Centre for
Automotive Safety Research

Accidents to intoxicated pedestrians in South Australia

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CASR REPORT SERIES
CASR061
February 2009

THE UNIVERSITY
OF ADELAIDE
AUSTRALIA

Report documentation

REPORT NO.	DATE	PAGES	ISBN	ISSN
CASR061	February 2009	28	978 1 920947 63 7	1449-2237

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AVAILABLE FROM

Centre for Automotive Safety Research
http://casr.adelaide.edu.au/publications/researchreports

ABSTRACT

This report reviews the literature on alcohol-intoxicated pedestrian casualties, concentrating on possible countermeasures. It also presents data on the blood alcohol concentrations (BAC) of pedestrian accident victims in South Australia, though all the datasets used have limitations (BAC is unknown in many cases). In South Australia and elsewhere, the alcohol levels of many pedestrians killed and injured are very high indeed. A number of measures are available for preventing intoxicated pedestrian accidents, but it is unlikely that any would have a large effect on the total number of pedestrian casualties. In most respects, improved safety of drunk pedestrians will come about by making the environment safer for all pedestrians, drunk or sober. The measure that would be expected to be most effective is a reduction of speed limits.

KEYWORDS

Pedestrian, Alcohol usage, Blood alcohol content, Traffic accident, Injury, Accident countermeasure

Summary

Firstly, this report gives a selective review of the literature on alcohol-intoxicated pedestrians, concentrating on possible countermeasures. This is organised as: prevention of high levels of intoxication in pedestrians, minimising pedestrian activity by the intoxicated, and minimising risk of injury among intoxicated pedestrians. Secondly, data is presented on the blood alcohol concentrations (BAC) of pedestrian accident victims in South Australia. All the datasets used have limitations (in particular, BAC is unknown in many cases). It is clear, though, that the alcohol levels of many pedestrians killed and injured are very high.

There is a concentration of pedestrians with positive BAC on Fridays and Saturdays, and in the evenings. Most pedestrian accidents for which the pedestrian had a positive BAC occurred midblock rather than at intersections, with no form of traffic control present, and with the speed limit being 50 or 60 km/h. Some 14 per cent occurred within 1 km of the centre of Adelaide. Most pedestrians who had a positive BAC were male, and they were concentrated in the age range 20 to 49.

There are a number of measures available for specifically preventing intoxicated pedestrian accidents. None of them, however, would be likely to have a large effect on the total number of pedestrian casualties. (A possible exception is a statutory limit on blood alcohol level in public places, accompanied by enforcement.) Instead, in most respects, improved safety of intoxicated pedestrians will come about by making the environment safer for all pedestrians, drunk or sober. The measure that would be expected to have the greatest effect quickest is a reduced speed limit, especially in locations where traffic is busy and there are many pedestrians. Improved street lighting, attention to the details of traffic engineering (e.g., minimising visual obstructions, pedestrian-friendly intersection design), and greater conspicuity of pedestrians (e.g., by wearing of retro-reflective markings at night) may have worthwhile effects also.

Contents

1 Introduction

It has been known for decades that a substantial part of the pedestrian accident problem arises from intoxicated pedestrians. The present report will both examine data from South Australia on this and critically discuss possible countermeasures.

Several abbreviations will be used repeatedly, and explanation should be given of some particular words.

BAC. Blood alcohol concentration (grams of alcohol per 100 millilitres of blood, g%).

TARS. Traffic Accident Reporting System. This is the South Australian database of road crash information. In South Australia, police attend some road crashes, and later enter the data into their database. Other crashes are reported when one or more of the people involved attend a police station some hours or days later, and provide information that is then entered into the database. The police transmit records of road crashes to the State roads authority (Department for Transport, Energy and Infrastructure) in electronic form. The procedures, the difficulties faced by the police, and the limitations with the resulting dataset are similar to those elsewhere in the developed world, see Hutchinson (1987).

