be interrupted in communicable disease, a similar pathway model may help us identify steps along the pathway to injury, whether intentional or unintentional, where intervention may be effective.

No straight road

²² Roberts I and Di Giuseppe C Smoke alarms, fire deaths, and randomised controlled trials *Injury Prevention* 1999;5:244–246

²³ Roberts I, Power C. Does the decline in child injury death rates vary by social class? *BMJ* 1996;313:784–6.

²⁴ WHO (2004). World report on road traffic injury prevention. WHO, Geneva. http://www.who.int/world-health-day/2004/infomaterials/world_report/en/

²⁵ Global safety partnership, <http://www.grsproadsafety.org/?pageid=10>

²⁶ Mitchell, Jeannette. What is to be done about illness and health? Harmondsworth, Penguin, 1984

²⁷ Mitchell, Jeannette. What is to be done about illness and health? Harmondsworth, Penguin, 1984

The pathway between determinants and intentional or unintentional injury, is not, unfortunately, a straight road from A to B, where a well-situated bridge (arching over the determinants) or a well-designed behavioural intervention (acting on individuals) can eliminate the problem.

This section provides examples of determinants of injury and violence in order to chart some of the pathways between social determinants and injury, and identify areas where interventions along these pathways might be effective, feasible and acceptable. It should be remembered that the same set of circumstances may lead to no injury, minor injury, serious injury or death, and in many cases, the different outcomes will themselves be related to the determinants of inequalities and poor outcomes in other spheres. Poverty, poor housing, poor education, poor standards of, or access to, healthcare determine exposure to risk, and in the case of healthcare, may also determine the outcome once an injury occurs.

Many determinants have pathways linking them to a variety of health outcomes. So the framework we advance here, and the interventions we propose to reduce injury and violence, may impact on other areas which have been the focus of the Commission on Social Determinants and Health. Similarly, some of the actions suggested by the other reports within the Knowledge Networks of the Commission, including for instance, those on early development, urban settings, and challenging inequities through health systems, will also have an impact on injuries and violence.²⁸

It has long been established that the determinants of injuries and violent deaths are multi-factorial,²⁹ though by the time any single death is investigated, there will often be a single factorial explanation – ‘speeding’, ‘drunken driver’ ‘crossing the road without care.’ These explanations, focussing as they do on only one element of the causal pathway, have led in some cases to inadequate ‘solutions’ to the problem³⁰ including educational interventions which may attempt to educate the public in general, and children in particular, to use the road in the ‘right’ kind of way. As a community advisor in a study of safety as a social value put it: ‘It’s like teaching your child to swim in a pool full of alligators.’³¹

The overall framework within which this discussion of pathways is set is Dahlgren and Whitehead’s³² (see Figure 4 below), which nicely illustrates the nested way

²⁸ http://www.who.int/social_determinants/resources/latest_publications/en/index.html

²⁹ Haddon W, Suchman E, Klein D (eds) (1964) *Accident Research: Methods and Approaches*, Harper and Row, New York, Evanston and London

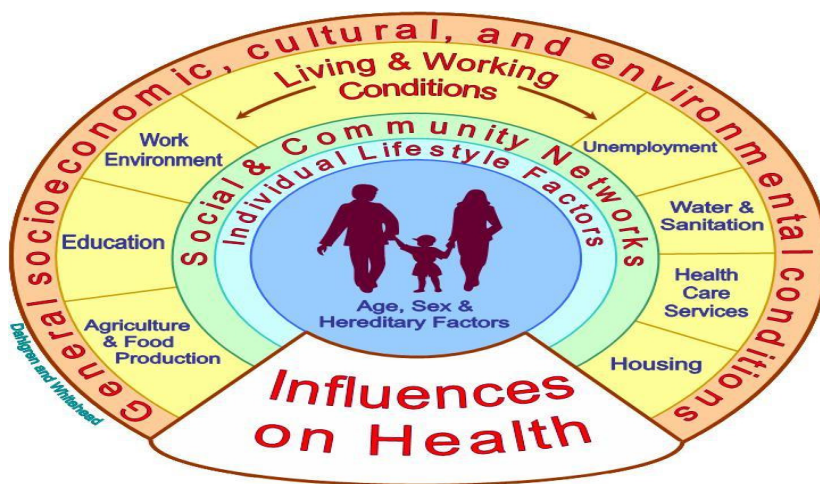
³⁰ Duperrex O, Bunn F, and Roberts I Safety education of pedestrians for injury prevention: a systematic review of randomised controlled trials, *BMJ* 2002; 324: 1129, <http://www.bmj.com/cgi/content/abstract/324/7346/1129>

³¹ Rice C, Roberts H, Smith S.J, Bryce C. (1994) ‘It’s like teaching your child to swim in a pool full of alligators’: lay voices and professional research on child accidents, in Popay J and Williams G (eds) *Researching the People’s Health*, London, Routledge

³² Dahlgren G and Whitehead M (1991), *Policies and strategies to promote social equity in health*, Institute of Futures Studies, Stockholm

in which individual, societal, community and socio-economic factors inter-relate, and gives us scope for understanding why addressing only one part of the picture may fail to have the desired effect, or even increase inequalities. This complements the framework illustrated in Figure 5, which is more general in terms of its ecological descriptive power, but emphasizes the temporal and causal pathways through which factors at the social level mediate their effects on individuals and their health status. We refer to both frameworks in our discussion.

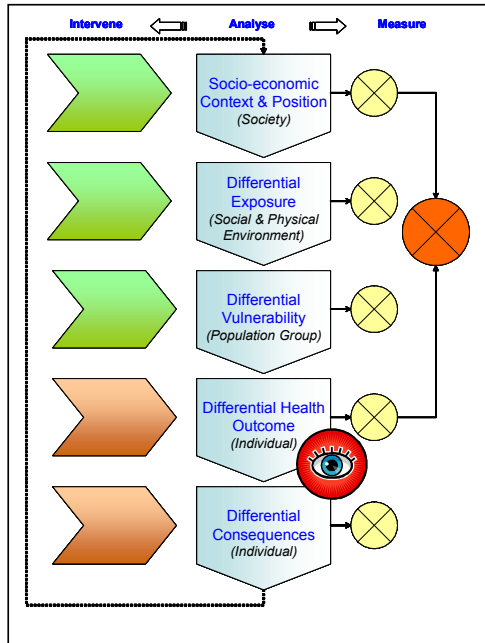
Figure 4: Influences on health



Source: Dahlgren G and Whitehead M (1991), *Policies and strategies to promote social equity in health*, Institute of Futures Studies, Stockholm

Figure 5: Pathways framework

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Determinants

In what follows, we take a range of determinants – alcohol, housing and neighbourhoods, roads and vehicles, in order to chart, albeit only in part, some of the pathways between these determinants and injury, and these determinants and other determinants. It would be a gargantuan task to analyse all possible social determinants of injury. Our decision to focus on these three determinants has been made for reasons of conceptual clarity and illustration. We are very much aware that other determinants might have been viable candidates for this closer scrutiny – including, for instance, fuel and the injuries resulting from wars related to the control of fuel. Oil/fuel is also a powerful determinant in this area, but the potential to recommend appropriate interventions goes beyond the scope of this report. One demonstration of the pathway between fuel and injury is the sensitivity of injury to fuel shortages.³³ The steep drop in energy use during the 1970s oil crises has been linked to short term reductions in road deaths, especially of pedestrians³⁴. Similarly, researchers studying causes of armed conflict have advanced evidence that a wide range of social determinants -

³³ Roberts I, Crombie I. Child pedestrian deaths: sensitivity to traffic volume—evidence from the USA. *J Epidemiol Community Health* 1995;49:186–8.

³⁴ Roberts I, Marshall R, Norton R. Child pedestrian mortality and traffic volume in New Zealand. *BMJ* 1992;305:283

particularly political, social, and economic inequalities are powerful causes of war.³⁵

Without question some of these factors shaping risk for the outcome of youth violence would qualify as 'social determinants'. Relevant examples include but are not limited to: living within an urban setting (even more particularly living within a community in an urban setting with limited public infrastructure such as sewerage, street lighting, regular policing, etc.), social exclusion, rapid demographic changes, income inequality, societal regulation (or lack thereof) of access to lethal means, and quality of governance³⁶.

Obviously one approach to addressing relationships between injury and violence outcomes and social determinants could be to attempt to painstakingly catalogue the evidence base linking various determinants with outcomes. Our decision here to concentrate on three specific determinants is to draw upon them as illustrative examples which yield information about the nature of pathways between them and the outcomes of interest and offer insights into potential entry points for intervention.