CASR. Centre for Automotive Safety Research, University of Adelaide.

"Drunk" and "intoxicated". We will use these terms interchangeably. They are intended to convey that the person's behaviour has changed from a sober person's to a degree that is noticeable to others --- in boisterousness and unsteadiness of gait, for example. It is largely these people, not those who have had a couple of drinks, who are the major part of the problem. We consider that "drunk" and "intoxicated" convey our meaning better than, say, "under the influence" or "affected by alcohol" or "impaired". We do not intend either term to refer to a particular range of BAC's. In contrast to these vague, subjective, terms, much of the data will consist of numerical measurements of BAC.

"Accident". The term "accident" will not exclude deliberate acts. (It is reasonably clear that some pedestrian deaths and injuries are the result of a definite intention to kill themselves, and that in other cases the pedestrian has been utterly indifferent to their own survival.)

More broadly than drunk pedestrian accidents, the totality of pedestrian accidents in the Adelaide Metropolitan Area (along with cyclist accidents also) has been recently discussed by Hutchinson and Lindsay (2008). Their major findings in respect of the alcohol problem are given in Section 2 of this report. Section 3 is a selective review of the literature, concentrating on possible countermeasures. This is organised, following the suggestion of Brooks (1998), as: prevention of high levels of intoxication in pedestrians, minimising pedestrian activity in the intoxicated, and minimising risk of injury among intoxicated pedestrians. Sections 4 and 5 discuss data on the BAC of pedestrian accident victims in South Australia. Evidence about BAC from three datasets (fatal cases in TARS, non-fatal cases in TARS, and hospital case notes) is considered in Section 4. Section 5 gives several tabulations, from TARS, of how the percentages of injured pedestrians with BAC at different level compare in different circumstances. All the datasets have limitations (in particular, BAC is unknown in many cases). It is clear, though, that the alcohol levels of many injured pedestrians are very high. In Section 6 it is concluded that there is no reason for optimism about directing safety measures specifically at drunk pedestrians. In most respects, improved safety of drunk pedestrians will come about by making the environment safer for all pedestrians, drunk or sober. Reduced speed limits (and enforcing them) is likely to be the most effective measure.

2 Background: Recent findings about pedestrian accidents in Adelaide

More broadly than drunk pedestrian accidents, the totality of pedestrian accidents in the Adelaide Metropolitan Area (along with cyclist accidents also) has been recently discussed by Hutchinson and Lindsay (2008).

A brief examination was made of recent pedestrian fatalities recorded in TARS. Most of the fatalities fell into three overlapping groups: occurring at night, or involving drunkenness of the pedestrian, or the pedestrian was elderly. In 2003-2006, 40 pedestrian fatalities occurred (the statewide figure was 49), and only 11 did not fall into at least one of those three types. Of the 40 pedestrian fatalities in 2003-2006, 12 were drunk. In three or four of these cases, the pedestrian was sitting or lying on the road at night. Thus, as has been found many times previously, drunkenness is common among pedestrian fatalities. In a substantial fraction of these cases, the degree of intoxication is extreme, as evidenced by a very high BAC or by behaviour in the seconds before the accident.

The main dataset utilised by Hutchinson and Lindsay (2008) was that of the in-depth at-scene investigations. (For the methods used in those investigations, see Section 2.1 of Hutchinson and Lindsay, 2008, and Section 3.2 of Baldock et al., 2005.) In that dataset, there were many recognisable types of pedestrian accident; intoxication of the pedestrian was one of these, but by no means dominant. However, the collection of the dataset was mainly in the daytime, and drunkenness is largely an evening and nighttime problem. There were 81 cases in this series. Hutchinson and Lindsay (2008) considered that in six cases, the pedestrian being drunk was the major feature of the accident, plus in another two, alcohol was relevant but less central.

To illustrate the accounts that can be found in the in-depth dataset, two examples are given below, taken from Hutchinson and Lindsay (2008).

In-depth case example 1

Lighting conditions. Dark with street lighting.

Road characteristics. Multi-lane two way.

Narrative. A pedestrian, in an intoxicated state (BAC 0.206), staggered across a main arterial road, from left to right as seen by the drivers. A van was forced to veer into the left lane to avoid collision. The driver of a car in the right lane was unaware of the pedestrian and driving at a self-reported speed of 60 km/h. The front left bumper and headlight area of the car struck the pedestrian within the right northbound lane. The pedestrian came onto the bonnet of the vehicle before his head struck the upper left side of the windscreen and the A pillar. The driver of the car braked on impact, coming to rest in the right lane. The pedestrian fell to the left lane and was found to be deeply unconscious.

In-depth case example 2

Lighting conditions. Dark with street lighting.

Road characteristics. Multi-lane divided.

Narrative. A teenage pedestrian in a highly intoxicated state (BAC 0.3) attempted to cross three (one way) lanes from right to left as seen by the traffic. A car was travelling in the centre lane at a speed reported by the driver to have been 60 km/h when the driver was suddenly confronted with the pedestrian directly ahead of him. There was little time for the driver to take evasive action prior to the impact. The front left of the car struck the left side of the pedestrian. The pedestrian was thrown onto the left side of the bonnet before her head struck the windscreen directly over the left windscreen wiper. The driver braked on

impact and came to rest 18 to 20 metres from the estimated impact point. The pedestrian was thrown forward of the vehicle and came to rest in the centre lane of the carriageway 1.5 metres ahead of the car in final position. The pedestrian was deeply unconscious at the scene. The pedestrian was wearing dark clothing at the time of the collision, which is likely to have made her less visible to the driver of the car. She has a long history of self-harm and other mental heath issues, including substance abuse, and it is possible that this could have been a deliberate attempt on her own life.

Comments on the cases investigated in depth

Some of these cases may have been suicide or attempted suicide. The BAC's of the six pedestrians were very high, ranging from .176 to .352 g%. It is highly likely that in all cases the pedestrian had a habit of alcohol abuse. Beyond that, this is a type of crash for which there are special difficulties with in-depth investigations: it is often the case that the injured pedestrian is impossible to contact, not willing to cooperate, or is unable to remember anything about the accident or preceding events.

The picture of pedestrian casualties with high BAC's that this series presents is one of alcohol abuse, drug abuse, and suicide attempts. It might be asked whether this would have been so had those injured in the evening and at night been fully represented in the sample: it is possible that pedestrians having a high BAC late on a Friday or Saturday night have a much more conventional lifestyle. Actually, four of the six cases did occur between 9 pm and midnight on a Friday or Saturday, suggesting this is not a major source of distortion. There is a little relevant data from an earlier Adelaide in-depth study at pp. 20-21 of McLean et al. (1979), which McLean et al. sum up as follows: "For those pedestrians who were intoxicated at the time of their accidents there existed a clear pattern of regular and substantial alcohol consumption". In contrast, in their Australian series of 240 intoxicated adult pedestrian fatalities, Cairney et al. (2004, p. 77) identified only 25 as having a history of problems related to drugs or alcohol. Cairney et al. appear to consider that this is a reasonably accurate figure, not one artificially low because of missing information, as they say without any such qualification (p. 104) that "Small proportions were identified as having pre-existing alcohol, drug or medical problems". However, it seems likely to us that the figure substantially understates the true number. Ryb et al. (2007) report a study that included a formal procedure of diagnosing alcohol and drug disorders in seriously-injured pedestrians. It was conducted in Baltimore in 1994-1995, and 39 per cent of pedestrians in the sample had a positive BAC. The proportion in the sample diagnosed with alcohol dependence was 35 per cent, and 20 per cent were diagnosed with drug dependence.