What we give up in terms of breadth of coverage of possible determinants is in our view compensated by a more comprehensive understanding of the pathways for the determinants we focus on, and the general applicability of our findings for other determinants.

A Alcohol as a determinant

Alcohol is more commonly perceived as a consumer choice than a determinant of public health problems. And it is precisely because of the shaping of social and cultural attitudes about alcohol intake that we feel it appropriate to consider alcohol as a social determinant. Indeed, other work in this volume looks specifically at the causal pathways linking alcohol to a variety of health outcomes and other [consequences](#).

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Alcohol is implicated in injury in low, middle and high income countries and plays an important part in a wide range of intentional and unintentional injuries. A recent WHO report³⁷, for instance, suggests that of the large number of deaths associated with alcohol globally, 32.0% are from unintentional injuries, and 13.7% are from intentional injuries.

Injury outcomes related to alcohol use

³⁵ Stewart F. Root causes of violent conflict in developing countries. *British Medical Journal* 2002 Feb 9;324:342-345.

³⁶ Krug, E, Dahlberg L, Mercy J, Zwi A, Lozano R (2002) *World Report on Violence and Health*, Geneva, WHO

³⁷ WHO collaborative study on alcohol and injuries (2007) *Alcohol and injury in emergency departments*, World Health Organisation, Geneva.

Road traffic injury is perhaps the most evident injury outcome which has a strong and consistent association with alcohol intake. After a certain level of blood alcohol concentration, relative risk of crash involvement for drivers of vehicles begins to increase significantly³⁸. Individuals operating vehicles who have elevated blood alcohol levels place themselves at risk and are more likely to place other non-motorized (and therefore more vulnerable) road users at even greater risk.

Availability and use of alcohol has been shown to be an important situational factor that can precipitate a range of violent acts including youth violence, perpetration of intimate partner violence by men, sexual violence, and suicide³⁹.

Injury related alcohol use and relationships with other social determinants

A key feature of alcohol use that is associated with injury outcomes is that the drinking or pattern of drinking is destructive. Destructive patterns of alcohol intake have been well documented and the population level health effect of this has in the case of the Russian Federation been evoked as a potential contributor to observed declines in life expectancy among men⁴⁰.

If we begin with the health outcome of interest, and relating the available data to Figure 5, injury related alcohol use shows strong differential health outcomes within both wealthy and poorer countries, including those where alcohol is discouraged. The WHO study referred to above found that those presenting to emergency departments with alcohol related injury were more likely to be young (with a peak in the teenage and young adult years); more likely to be male, and more likely to be of low to medium socio-economic status. The sex differential is particularly striking, and any social determinant informed approach to addressing the destructive use of alcohol in relation to injury risk needs to take account of this. A 2002 WHO report on gender and road traffic injuries⁴¹ reviewed available data and reported that:

- Data consistently show that men are more likely than women to be driving or walking on the road under the influence of alcohol.
- Studies from US and Kenya report that male drivers were far more likely than females to have been drinking prior to a motor vehicle accident.

³⁸ Peden M Scurfield R, Sleet D, Mohan D, Hyder A, Jarawan E and Mathers C (2004) World report on road traffic injury prevention, Geneva, World Health Organization.

³⁹ Krug, E, Dahlberg L, Mercy J, Zwi A, Lozano R (2002) World Report on Violence and Health, Geneva, WHO

⁴⁰ Marmot, M. The Status Syndrome. In Chapter 8 The Missing Men of Russia pp 190-215. Times Books 2004, New York.

⁴¹ WHO Department of Gender and Women's Health (2002) Gender and Road Traffic Injuries, World Health Organisation, Geneva.

- In the USA, alcohol use is implicated in approximately one-third of all fatal crashes involving teenagers, and the risks are greatest among young males
- A national survey of Canadian youth reports that of those who reported drinking at parties, males were 3.5 times more likely to drive after drinking
- In Sweden, more than twice as many male pedestrian fatalities during 1977-1995 tested positive for blood alcohol as compared to females.
- In a 1996 hospital-based study in Cape Town, South Africa, male pedestrians injured were twice as likely to be positive for blood alcohol as females, and had significantly higher mean blood alcohol levels than females.

The report also found that the problem of alcohol-related injuries is particularly alarming in many low- and middle-income countries, where alcohol consumption is increasing, injury rates extremely high, and policies and resources to deal with prevention through tackling the determinants (or indeed the injuries themselves) are not in place. This means that differential consequences of injury as a result of excessive alcohol use are inevitably greater amongst those with poor access to health care.

Pathways

The differential distribution of health outcomes described above provides some insight into relevant pathways. Lower socioeconomic context and position is correlated with patterns of drinking which lead to injury to the less well off, including those who engage in problem drinking. For the better off problem drinkers, particularly those inside a vehicle, the damage may relate to the less well-off. At the same time, gender differences, suggest different vulnerabilities to factors such as peer pressure regarding alcohol intake and high risk behaviour during young adulthood.

The risk of causing, or being involved in, an injury producing event while under the influence of drink is heightened, but by no means inevitable, which is one of the factors which may reduce the effectiveness of interventions which focus on individuals rather than determinants. Setting on one side the adverse non-injury health effects of alcohol use, alcohol use may lead to no injury, minor injury, serious injury or death.

It makes sense from a public health perspective to focus on aspects of the pathways that precede alcohol intake and are amenable to social intervention and policy making. This is not to say that the pathway connecting the state of alcohol induced impairment and injury does not exist, only that it is less relevant to attempt to intervene at this point. For example, the psychoactive effects of alcohol and its motor effects are of proximal importance to an individual operating

Comment [DRM3]: Reference here to the discussion of gender and alcohol intake given in the alcohol chapter - also discussed with Dag Revke.

a motor vehicle being unable to brake quickly enough to avoid colliding with a wall or a pedestrian. Similarly, the psychoactive effects of alcohol intake have been shown to play a disinhibiting role in certain types of sexual violence⁴². Thus, the biological effect of alcohol is without question an important link in the overall pathway by which destructive alcohol use is associated with injury. Nevertheless, intervening at a more distal point along the pathways linking alcohol and injury is not only more plausible in terms of reducing risk of injury and violence; it is more likely to have wider societal impacts.

Steps along those pathways where an intervention may interrupt the chain from determinant to injury include cultural attitudes towards alcohol use, access to alcohol and enforcement of sanctions for infringements for underage (or in some countries, any drinking) and measures to prevent drinking while in charge of a vehicle, or being drunk in public. These potential intervention points can be mapped to any of the top three levels of Figure 5. Specific interventions which may interrupt these pathways are discussed in Section III below. Suffice it to say at this point that in this, as in many other public health areas, an historical perspective suggests that interventions with strong face validity (such as prohibition) may themselves carry adverse outcomes.

B Housing and neighbourhoods as a determinant

Housing's potential as a *protective* factor in health is clear; however, the home is also a common location for both intentional and unintentional injury. Our decision to examine here housing and neighbourhoods is important as there are injury outcomes that relate directly to the quality of the housing itself whereas others relate more to the wider habitat within which housing is situated. In terms of the first of these, poor design, poor building regulations and poor maintenance are all implicated in injury. Overcrowding within households appears to relate to injury in some cultures, while regional differences in habitations, such as flat roofs in hot countries, deficient heating systems in cold countries, and inability to withstand natural disasters are also factors in injury.

With regard to the wider habitat within which housing is situated, as others have pointed out, housing is a concrete manifestation of socioeconomic status, which has an important part to play in the development of explanations of the social production of health inequalities.⁴³ Moreover indirect housing effects related to housing tenure, including wealth impacts, and neighbourhood effects are of fundamental importance.⁴⁴ Indeed, the scope of factors that we consider falling

⁴² Miczek KA et al. Alcohol, drugs of abuse, aggression and violence. In: Reiss AJ, Roth JA, eds. *Understanding and preventing violence. Vol. 3. Social influences*. Washington, DC, National Academy Press, 1993:377-570.

⁴³ Dunn JR. Housing and inequalities in health: a study of socioeconomic dimensions of housing and self reported health from a survey of Vancouver residents. *J Epidemiol Community Health* 2002;56:671-82

⁴⁴ Howden-Chapman P, Housing Standards: a glossary of Housing and Health, *Journal of Epidemiology and Community Health* 2004;58:162-168

within consideration of housing and neighbourhoods as a determinant is quite wide. We would include property boundaries, and disputes over these, overcrowding and road congestion, uncontrolled noise levels, formal or informal inhabitation of unsafe land areas such as steep slopes or flood risk areas, unsafe access to social structures such as schools or markets, and absent or generally deficient social infrastructure such as public sewerage, street lighting and regular police patrolling. All of these factors have been demonstrated to be associated with both intentional and unintentional injury outcomes and underline the fundamental importance of the human habitat as a determinant of health and safety.