Visual factors are sometimes identified as relevant to drunk pedestrian accidents, particularly as many are at night. Further, this may be thought of as an area where improvement is practicable, both in better street lighting and other methods (removal of visual obstructions and reduction of visual "clutter"). The in-depth series of cases is a potential resource if it were desired to study this in greater detail: precision about the relative positions of pedestrian, driver, shadow, and obstructed field of view would be needed, and it is unlikely that this would be possible using routine data.

3 Comments on selected research: What are the prospects for countermeasures?

A substantial part of the pedestrian accident problem arises from intoxicated pedestrians. This has been known at least since the studies of Heise (1934) in Uniontown, Pennsylvania, and Gonzales and Gettler (1941) in New York City. The later study by Haddon et al. (1961), on adult pedestrians fatally injured in Manhattan, has become regarded as a classic. This is because it used a case-control method: for each case, the researchers recruited four pedestrians on the same day of week and at the same time of day, and made a comparison of the case series and the control series. There was an appreciable proportion of remarkably high BAC's in the cases, but not in the controls, as shown in Table 3.1.

Table 3.1
BACs of pedestrians (Haddon et al, 1961)

BAC	% of cases	% of controls
.000	26	67
.001-.149	42	30
.150 and higher	32	3

Haddon et al. (p. 672) concluded that "The case series was comprised of two substantially discrete groups each of which had an increased risk of fatal involvement, namely, a group of the elderly whose blood either contained no measureable amounts of alcohol, or relatively little, and a group of the middle-aged who had been drinking heavily".

What are the reasons why alcohol predisposes pedestrians to accident involvement? These are well known in their general features (Oxley et al., 2006): perceptual, cognitive, and physical skills (including detecting vehicles in motion, integrating multiple sources of information, and initiating actions) are all adversely affected. It may be added that it seems likely that a very high BAC sometimes leads to a positive attempt at suicide or at least to utter indifference to one's own survival. And situational factors are relevant, in that drunk pedestrians may be on the streets at times when it is dangerous for other reasons (darkness; high speed traffic). In contrast to the general reasons for the dangers of alcohol being well known, Oxley et al. (p. 259) also considered that "there is very little research-based evidence detailing the effect of alcohol on specific skills required to cross roads safely". In a simulator-based road crossing experiment, Oxley et al. found that an appreciable proportion of people whose BAC was at least .070 accepted a gap of only 1 second. This is consistent with evidence from interviewing injured pedestrians: McLean et al. (1979, p. 20) noted that four out of five pedestrians in their sample who had a BAC of at least .010 recalled having noticed the headlights of an approaching car, but then mistakenly attempted to cross.

Countermeasures to the intoxicated pedestrian problem have been classified by Brooks (1998, p. 116) as follows: prevention of high levels of intoxication in pedestrians, minimising pedestrian activity in the intoxicated, and minimising risk of injury among intoxicated pedestrians. The discussion below will be organised in this way, after a summary of what has previously been said about countermeasures. Publications including Austroads (1998), Cairney and Coutts (2003), Cairney et al. (2004), Road Safety Committee, Parliament of Victoria (1999), and others will be drawn upon. Our view of this literature is that it gives no cause for optimism about the problem.

3.1 Recommendations previously made about countermeasures

Cairney and Coutts (2003) discussed 240 pedestrian fatalities in Australia between 1999 and 2002, using information in the ATSB (Australian Transport Safety Bureau) Coronial Database. They highlighted the following: overrepresentation of male victims, overrepresentation of indigenous persons, night and weekend occurrence, very high BAC's (80 per cent exceeded

.150), long period of drinking, a large number of cases in which the pedestrian was sitting or lying on the road (40 per cent), and the frequent co-occurrence of other drugs (18 per cent). They regarded these features as in line with previous literature. A fuller report on the same dataset is by Cairney et al. (2004). At p. 118 of this, some information is given about a modified sample that excluded persons recorded as indigenous (mostly from the Northern Territory or Western Australia). A notable difference is that the proportion of cases in which the pedestrian was lying on the road was less than half what it was in the total sample. (The figures given are 8 per cent and 21 per cent. However, these percentages are artificially low, in that they are based on the total deaths including those for which pedestrian behaviour was not known.)

Cairney and Coutts (2003) made the following recommendations. (See also Cairney et al., 2004, pp. 113-114.)

> "1. A higher priority for the intoxicated pedestrian issue in road authority action plans and increased attention from the road safety research community.
>
> 2. Reinforce Responsible Serving of Alcohol Programs, including reconsidering the criteria for refusal of service, making it the duty of all employees to inform bar staff of persons who seem to be affected by alcohol, to encourage staff to organise transport home where required, and to encourage staff to arrange for someone to accompany intoxicated persons.
>
> 3. Publicity aimed at patrons, specifically to encourage them to assist intoxicated persons.
>
> 4. Publicity aimed at drivers, specifically to encourage them to report persons lying on the road and to use their vehicle to protect persons lying on the road until help arrives.
>
> 5. Traffic engineering treatments outside drinking establishments, including safety audits.
>
> 6. Programs aimed at disadvantaged groups in the community.
>
> 7. Continued monitoring of alcohol-affected pedestrian fatalities."

These recommendations seem entirely appropriate to us. However, it is questionable how effective these measures would be. Writing from Brisbane, Lang et al. (2003, Section 1) say, "Alcohol-impaired pedestrian crashes continue to present a challenge to road safety practitioners because there are few known effective countermeasures and due to the difficulty of measuring and modifying behaviour in this area". It is indeed difficult to think of plausible countermeasures. From Vancouver, Wilson et al. (2003) say there are few available proven countermeasures and that legislative approaches "may have little preventative value because of the high proportion of chronic or severe alcohol abusers among pedestrian casualties". In the case of motorists impaired by alcohol, it is possible to imagine fitting alcohol interlocks in all new cars, and thereby achieving a technological solution (Coxon, 2005), but for pedestrians impaired by alcohol, such an approach seems impracticable.

3.2 Prevention of intoxication

Chronic alcohol abuse

The high alcohol levels in pedestrians killed and injured suggest they drink much too much alcohol. Without going into the issue of whether they should be termed alcoholics, it is plain that many of them have a long-term habit of abusing alcohol. Prevention and treatment of alcoholism and alcohol abuse must be on the list of possible strategies for preventing pedestrian accidents.

Many forms of treatment are effective to a useful degree, including various forms of psychotherapy, self-change manuals, and some pharmacological interventions such as naltrexone and acamprosate (which are thought to work by different mechanisms). See, for example, Raistrick et al. (2006, Chapter 3) and Bergmark (2008). The encouraging data does, however, refer to people who access the medical system. According to the *National Alcohol Strategy 2006-2009* (Ministerial Council on Drug Strategy, 2006, p. 26), "The low uptake of some proven treatment options for alcohol dependence, such as early and brief interventions and pharmacotherapy for alcohol dependence, despite their proven effectiveness is an issue. Brief interventions are known to be effective in early detection and prevention of alcohol-related health problems."

Occasional abuse of alcohol

"Most of the harm that stems from intoxication is associated with the many people who do not generally drink excessively but occasionally drink to intoxication." That quotation is from p. 38 of Loxley et al. (2004). Those authors highlight as effective the following law enforcement interventions against alcohol.

> Increase price through taxation.
>
> Hypothecated taxes on alcohol to fund treatment and prevention programs.
>
> Restrict trading hours.
>
> Responsible alcohol service, provided such programs are accompanied by visible enforcement.
>
> Restrictions on price discounting.
>
> Licensee codes of conduct (accords), provided they are accompanied by enforcement.
>
> Licensing restrictions in indigenous communities.
>
> Declaration of indigenous communities as dry.

At the level of the individual, there is evidence (e.g., a review by Moyer et al., 2002) of fairly small, but worthwhile effects of brief interventions given by health professionals to non-treatment-seeking samples.