The types of injury which may be implicated

A very broad range of injury and violence outcomes relate to housing and neighbourhoods. Common injuries in the home are falls, and injury or death from fire, scalds, and smoke. The home, sometimes seem as a place as safety, may be an unsafe place in relation to interpersonal violence including partner violence and child and elder abuse. In the wider context of the neighbourhood within which housing is situated the range of factors referred to above have been shown to be associated with road traffic injury, injuries related to natural disasters such as flooding, earthquakes and major weather events, and a variety of forms of interpersonal violence including youth violence, sexual violence, and violence in institutional settings.

The pathways and relationship between housing and neighbourhoods related injuries and inequality

Exposure to risks emanating directly from housing is, of course, increased in those who spend the greatest time in the home, amongst whom will be the very old^{45 46} and the very young⁴⁷, the unemployed, the sick or disabled, and those tasked with cooking and keeping the house warm. Injury deaths in poor housing in relation to fire have been well documented^{48 49 50 51}. A marked socioeconomic

⁴⁵ Kannus P, Parkkari J, Koskinen S, Niemi S, Palvanen M, Järvinen M, et al. Fall-induced injuries and deaths among older adults. *JAMA* 1999; 281 (20): 1895-9.

⁴⁶ McClure R, Turner C, Peel N, Spinks A, Eakin E, Hughes K. Population-based interventions for the prevention of fall-related injuries in older people. *Cochrane Database of Systematic Reviews* 2005

⁴⁷ UNICEF Innocenti Research Centre. A league table of child death by injury in rich nations. Report Card No. 2. Florence, 2001. (www.unicef-icdc.org/publications/pdf/repcard2e.pdf).

⁴⁸ Roberts I. Deaths of children in house fires: Fanning the flames of child health advocacy? *BMJ* 1995;311:1381-2.

⁴⁹ Istre GR, McCoy MA, Osborn L, et al. Deaths and injuries from house fires. *N Engl J Med* 2001;344:1911-16

⁵⁰ Runyan CW, Bangdiwala SI, Linzer MA, et al. Risk factors for fatal residential fires. *N Engl J Med* 1992;327:859-63

⁵¹ Di Guiseppi C, Roberts I, Li L. Smoke alarm ownership and house fire death rates in children. *J Epidemiol Community Health* 1998;52:760-1.

gradient is a prominent part of this analysis - as stated earlier in this chapter, even in a comparatively wealthy setting such as the United Kingdom a child from the lowest social class is 16 times more likely to die in a house fire than one from a wealthy family. So while poorly maintained, poorly heated, and poorly constructed housing all act as direct drivers for injury producing events it should be borne in mind that these inherent risks are not borne equally within societies. The most socially disadvantaged members of society are more likely to be constrained to reside in such marginal housing.

Referring more broadly to the neighbourhoods in which housing is situated, collective agglomerations of marginal housing constitute the settings variously referred to as informal settlements, shantytowns, slums, favelas and barrios - terms synonymous with social exclusion, and threat. The nature of the threat may change from setting to setting. A boy celebrating his 15th birthday in the Cape Town settlement of Nyanga has a greater than 1 in 20 chance of being shot dead by the age of 35.⁵² In the Banshbari slum of Dhaka politically and economically marginalized residents interviewed report not going out after nightfall due to security fears and the targeting of women for abduction, rape and trafficking.⁵³ In still other settings the threat may come from major arterial, high-speed traffic routes cutting such areas off from the rest of the urban area, or bisecting entire neighbourhoods.

In some countries, housing tenure (i.e. whether a house is rented or owned) is correlated with injury, although of course the relationships between poverty, housing and health are complex.⁵⁴ There is some evidence that in wealthier nations, older people in institutional care have an excess risk of falls leading to fractures (which may, of course be a consequence of the factors which bring them into residential care)⁵⁵. Housing inequalities are also related to injury rehabilitation, with housing maladapted to those disabled in an accident further disabling them in terms of day to day living. Poor (or no) fire services increase the risk to those living in poverty.

In summary, there are a wide range of pathways between housing and neighbourhoods and injury and violence outcomes. These relate both to the inherent safety of building structures, safety devices, and activities taking place within housing such as cooking and heating as well as to the broader qualities of

⁵² Pinheiro PS. World report on violence against children. United Nations Publishing Services, Geneva. 2006.

⁵³ Meddings D, Bettcher D, Ghafele R. Violence and human security: policy linkages. In: Global Health Challenges for human security. Chen L, Leaning J, Narasimhan V eds. Global Equity Initiative, Cambridge, Massachusetts 2003.

⁵⁴ Kawachi I and Berkman L.B. (eds.), *Neighborhoods and Health*, Oxford University Press, 2001

⁵⁵ Johansen A.; Lyons R.A.; Jones S.; Jones G.; Stone M.D.; Palmer S.R., Fracture incidence among elderly people in institutional care: linking injury surveillance data with a postal code-based register of residential and nursing homes, *Injury Control and Safety Promotion*, Volume 6, Number 4, December 1999 , pp. 215-221(7)

the neighbourhood within which housing is situated. Interruption to these pathways depends on awareness and understanding of their interconnections with health, effective regulation, sound planning and adequate space, and the occupational health of domestic labour, including the ways in which meals are created. Relating the scope of these factors to the frameworks in Figure 5, housing and neighbourhoods mediate influences on injury risk through all 3 top levels (i.e. with unsafe or substandard housing being a marker for socioeconomic position, by virtue of unsafe environments constituting a direct and differential exposure for risk of injury, and through groups living within unsafe settlements constituting visible population groups that are differentially more vulnerable to injury risk).

C Roads and vehicles as determinants

Poor road design has long been identified as a determinant of road traffic injury and death⁵⁶. Improved design (improved road surfaces, or better sightlines for instance) may unintentionally result in increased risk for these injuries through higher speed. Much the same observation can be made in relation to vehicles, with within- vehicle modifications having the potential to improve the attractiveness of the vehicle to consumers, and/or the safety of those who travel inside the vehicle, while potentially reducing the safety of other road users. A study commissioned by the Department for Transport in England, for instance reported that analysis of accident records showed that 2-3 fatalities, and about forty serious injuries, at a cost of some £6M a year caused were by bull bars⁵⁷ and whilst risk compensation theories remain controversial, observational studies confirm increased speed in powerful vehicles and increased proximity between motor vehicles and cyclists wearing helmets.

The types of injury which may be implicated

The injuries and deaths related to roads and vehicles are largely road traffic injuries - a health outcome that is inequitably distributed globally and an important driver of further inequalities worldwide.

The pathways and relationship between roads and vehicle related injuries and inequality

The relationship between socio-economic inequalities and injury on the roads has been frequently described, and can be observed in both wealthier and poorer nations although roughly 90% of the global burden of road traffic injury deaths occur in low- and middle-income countries⁵⁸. Within these settings non-motorised

⁵⁶ Peden M et al., eds. (2004). *World report on traffic injury prevention*. Geneva, World Health Organization

⁵⁷ <http://www.dft.gov.uk/rmd/project.asp?intProjectID=10328>

⁵⁸ Peden M et al., eds. (2004). *World report on traffic injury prevention*. Geneva, World Health Organization

forms of transport tend to constitute the major mode of transport, and for the world's poor people, walking is the main mode of transport^{59, 60}. The young and the old are at particular risk and those who live or work close to busy roads exposed to greater danger than those who have gardens, grounds, or land to play on. There is an increased risk to males of road traffic injuries. Those outside motorised vehicles are at greater risk than those inside them - indeed, this dimension of the injury risk is a perfect illustration of both differential exposure and differential vulnerability. For those who own or drive vehicles, safer vehicles tend to be those which are more expensive (though these vehicles are also the ones more capable of high speeds), and thus vehicle ownership and safety of vehicles owned as a marker for socioeconomic position is yet another aspect of the manner in which this determinant influences injury risk. Among those who drive for a living, in countries where regulation is poor, long hours and the need to earn a living wage may contribute to unsafe driving as a result of fatigue.

The pathways between this group of determinants and injury include the separation of roads and traffic from pedestrians, safe vehicle maintenance and regulation and some of the consequences of globalization and the movement of goods across large distances by road.

Inter-relationships between determinants, inequalities and injury

There are a number of important inter-relationships between the determinants we have touched on here. Some relevant examples below highlight the potential for synergistic effects between the determinants and once again underline the potential value of public health interventions that target the social determinants driving health outcomes.

Alcohol and housing The consequences of their own or others' alcohol use is exacerbated for those who live in poor housing, who themselves are more likely to be poor, and more likely to be smokers. Falling asleep while smoking, leaving cooking devices unattended, or knocking over heating implements while under the effect of alcohol have all been implicated in fire injury. Falls under the influence of alcohol are more likely in poorly maintained housing.

Housing and road traffic injuries Poor housing is less likely to be well-separated from traffic, and poor people are less likely to live in housing or settlements away from busy, or fast roads. In wealthier nations, 'traffic calming' initiatives tend to be seen more frequently in wealthier areas.

Alcohol and road traffic injuries The effects of alcohol on road injury have been well documented with an excess of driving deaths and injuries following drinking.

⁵⁹ Bannister D, Wright L, The role of transport in supporting sub-national growth. Report prepared for Department for International Development (DFID), Bartlett School of Architecture, University College London, 2005.

⁶⁰ Woodcock J, Banister D, Edwards P, Prentice A, Roberts I. Energy and Health 3. Lancet (forthcoming).

These brief examples are discussed further in the next section where we shift to considering interventions.

III Strategies and interventions to reduce injury by affecting the determinants

The ideal position in a chapter of this kind would be to provide a menu of 3 or 4 'best buys' in order to act on each of the determinants to reduce injuries, but while we are starting to know more about ineffective or harmful interventions, there is a good deal more to be known about the most effective and cost effective courses of action, and how to implement them most successfully.

There is no evident magic bullet, or pump handle to remove, since the particular determinants looked at here involve cross cutting responsibilities, and in some cases, powerful vested interests. This does not mean that *inaction* is the answer, but that there may be different priorities and possibilities in different contexts.

A general remark is in order here about interventions that target social determinants. By definition such approaches move away from focusing on the individual and individual behaviours. While it is true that there is a behavioural aspect to the injuries related to the determinants we have focused on here there are known limitations to interventions which focus on behaviour change. Indeed, arguably a far greater impact of behaviour change on injury outcomes would come from behavioural change on the part of architects, planners, builders, politicians and policy makers. Progress in other areas in reducing risk such as anaesthesia and aviation show that systems approaches - despite being more complex and difficult to evaluate - are more likely to be successful than a focus on the individual. Targeting systems with the objective of making health and healthier lifestyles more likely (whether it be the safe purveyance of drinking water, mobilizing political and financial support for reducing threats to health such as malarious swamps in southern Europe, or enacting barriers to tobacco sales) has a strong history of effect.

In a sense then, the notion of public health mobilizing to act on broad-based social determinants of health is not so much new as a slightly different take on an established theme. The main deflection is towards focusing systems approaches on sectors and issues that seem visibly further removed from health outcomes than malarious mosquitoes but which on closer inspection are tightly linked with entire arrays of health outcomes. A holistic approach is needed to ensure that we do not trade off gains in one health area against losses in another. There is some evidence that in wealthier nations, a drop in child injury, for instance, has been 'bought' at the cost of restrictions on children's freedom to walk or cycle at will, with consequences in the round for child health and well-being.

As Woodcock et al point out, however, there can be virtuous as well as vicious cycles in this area, and public policies that encourage a transition to a low-carbon low-energy transportation system, for instance, have the potential to bring

substantial public-health benefits in addition to injury reduction by affecting a number of health pathways .

Per kilometre travelled, heavy goods vehicles are twice as likely to be involved in fatal crashes than are cars. In low-income and middle-income countries, trucks are involved in most fatal crashes.⁶¹ In most settings, those at greatest risk are people on low incomes who do not have the option of car travel and often have to walk long distances on roads carrying high-speed vehicles. Rumble strips and speed humps are effective interventions in developing countries⁶² .

As Figure 6 below suggests, research evidence is only one of many influences on policy or practice strategies to reduce injury. While research evidence is the factor most consistently used in this chapter, reference has also been made to other influences, such as tradition, values and expertise including lay expertise.

Figure 6: Factors influencing policy making⁶³



⁶¹ Mohan D, Work trips and safety of bicyclists, *Indian Journal of Transport Management*, 26(2), 225-233, 2002

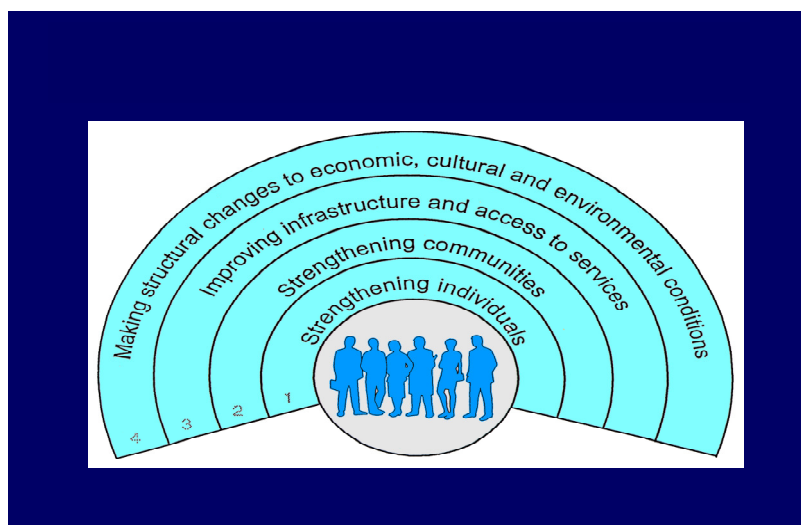
⁶² Afukaar FK. Speed control in developing countries: issues, challenges and opportunities in reducing road traffic injuries. *Injury Control and Safety Promotion* 2003; 10: 77–81.

⁶³ Davies, P.T., 2004, 'Is Evidence-Based Government Possible?' Jerry Lee Lecture, 4th Campbell Colloquium, Washington D.C. 19 February 2004. Available at: <http://www.policyhub.gov.uk/downloads/JerryLeeLecture1202041.pdf#page=1>

Source: Davies, P.T., 2004, 'Is Evidence-Based Government Possible?' Jerry Lee Lecture, 4th Campbell Colloquium, Washington D.C. 19 February 2004. Available at: <http://www.policyhub.gov.uk/downloads/JerryLeeLecture1202041.pdf#page=1>.

All of the factors above will play a part in determining which strategies are likely to be capable of implementation, but the configuration of factors, and the extent to which evidence of the type presented here plays the central role, is likely to vary from region to region. Moreover, different kinds of research evidence will be used by those in a position to act on the determinants of injury. In two linked articles, Petticrew, Whitehead et al^{64 65} draw attention to the jigsaw of evidence required for public health policy on inequalities. The pathways of action to interrupt injury will also be influenced by the kinds of actions described by Margaret Whitehead's (unpublished) diagram below, further explicated in her work⁶⁶ outlining the questions which need to be responded to i.e. what is the underlying theory about the cause of the problem? What is the reasoning about how the proposed intervention will work to bring about change or improvement?

Figure 7: A typology of interventions to tackle inequalities in health⁶⁷



⁶⁴ Petticrew M, Whitehead M, Macintyre SJ, et al. Evidence for public health policy on inequalities: 1: The reality according to policymakers. *J Epidemiol Community Health* 2004;58:811–16

⁶⁵ Whitehead M, Petticrew M, Graham H, et al. Evidence for public health policy on inequalities. Paper II: assembling the evidence jigsaw, *J Epidemiol Community Health* 2004;58:817–21

⁶⁶ Whitehead M A typology of actions to tackle social inequalities in health, *Journal of Epidemiology and Community Health* 2007;61:473-478

⁶⁷ Whitehead M. Reflections on a Rainbow. Keynote speech to "Dahlgren and Whitehead and beyond" Conference, Society for Social Medicine/Institute of Health Research, Cardiff, 21st April 2005

Source: Whitehead M. Reflections on a Rainbow. Keynote speech to "Dahlgren and Whitehead and beyond" Conference, Society for Social Medicine/Institute of Health Research, Cardiff, 21st April 2005.