Licensed premises

Drunk pedestrians often get that way at a pub or club. Potentially, this is a point at which intervention could take place: in many jurisdictions, it is an offence to serve alcohol to an intoxicated person, and it might be practicable to both train bar staff better and to enforce the law much more vigorously. Considerations of civil liability could also be an incentive: if duty of care of a licensee extended to their customers' safety as pedestrians, the customers and also the insurers of drivers in collision with them might make financial claims on the grounds of contributory negligence (see Hamad, 2005, especially p. 31).

Perham et al. (2007) give some data, collected in Cardiff, on the relationship between BAC and the probabilities of three behavioural indicators of drunkenness (staggering gait, glazed eyes, and slurred speech): a probability of 0.50 of having a staggering gait occurred at a BAC of .186, for example.

Public health messages

Government often wants to get social and health messages over to its population, and thereby change behaviour. There is a wide range of opinion about the effectiveness of mass media. There is quite a substantial body of opinion, based on evaluations of individual

campaigns, that advertising and education campaigns will not usually improve behaviour. For example, according to Strecher et al. (2006, p. 35), "One-size-fits-all mass media interventions that run independently of other strategies have demonstrated little or no behavioural improvement." In the context of alcohol misuse, DeJong (2002) makes a qualified recommendation specifically against fear appeals, as being difficult to execute and rarely succeeding.

On the other hand, we should draw attention to the enormous changes in some attitudes that seem to have occurred over the past 30 years --- less tolerance of smoking, drink-driving, and speeding, for example. It is likely that most people will say that public health messages played a part in this.

3.3 Minimising pedestrian activity by the intoxicated

Licensed premises

Staff of licensed premises can encourage the friends of intoxicated people to look after them and see them home safely, or can call a taxi. There may be some scope for locating bus stops and taxi ranks close to pubs and clubs. Licensed premises could provide a minibus to drive customers to and from their home, thus presumably reducing the traffic risk. Quite a number of venues in suburban Sydney, for example, do this. There are a variety of ways of organising transport for intoxicated people (Graham, 2000, pp. 635-637); the chief aim is usually to prevent drink-driving, but an effective system would presumably prevent drink-walking, too.

Policing of public drunkenness

Possibly the police could more readily intervene to protect someone from themselves who is observed drunk on the street. It is not likely that taking care of drunks is an activity that is popular with the police, but the lack of many other ideas means this has to be listed.

In South Australia, it is not an offence to be drunk, but police may take into custody a person who is drunk in a public place, and take the person home or to a police station or a sobering up centre (Legal Services Commission of South Australia, n.d.). (Being disorderly in a public place, e.g., being abusive to others, is an offence.) As to exactly who may be apprehended in this way, the relevant Act, the *Public Intoxication Act 1984*, refers to a person "under the influence of" alcohol, who "by reason of that fact is unable to take proper care of himself". In Queensland and Victoria, public drunkenness is an offence (see Ministerial Council on Drug Strategy, 2006, p. 11).

It sometimes happens that the drunk pedestrian is seen behaving irresponsibly in the minutes before the accident. However, the impression we have from in-depth cases and the text field in routine police reports (TARS) is that this is the exception rather than the rule --- that is, there usually is little opportunity for a stranger to intervene. Moreover, alcohol pedestrian crashes are highly dispersed geographically.

Increasing video surveillance of public places is making detection of drunken behaviour more and more feasible. It is far from clear how behaviour in public and relations between police and public will develop in coming years, as surveillance continues to increase.

Should it be an offence to have too high a BAC in public?

By analogy with drink-driving legislation, it is likely that the most effective way to get drunk pedestrians off the roads would be to make it an offence to be walking around with too high a BAC, and to permit the police to administer random breath tests to enforce this.

It seems very doubtful that the public would support legislation that made having too high a BAC in public a criminal offence. It is not out of the question, though: drunkenness in public is an offence itself in some jurisdictions, and offences based on BAC are now familiar in the

laws against drink-driving. Hawks (2006) has advocated such a law, on similar logic to passive smoking legislation, and the idea has been cited approvingly by Kypri et al. (2007).

Naturally, if such a legislative change were to be considered, the question would immediately arise of what is too high a BAC.

> A rare example of someone being specific about this is Harris (1998, p. 141). She gives attention to making it an offence to be walking in or near traffic in an extreme state of intoxication, by which she means having a BAC of .150 or greater.
>
> In a slightly different context, the Road Safety Committee, Parliament of Victoria (1999) recommended that a legal definition of intoxication be established. (The context was that of a licensee's responsibility not to supply liquor to a person in a state of intoxication.) They do not suggest a specific number, but they are firm that it should be less than .150 (see p. 74 of their Report). On the other hand, until quite recently, .080 has been the limit for drivers, who put others at much greater risk than pedestrians do. It seems reasonable to presume that, had the Road Safety Committee been pressed, they would have specified a number substantially lower than .150 and substantially higher than .080: perhaps .110 or .120 (halfway between). In its response to the Road Safety Committee, the Government of Victoria (2000) were against defining intoxication in terms of BAC. This was partly on the grounds that intoxication refers to an effect (on a person's mental and physical faculties, and behaviour) rather than to a BAC, and partly on the grounds of the practical difficulties for licensees and police.
>
> In the U.S. state of Texas, it is an offence to have a blood alcohol concentration of .080 or more while in a public place (Texas Alcoholic Beverage Commission, 2005).

It is possible that there would be support for a BAC limit of .150, even if there were not for .080.

3.4 Minimising risk of injury

Public health messages

It is desirable to promote awareness among drivers that pedestrians might be drunk and awareness among pedestrians that their judgment may be impaired (see Recommendation 8 of Austroads, 1998). Campaigns often have no detectable effect on crashes, but it is possible that there is an eventual gain in knowledge of dangers by the public, and a shift in attitudes and behaviours.

Information about crash locations

Knowing crash locations is basic to traffic engineering. It seems likely that information about accidents to drunk pedestrians could be better used in three ways.

- Information enables attention to be paid to where accidents to drunk pedestrians have happened in the past. Because BAC is often unknown, the whole topic of trying to keep drunk pedestrians safe may have been relatively neglected.

- Information may permit description of the *types* of site where such accidents have happened in the past, and therefore are likely to happen in the future. The great majority of sites of drunk pedestrian accidents do not have more than one such accident per year. Direct use of such data to identify dangerous sites is likely to fail. Instead, it may be more feasible to describe the characteristics of such sites --- for example, on arterial roads, and close to licensed premises.

- However, it may be that the surroundings of a crash site are not well described in routine data. Recent improvements in integrating different geographical databases

with the crash database may permit greater utilisation of data on, for example, land use.

Traffic engineering

Some methods of improving facilities for pedestrians have been promoted on the basis that they will improve the safety of drunk pedestrians. Such facilities include fencing to channel pedestrians to cross the road at particular locations, short cycle times at traffic signals, and quick response of signals to pedestrian demand. They are likely to improve the safety of all pedestrians, whether or not they have been drinking. In this broader context, Retting et al. (2003, p. 1462) highlighted the following: "Highly effective countermeasures include single-lane roundabouts, sidewalks, exclusive pedestrian signal phasing, pedestrian refuge islands, and increased intensity of roadway lighting".

As an example of an experimental treatment of intersections, there have been recent trials in Victoria of "Dwell-on-Red" (Lenné et al., 2007; Archer et al., 2008). This refers to introducing an all-red phase at traffic signals when there is no traffic demand during late evening and early morning. It is successful in reducing traffic speeds. However, there is a potential danger not discussed by Lenné et al. and Archer et al.: the public at present know very well that disobeying a red signal is dangerous, and this could be undermined if Dwell-on-Red became popular. We would recommend more conventional treatments, such as those mentioned by Retting et al. (2003).