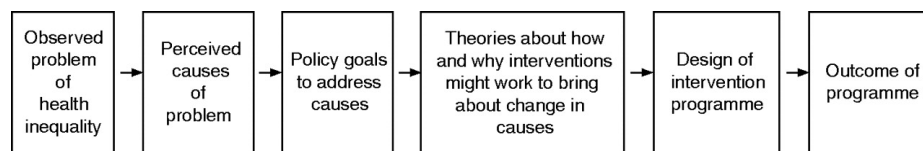
Research evidence on reducing the determinants of injury

We present here the evidence base for interventions to reduce injury from two major sources - systematic reviews and individual studies. The individual studies we mention here may not have the evidentiary strength of a systematic review but have been selected because they either directly address the top 3 levels of Figure 5 or because they are targeted in a manner which is informed by these.

We will present our systematic reviews first for each determinant, followed by individual studies. The Cochrane injury group is probably one of the better populated review groups in terms of attempts made to focus on determinants, and efforts to look at the problem beyond the confines of wealthier nations. Nevertheless, in line with the predominant focus on injury rather than the antecedents to injury, a relatively small number of reviews address the determinants of injury beyond behaviour. Of those that do, the evidence cupboard in terms of robust primary studies is often disappointingly bare. Among other review groups, the EPPI Centre⁶⁸ in London uses a broader range of study types, including user views in research syntheses, while the Campbell Collaboration⁶⁹, a sister collaboration to Cochrane, exists to help people make well-informed decisions about the effects of interventions in the social, behavioural and educational arenas. In due course, these latter sources are likely to have considerable contributions to make to tackle the determinants of inequalities in health.

Meanwhile, Cochrane reviews which address the particular determinants described in the previous section are described below before returning to the Whitehead model in Figures 7 above, and 8 below, and looking at the part these sorts of interventions, and the issues raised by these reviews, may play in acting on determinants.

Figure 8: A typology of health inequalities interventions



⁶⁸ <http://epi.ioe.ac.uk/cms/>

⁶⁹ <http://www.campbellcollaboration.org/>

Source: Whitehead M A typology of actions to tackle social inequalities in health, *Journal of Epidemiology and Community Health* 2007;61:473-478

Cochrane reviews relevant to alcohol and injury

In a review of ways of working with problem drinkers⁷⁰, the authors point out injuries (both intentional and unintentional) are one of the most important ways in which excess alcohol use can result in harm. They identified 17 studies from the USA, Australia, New Zealand, UK, Sweden, Bulgaria, and including a 10 country study from WHO of programmes, reporting on whether working with problem drinkers reduced injuries. The evidence from these studies suggests that behavioural change interventions with problem drinkers is effective in reducing both injuries and events that lead to injury (such as falls, motor vehicle crashes, and suicide attempts).

One way of addressing determinants is through outlets serving alcohol. A Cochrane review on interventions in alcohol serving settings⁷¹ points out that while many interventions to reduce alcohol-related injuries have a demand-side focus and aim to reduce individuals' consumption of alcohol, attention on supply-side interventions, which attempt to alter the environment and context within which alcohol is supplied and consumed so that potential harm is minimized are also required. Their review examined the evidence for the effectiveness of interventions implemented in the alcohol server setting for reducing injuries. They found 20 studies; only five of which measured the effect on injury, the remaining 15 measuring the effect on behaviour (by the patrons and/or the servers of the alcohol within the premises). The studies investigated a range of interventions involving server training, health promotion initiatives, a drink driving service, a policy intervention and interventions that targeted the server setting environment. The authors conclude that there is no reliable evidence that interventions in the alcohol server setting are effective in preventing injuries.

A review active on a passive intervention – an alcohol ignition interlock⁷² - describes how convicted drink drivers are sometimes offered the choice of a standard punishment, or for an alcohol ignition interlock to be fitted to their car for a fixed period. To operate a vehicle equipped with an interlock, the driver must first give a breath specimen. If the breath alcohol concentration of the specimen is too high, the vehicle will not start. A number of studies have been conducted to see whether the interlock stops drink drivers from offending again. Most of these

⁷⁰ Dinh-Zarr T, Goss C, Heitman E, Roberts I, DiGiuseppi C. Interventions for preventing injuries in problem drinkers. *Cochrane Database of Systematic Reviews* 2004, Issue 3.

⁷¹ Ker K, Chinnock P. Interventions in the alcohol server setting for preventing injuries. *Cochrane Database of Systematic Reviews* 2006

⁷² Willis C, Lybrand S, Bellamy N. Alcohol ignition interlock programmes for reducing drink driving recidivism. *Cochrane Database of Systematic Reviews* 2004, Issue 3

studies have not been of high quality. The authors conclude that while the interlock seems to reduce re-offending as long as it is still fitted to the vehicle, but there is no long-term benefit after it has been removed, but the low percentage of offenders who choose to have an interlock fitted also makes it difficult to reach firm conclusions about their effectiveness.

Moving away from systematic reviews to single studies, a study documented a multi-level intervention in Cali Colombia which restricted bar opening hours and limited access to firearms and found a significant reduction in firearm-related homicide⁷³. Aspects of this intervention which make it relevant to this work were that the restrictions on bar closing hours and on firearm carrying were strategically enforced by authorities who targeted the poorer districts of the city where most homicides had previously taken place. Another study evaluated the effect of a 2 a.m. (as opposed to 5 a.m.) closure of bars in the city of Juárez, Mexico⁷⁴. Prior to this effective partial ban on alcohol sales the city was a favoured destination for young adults crossing the US-Mexican border to take advantage of a lower drinking age (18 as opposed to 21), and lower priced alcohol. The study found an 89% reduction on youthful drinkers crossing the border after 3 a.m. Finally, a recent meta-analysis that included 13 studies found emergency department interventions for alcohol problems resulted in halving future risk for an alcohol-related injury⁷⁵.

The reviews and individual studies above relate to alcohol, housing and transport, but with alcohol as the primary presenting problem. Pathways identified are individual behavioural, (potentially strengthening individuals); contextual (potentially strengthening communities and targeting availability) and a passive measure (interlocking) which might fit into Whitehead's infrastructure category.

Actions needed: an identification of the level at which a particular neighbourhood, region, or country might identify the level for action; a need for any action on determinants, given the limited high quality studies, to be well designed; the need for co-working between alcohol users and those who live with them , policy makers and practitioners.

⁷³ Effect of a Ban on Carrying Firearms on Homicide Rates in 2 Colombian Cities
Andrés Villaveces, MD, MPH; Peter Cummings, MD, MPH; Victoria E. Espitia, MSc; Thomas D. Koepsell, MD, MPH; Barbara McKnight, PhD; Arthur L. Kellermann, MD, MPH .JAMA. 2000;283:1205-1209

⁷⁴ A partial ban on sales to reduce high-risk drinking South of the border: seven years later. Voas RB, Romano E, Kelley-Baker T, Tippetts AS. [J Stud Alcohol](#). 2006 Sep;67(5):746-53.

⁷⁵ Systematic review and meta-analyses of strategies targeting alcohol problems in emergency departments: interventions reduce alcohol-related injuries. Havard A, Shakeshaft A, Sanson-Fisher R. [Addiction](#). 2008 Jan 8 (published electronically ahead of print).

Individual studies and reviews relevant to housing and neighbourhoods and injury

A Cochrane review on home safety education⁷⁶ found that home safety education provided most commonly as one-to-one, face-to-face education, in a clinical setting or at home, especially with the provision of safety equipment is effective *in increasing a range of safety practices*. The studies included were largely from the USA, with smaller numbers from the UK, Australia, France, New Zealand, Sweden, Denmark, Canada, Singapore, Norway, Greece, Hong Kong, Israel, Italy, China, Mexico and South Africa. There was no consistent evidence that home safety education, with or without the provision of safety equipment was less effective in those at greater risk of injury, but the effect of home safety education appeared to diminish with time, with greater effects for most outcomes over a shorter (three months or less) than a longer time period. The positive impact on safety *practices* in this review was somewhat mitigated by a lack of evidence regarding its impact on child injury rates.

A review of community-based interventions to reduce burns and scalds in children⁷⁷ included studies from the United States and Norway. Only one of these showed a significant decrease in paediatric burn and scald injury in the intervention community compared with the control community. The authors suggest that it is important that a framework for considering the problem of burns/scalds in children from a prevention perspective be articulated, and that an evidence-based suite of interventions be combined to create programme guidelines suitable for implementation in communities throughout the world. As the authors point out, there remains a gap between "what we know works" in childhood burns and scalds injury prevention and "how to make it work" in a real world setting. There is a paucity of research evidence from which to develop a set of evidence-based guidelines for practitioners implementing community-based programmes of activity in this area.

A review of modifications to the home environment⁷⁸ was similarly cautious, finding that there is insufficient evidence to determine the effects of interventions to modify environmental home hazards. Further interventions to reduce hazards in the home should be evaluated by adequately designed randomized controlled trials measuring injury outcomes.

⁷⁶ Kendrick D, Coupland C, Mulvaney C, Simpson J, Smith SJ, Sutton A, Watson M, Woods A. Home safety education and provision of safety equipment for injury prevention. *Cochrane Database of Systematic Reviews* 2007, Issue 1.

⁷⁷ Turner C, Spinks A, McClure R, Nixon J. Community-based interventions for the prevention of burns and scalds in children. *Cochrane Database of Systematic Reviews* 2004, Issue 2.

⁷⁸ Lyons RA, John A, Brophy S, Jones SJ, Johansen A, Kemp A, Lannon S, Patterson J, Rolfe B, Sander LV, Weightman A. Modification of the home environment for the reduction of injuries. *Cochrane Database of Systematic Reviews* 2006, Issue 4

Interventions to promote functioning smoke alarms to reduce injury were reviewed in 2001⁷⁹ again, with less than positive findings. As the authors point out, many children aged 0-16 are killed or injured by house fires each year. Fires detected with smoke alarms are associated with lower death rates. This review of trials found that interventions to promote smoke alarms have at most only modest beneficial effects on smoke alarm ownership and function, fires, and fire-related injuries. Counselling by health care workers, as part of child health care, may increase ownership and use of smoke alarms in homes but did not show any effect on injuries. They conclude that interventions to promote smoke alarms have at most only modest beneficial effects on smoke alarm ownership and function, fires, and fire-related injuries.

A review of pool fencing⁸⁰ is more positive, concluding that while there were no trials, evidence from other studies found that pool fencing that adequately prevents children reaching the pool unsupervised can prevent about three-quarters of all child drowning in pools.

Also positive in its conclusions is a review of population based interventions to prevent falls in the elderly⁸¹ suggesting on the basis of studies from Australia, Denmark, Norway, and Sweden a relative reduction in fall-related injuries ranging from 6 to 33%, providing support for a population based approach.

Similarly cautiously positive is a review of the WHO Safe Communities approach⁸² to population-based injury reduction. The emphasis of the Safe Communities approach is on collaboration, partnership and community capacity building to reduce the incidence of injury and promote injury-reducing behaviours. More than 80 communities throughout the world have been designated as 'Safe Communities', in countries as diverse as Sweden, Australia, China, South Africa and the Czech Republic. Programmes target high-risk groups or environments and promote safety for vulnerable groups. They range from bicycle helmet promotion in Sweden to anti-violence programmes in South Africa, traffic safety initiatives in South Korea and indigenous community injury prevention programmes in New Zealand. The authors conclude that evidence suggests the WHO Safe Communities model is effective in reducing injuries in whole populations, while drawing attention to methodological problems in included studies, and to the lack of good studies from the poorer parts of the world which contribute to this collaboration.

⁷⁹ DiGiuseppi C, Higgins JPT. Interventions for promoting smoke alarm ownership and function. *Cochrane Database of Systematic Reviews* 2001, Issue 2.

⁸⁰ Thompson DC, Rivara FP. Pool fencing for preventing drowning in children. *Cochrane Database of Systematic Reviews* 1998, Issue 1

⁸¹ McClure R, Turner C, Peel N, Spinks A, Eakin E, Hughes K. Population-based interventions for the prevention of fall-related injuries in older people. *Cochrane Database of Systematic Reviews* 2005, Issue 1

⁸² Spinks A, Turner C, Nixon J, McClure R. The 'WHO Safe Communities' model for the prevention of injury in whole populations. *Cochrane Database of Systematic Reviews* 2005, Issue 2.

Shifting focus from the attributes of the household to the quality of the living environment within the household, particularly in terms of a nurturing environment for children, one finds a number of early childhood interventions that appear to be particularly effective when targeting populations living in lower socioeconomic neighbourhoods. One systematic review reviewed a range of early childhood interventions which were primarily based on home visitation and/or home visitation combined with parental education⁸³. Programmes typically were situated within the first 5 years of life and a subset of the programmes reviewed were targeted at high risk households (where risk equated to markers such as a household with an income below the poverty line, a single parent household etc.).

Overall the findings of evaluation results for the 20 programmes with evaluation designs that were considered strong experimental or quasi-experimental designs were highly positive and the benefits tended to be more pronounced in programmes that focused specifically on disadvantaged populations. Benefits were measured over a wide variety of domains (cognition and academic achievement, behavioural/emotional competencies, educational attainment, child maltreatment, health, delinquency, use of social welfare programmes, and labour market insertion). The broad array of domains studied in which benefits accrue shows the impact of such programmes extend beyond injury and violence and extend into other domains of health interest including adolescent and reproductive health, mental health etc. The benefits in these different domains were observed in early, middle, late childhood and through to adulthood with in at least one instance benefits being measurable 35 years after the programme had ended.

Another systematic review looked at early childhood interventions and tenant-based rental voucher programmes, designed to allow poorer families to move to better housing and neighbourhoods⁸⁴. Results of the task force undertaking the review were to support early childhood development programs for children 3-5 at risk because of poverty on the basis of a range of positive outcomes, and also to support rental voucher programmes on the basis of improved household safety and reduced risk of victimization due to violence and exposure to violence. Long term effects (after 15 years) of home visitation have found the intervention particularly effective in low income, unmarried mothers in terms of reducing a

⁸³ Early childhood interventions : proven results, future promise. Lynn A. Karoly, M. Rebecca Kilburn, Jill S. Cannon. Report prepared for the PNC Financial Services Group, Inc. by RAND Labor and Population, a division of the RAND Corporation.

⁸⁴ Community interventions to promote healthy social environments: early childhood development and family housing. A report on recommendations of the Task Force on Community Preventive Services. Anderson LM, Shinn C, St CJ, Fullilove MT, Scrimshaw SC, Fielding JE, Normand J, Sanchez-Way R, Richardson T; Centers for Disease Control and Prevention. [MMWR Recomm Rep](#). 2002 Feb 1;51(RR-1):1-8.

wide range of negative outcomes for mother and child including child abuse and neglect, and criminal behaviour⁸⁵.

The reviews above relate to housing and neighbourhoods as a determinant. Pathways identified tend to be at the individual behavioural, (potentially strengthening individuals); socioeconomic contextual (potentially strengthening communities and improving the quality of the household environment) and physical environment and infrastructure levels (smoke alarms).

Actions needed: an identification of the level at which a particular neighbourhood, region, or country might identify the level for action; a need for any action on determinants, given the limited high quality studies, to be well designed; further research on potential 'low hanging fruit' such as the effectiveness of safer stoves for low- and middle-income settings or policies to enforce hot water temperature regulation in these settings; the need in the short term for policy makers and practitioners to act on the identification of risks by those living in poor housing, and in the longer term, for the land use policies described below to include housing initiatives

Individual studies and reviews relevant to the prevention of road traffic injury

The Cochrane database is relatively well-populated in this area, with thirteen published reviews and nine potential new reviews registered.

Four of these reviews are in the somewhat controversial area of helmet use by cyclists and motorcyclists. The first two reported here address legislative and non-legislative promotion of helmet wearing. A review on bicycle helmet legislation⁸⁶ concludes that this appears to be effective in increasing helmet use and decreasing head injury rates in the populations for which it is implemented. However, there are very few high quality evaluative studies that measure these outcomes (all of the included studies are from North America), and none that reported data on a possible decline in bicycle use. A review of non-legislative interventions to encourage the wearing of cycle helmets⁸⁷ is similarly positive, finding that while the results were varied, overall, after a campaign, children were more likely to wear helmets than other children. The reviewers could not identify the best way of reaching poorer children, and the studies they reviewed did not

⁸⁵ Long-term effects of home visitation on maternal life course and child abuse and neglect. Fifteen-year follow-up of a randomized trial. Olds DL, Eckenrode J, Henderson CR Jr, Kitzman H, Powers J, Cole R, Sidora K, Morris P, Pettitt LM, Luckey D. *JAMA*. 1997 Aug 27;278(8):637-43.

⁸⁶ Macpherson A, Spinks A. Bicycle helmet legislation for the uptake of helmet use and prevention of head injuries. *Cochrane Database of Systematic Reviews* 2007, Issue 2

⁸⁷ Royal ST, Kendrick D, Coleman T. Non-legislative interventions for the promotion of cycle helmet wearing by children. *Cochrane Database of Systematic Reviews* 2005, Issue 2

look at the impact of campaigns on injury rates, or assess whether the promotion campaigns had any negative effects. The included studies were from the USA, UK, Canada and New Zealand. The second two look at injury more directly. A review of the part played by helmets in preventing facial and head injury in cyclists⁸⁸ provides the robust conclusion that wearing a helmet reduced the risk of head or brain injury by approximately two-thirds or more, regardless of whether the crash involved a motor vehicle. Injuries to the mid and upper face were reported to be markedly reduced, although helmets did not prevent lower facial injuries. The included studies were from the USA, UK and Australia. Feedback from critics, and responses to this, make clear why work in this area is so complex⁸⁹

Finally a review of trials concluded that helmet use by motorcyclists reduce the risk of head injury by around 72%⁹⁰. This review included observational data from a wide variety of settings, including some developing countries, although the majority of studies were based on populations from developed countries. The risk of death is also reduced, although it is not possible to estimate a percentage figure for this reduction from the available evidence. The review supports the view that helmet use should be actively encouraged worldwide for rider safety.

A review of reflective clothing concluded that visibility aids have the potential to increase visibility and enable drivers to detect pedestrians and cyclists earlier⁹¹ but that the effect of visibility aids on pedestrian and cyclist safety remains unknown.

A review largely applicable to (and based on studies from) wealthier nations looks at the effectiveness of interventions to promote the use of booster seats in 4-8 year olds⁹² concluding that all interventions investigated by the studies were found to increase the use of booster seats. Specifically relevant to socioeconomic context and position, the distribution of free booster seats combined with education on their use, had a marked beneficial effect, as did incentives (for example, booster seat discount coupons or gift certificates) combined with education. Education-only interventions also produced beneficial outcomes. The authors conclude that the current evidence suggests that several types of interventions aimed at increasing the use of booster seats among children aged four to eight years, are effective.

⁸⁸ Thompson DC, Rivara FP, Thompson R. Helmets for preventing head and facial injuries in bicyclists. *Cochrane Database of Systematic Reviews* 1999, Issue 4

⁸⁹ <http://mrw.interscience.wiley.com/cochrane/clsysrev/articles/CD001855/frame.html>

⁹⁰ Liu B, Ivers R, Norton R, Blows S, Lo SK. Helmets for preventing injury in motorcycle riders. *Cochrane Database of Systematic Reviews* 2003, Issue 4

⁹¹ Kwan I, Mapstone J. Interventions for increasing pedestrian and cyclist visibility for the prevention of death and injuries. *Cochrane Database of Systematic Reviews* 2006, Issue 4.

⁹² Ehiri JE, Ejere HOD, Magnussen L, Emusu D, King W, Osberg JS. Interventions for promoting booster seat use in four to eight year olds travelling in motor vehicles. *Cochrane Database of Systematic Reviews* 2007, Issue 1

Turning to drivers, a review of whether graduated driver licensing (GDL) reduces crash rates among novice drivers by gradually introducing them to higher risk driving situations found that relatively little research has been done to see whether GDL actually works⁹³. This review found 13 studies that have evaluated various types of GDL programs. All of the studies reported positive findings, with reductions for all types of crashes among all teenage drivers. However, the size of the reductions varied and, from the evidence available, it is not possible to say which aspects of GDL programs have the biggest effect. A more sceptical, but also more conclusive, review looks at driver education⁹⁴. As the authors point out, drivers' errors are a factor often contributing to traffic crashes, driver education is often used in the belief that this makes drivers safer. Driver education for licensed drivers can be remedial programmes for those with poor driving records, or advanced courses for drivers generally. They can be offered by correspondence, in groups or with individualised training. The review of trials found strong evidence that no type of driver education for licensed drivers leads to a reduction in traffic crashes or injuries. Also in the area of driver education is a review of school-based education aimed at the prevention of traffic crashes for drivers⁹⁵ - an example of a review where a well-meaning intervention appears to have the reverse of the desired effect. The authors conclude that the results of their systematic review show that driver education in schools leads to early licensing, but there is no evidence that it reduces road crash involvement, and it may lead to a modest but potentially important increase in the proportion of teenagers involved in traffic crashes.

.A review with very positive findings explores the use of cameras at road junctions⁹⁶. As the authors report, a common place for road traffic accidents is at junctions (intersections) controlled by traffic signals. 'Red-light cameras' are now widely used to identify drivers that jump ('run') red lights, who can then be prosecuted. This review looked for studies of their effectiveness in reducing the number of times that drivers drive through red lights and the number of crashes. Very little research has been done and much of it has not allowed for the statistical problems that occur when recording this kind of information. However, five studies in Australia, Singapore and the USA all found that use of red-light cameras cut the number of crashes in which there were injuries. In the best conducted of these studies, the reduction was nearly 30%. They conclude that more research is needed to determine best practice for red-light

⁹³ Hartling L, Wiebe N, Russell K, Petruk J, Spinola C, Klassen TP. Graduated driver licensing for reducing motor vehicle crashes among young drivers. *Cochrane Database of Systematic Reviews* 2004, Issue 2.

⁹⁴ Ker K, Roberts I, Collier T, Beyer F, Bunn F, Frost C. Post-licence driver education for the prevention of road traffic crashes. *Cochrane Database of Systematic Reviews* 2003, Issue 3

⁹⁵ Ian Roberts, Irene Kwan and the Cochrane Injuries Group Driver Education Reviewers. School-based driver education for the prevention of traffic crashes. *Cochrane Database of Systematic Reviews* 2001, Issue 3

⁹⁶ Aeron-Thomas AS, Hess S. Red-light cameras for the prevention of road traffic crashes. *Cochrane Database of Systematic Reviews* 2005, Issue 2.

camera programmes, including how camera sites are selected, signing policies, publicity programmes and penalties. A similarly positive trend in a review of engineering measures relates to the use of speed enforcement devices (SEDs)⁹⁷ to prevent traffic injuries. The review authors found that although there were methodological limitations to the studies reviewed, the consistency of reported positive reductions in speed and crash outcomes across all studies suggest that SEDs are a promising intervention for reducing the number of road traffic injuries and deaths. The authors again make a plea for better studies and for studies from poorer countries.

Particularly revealing is a review of educational interventions for children.⁹⁸ The review of trials (mostly in children) found that pedestrian safety education can improve children's road safety knowledge and their observed road crossing behaviour. However, whether these changes to knowledge or behaviour can be linked to a reduction in pedestrian deaths and injuries is unknown.

A number of individual studies have documented prevention of road traffic injury or improved access to established safety interventions through interventions which have explicitly targeted or taken into account the socioeconomic context. In many low-income countries children are routinely transported on motorized two-wheelers and studies have shown factory workers need to work 11 times as long as counterparts from high-income countries to purchase motorcycle helmets. In Viet Nam a nongovernmental organization distributes tropical climate suited motorcycle helmets free of charge to school-age children⁹⁹.

Child restraint systems are very effective if correctly installed and used and a number of studies have shown that uptake of these interventions may be increased in populations where use is low through free distribution, loan schemes or subsidized rental schemes. In addition to the Cochrane review mentioned above which reported on this among other outcomes, a variety of studies have demonstrated such systems to have a marked beneficial effect on the uptake and use of appropriate restraint systems for children and to be highly cost-effective^{100,101}.

⁹⁷ Wilson C, Willis C, Hendrikz JK, Bellamy N. Speed enforcement detection devices for preventing road traffic injuries. *Cochrane Database of Systematic Reviews* 2006, Issue 2

⁹⁸ Duperrex O, Roberts I, Bunn F. Safety education of pedestrians for injury prevention. *Cochrane Database of Systematic Reviews* 2002

⁹⁹ Hendrie D et al. Child and family safety device affordability by country income level: a comparison of 18 countries. *Injury Prevention*, 2004, 10:338-343.

¹⁰⁰ Zaza S et al. Reviews of evidence regarding interventions to increase use of child safety seats. *American Journal of Preventive Medicine*, 2001, 21:31-37.

Finally, incorporating safety features into road design has been shown to be effective and has addressed the improvement of road networks in poorer environments. Ghana has road fatality rates some 30 to 40 times higher than industrialized countries and excessive speed has been shown to be a key contributory factor. Inexpensive speed bumps in pedestrian crash hot spots in towns lying alongside the main Accra-Kumasi highway have been associated with 35% reductions in road traffic crashes, 55% reduction in fatalities, and a 76% reduction in serious injury, showing the feasibility of addressing differential exposure to risk through speed control interventions in low income environments¹⁰².

Strategies and interventions to reduce injury - concluding remarks

This section has summarized much of the systematic review based evidence and some relevant individual studies which speak to injury control interventions addressing the determinants of alcohol, housing and neighbourhoods, and roads and vehicles. We have tried wherever possible to highlight instances where the nature of the implementation or the intervention itself is explicitly targeted along the lines of socioeconomic context and position, differential exposures, or differential vulnerabilities.

One thing that emerges from this analysis is the fundamental importance of a social determinants approach to the prevention of injury. Unlike many other health outcomes that might also benefit from a social determinants approach, we have no pills, no vaccines and no clinical manoeuvres which reduce rates of injury. Virtually all of the progress that has been made in preventing injury has come from acting directly on the social environment or on patterns of exposure to risk that correlate closely with factors such as socioeconomic context and position.

While the evidence presented here shows that addressing social determinants can reduce injury, much of the evidence base comes from high income settings. There is a pressing need to enhance the evidence base on effective social determinant based interventions which are either administered in low- and middle-income settings or which are explicitly targeted at the most disadvantaged populations. This brings us quite naturally to our concluding section, which will discuss measurement needs.

¹⁰¹ Kedikoglou S et al. A maternity hospital-based infant car-restraint loan scheme: public health and economic evaluation of an intervention for the reduction of road traffic injuries. *Scandinavian Journal of Public Health*, 2005, 33:42-49.

¹⁰² Afukaar FK, Antwi P, Ofosu-Amah S. Pattern of road traffic injuries in Ghana: implications for control. *Injury Control and Safety Promotion*, 2003, 10:69-76.

IV Measurement

To start with the positive, as the UK Statistics Commission has pointed out¹⁰³ there have been many examples of statistical evidence radically changing the way things are done. Florence Nightingale's application of disease statistics reduced mortality in those wounded during the Crimean war, and Richard Doll's research in the 1950's made the link between smoking and lung cancer. More recently the *Stern Review on the Economics of Climate Change* drew on statistical evidence. Less positively, a case study from IDRC¹⁰⁴ on crunching the numbers points out that many countries in the developing world have an inadequate or no system for registering vital information. For example, of the 57 countries that make up the World Health Organization's Africa and Southeast Asia regions, only 8 have usable vital events data, and only 1 has complete coverage of death. It is believed that, within the poor countries of the globe, there are one billion people whose births and deaths are never registered -- no official or government agency ever acknowledges that these people exist. For this reason, the 2008 study on violence-related mortality in Iraq published in the *New England Journal of Medicine*¹⁰⁵ - a study which includes domestic violence - is a testimony (albeit a depressing one) on what can be done to collect data in even the most unpromising conditions.

This section therefore discusses both what we know, and what we need to know. In this, as in other areas of health inequalities, we are stronger on description which records injuries and their sequelae than we are on describing the antecedents on an injury, and measuring *the determinants* of injury. In those parts of the world where data collection systems are poor, there is an understandable tendency to want to suggest that these be improved. However, if we look at those (largely wealthier) nations where data collection is less poor, data remain largely inadequate in relation to the determinants of injury, and data collection (which itself incurs a high cost) is frequently impenetrable and under-used or poorly used.

The first recommendation on measurement of this report is therefore that just as health care increasingly needs to be addressed in terms of cost benefit, so does data collection. At the point where a suggestion is made that new data be collected, there also needs to be a strategy to use it, and a strategy for resources in place to do so. If it is simply collected because it is there, or because this is what we have always done, or because it might be useful, these need to be tested against other uses of resources.

¹⁰³ Statistics Commission (2007) *Data on demand, access to official statistics*, Report No, 34, Crown copyright, www.statscom.org.uk.

¹⁰⁴ http://www.idrc.ca/tehip/ev-64954-201-1-DO_TOPIC.html

¹⁰⁵ <http://content.nejm.org/cgi/content/full/NEJMsa0707782>

Data collection is itself socially constructed, and in some cases highly contested. We need to consider what kinds of data are likely to have an impact on the social determinants questions discussed here. The macro-economic determinants of injury are not evident at the site of injury and are not captured by injury surveillance systems¹⁰⁶. Ironically, some measures which may narrow social exclusion (for instance wider availability of cheaper cars) would reasonably be expected to increase injury, and increasing motorisation that has accompanied socioeconomic development has typically borne that out. As a recent article in the *Lancet* points out, for the world's poor people, walking is the main mode of transport, but such populations often experience the most from the harms of energy-intensive transport and much investment in major road projects does not meet the transport needs of poor people, especially women whose trips are local and off road.¹⁰⁷ Bogotá (Colombia) and Curitiba (Brazil) are perhaps the two most notable examples of developing-nation cities that have shown innovation with low-cost alternatives to private motorisation. Both of these cities have achieved success with high-quality bus systems and a complementary package of supporting measures, including infrastructure for non-motorised transport and car-restriction measures¹⁰⁸. Measuring whether this progress is maintained or undermined is vital,

That said, there are areas where good data has helped to support cultural change. As well as the examples at the head of this section, at a time when drinking and driving was more widely tolerated than is currently the case in the UK for instance, the fact that drinking only rarely directly led to injury and death in any individual case would make the offer of 'one for the road' not uncommon amongst convivial hosts. Given that those who are drunk and in charge of a vehicle were unlikely to be perceived as (let alone perceive themselves as) criminals, *the data* which have enabled the association between alcohol, impairment while drink driving and injury to be seen is one of the metaphorical bridges which may cross the dangerous road.

One of the peculiarities of data collection on injury is that even in countries where relatively good data are collected, there is a greater emphasis on the sequelae than on the antecedents of injury – a result in part of the relatively good data collection systems in the health sector where either for administrative (costing) reasons, or for reasons related to treatment, what is important is the injury and how it is dealt with. So long as injury is considered a largely individual problem, to be tackled through behavioural or educational interventions, this sort of data may have been thought adequate. It is entirely inadequate however, in tackling determinants.

¹⁰⁶ <http://www.resurgence.org/resurgence/issues/roberts000.htm> 08/03/05 (accessed August 2007)

¹⁰⁷ J Woodcock, D Banister, P Edwards, A Prentice, I Roberts, (2007) *Energy and Health* 3, *The Lancet*, 370: 1078-1088.

¹⁰⁸ Bannister D and Wright L, *The role of transport in supporting sub-national growth*, report prepared for Department for International Development (DFID), Bartlett School of Architecture, University College London, 2005

While policies to tackle injury are made nationally, much of what we need to know in order to effectively tackle *the determinants* are known locally. This final section therefore points to gaps in the data, with a recommendation that these be considered at national and local level by those who are tasked with reducing the toll from injury deaths.

The areas where there are particular data/evidence gaps in terms of the determinants of injury include:

- (a) how we can best collect, and more particularly, use to good effect, data which illustrates the equalities gap in the incidence or morbidity, mortality, candidacy for risk, and access to effective treatment or better, prevention
- (b) how we can best draw on lay expertise on local determinants and risks (and responses to these) – a suggestion also made in the report on early childhood development



- (c) How we can best identify and monitor dangerous places, and social and economic structures
- (d) What the appropriate economic models are for looking at the cost effectiveness of simple public health interventions. At present, while modelling is well developed in clinical medicine, particularly for pharmaceutical interventions, both methods and outcomes need further work in public health economics. There is a clear need for a register¹⁰⁹ so that knowledge, including economic evaluations on public health interventions, can be shared.

Not all of this measuring, theorising, or data needs to be collected by statisticians, epidemiologists or administrators. Where tackling determinants is done through regulation, using official statistics to collect data is important – both

¹⁰⁹ E. Waters, N. Priest, R. Armstrong, S. Oliver, P. Baker, D. McQueen, C. Summerbell, M. P. Kelly, and B. Swinburn The role of a Prospective Public Health Intervention Study Register in building public health evidence: proposal for content and use *J. Public Health Med.*, September 1, 2007; 29(3): 322 - 327.

to reinforce the need for action and to enforce action where appropriate. But as many studies have shown, the lay public, including children are well able both to identify dangers in their own communities, and to suggest responses to those dangers. Keeping local logs of such lay knowledge is not only of interest to the historians of the future, showing (not for the first time) that ordinary citizens may identify problems long before they reach the public policy agenda. But more positively, these may be a way that improving health at a local level, through the kinds of collaborations supported through Safe Communities, can be encouraged and addressed in a way which tests different kinds of interventions.

All of the above suggests some economy of effort and thought will be achieved by combining efforts with the new Cochrane Equity group, who are developing checklists and tools currently under discussion.