We certainly consider that attention to details of traffic engineering has an important part to play in road safety. Too much should not be expected of this strategy, however. There is some degree of geographical concentration of drunk pedestrian accidents (at places where there is much traffic, fast traffic, many pedestrians, and licensed premises), but this degree of concentration is not great.

In relation to concentration of accidents close to licensed premises, we should note that in their Australian series of 240 intoxicated adult pedestrian fatalities, Cairney et al. (2004, p. 109) found that "In almost half the cases where the location of the collision could be specified in relation to the drinking venue, it was immediately outside the venue". However, this refers to 23 cases out of only 52 for which the distance from the drinking venue was known. It is possible that knowing the location of the collision in relation to the drinking venue is strongly associated with the accident being immediately outside the venue --- if so, it may be that in few of the other 188 cases was the accident immediately outside the venue.

The measures that will most improve the safety of drunk pedestrians are the same as those that will most improve the safety of sober pedestrians: speed limits that are lower than at present and that are enforced more strictly, and perhaps improvements to street lighting. (Street lighting that is considered good is not necessarily good enough --- the time needed to correctly perceive something unexpected, e.g., to perceive a shadow on an artificially illuminated road surface as a pedestrian lying there, and react appropriately may be seconds longer than in sunlight.) However, in the context of people lying on the road, Cairney et al. (2004, p. 109) were sceptical of the potential of improved lighting, on the grounds that the crash locations are widely dispersed. Matters of detail such as minimising visual obstructions and surface irregularities that the pedestrian might trip on are worth attention, too.

Pedestrian conspicuity

High conspicuity of the pedestrian is desirable. It is worth encouraging, for example, the wearing of retro-reflective markings on clothing at night. High conspicuity is desirable whether the pedestrian is sober or drunk, but is particularly important at night, and thus of particular relevance to drunk pedestrians. The following is based upon what we said in Hutchinson and Lindsay (2008, Section 10.2).

A review by Kwan and Mapstone (2006) found good evidence had been published for improved detection and recognition by drivers, but they were unable to locate any methodologically-satisfactory studies of accidents. The conspicuity or ease of detection of an object is a many-faceted concept, as a review by Langham and Moberly (2003) makes clear. Further, it seems that it is not known what type of visual performance of the driver should be measured in order to predict visual aspects of driving performance (Wood and Owens, 2005). Accident information provides some guidance as to which aspects of conspicuity are most relevant and what countermeasures would be expected to work best. First, there is nothing to contradict the common sense idea that if pedestrians and cyclists wear conspicuous clothing, they are more likely to be seen. It is important, though, that pedestrians and cyclists not think they are more conspicuous than they really are. Second, regarding road users' lack of appreciation of their own inconspicuousness, it might be worth emphasising in publicity aimed at the young and youngish that the eyes of elderly drivers do not perform as well at night as their own eyes (Wood and Owens, 2005; Wood et al., 2005). Third, it seems that in many of the cases for which pedestrian conspicuity might be relevant, the pedestrian is not crossing the road in a normal fashion. Instead, the (drunk) pedestrian is stationary in the road, or behaving erratically, typically at night on a lit road. Now, a driver at night is continually seeing irregular patches of dark on the road surface; as noted above, it seems likely that the issue is not so much seeing, but correctly interpreting a patch of dark and reacting appropriately. This line of thought is not conclusive, but the countermeasures it suggests are that lighting should be sufficient for a pedestrian lying on the road to be instantly identifiable as such, that the possibility of a pedestrian lying on the road be publicised to drivers, and that driving speeds be reduced in order to lessen the distance travelled in a given reaction time.

3.5 Conclusion from the literature

There is a problem of alcohol abuse, there is a problem of pedestrian accidents, and there is overlap of these in the problem of drunk pedestrian accidents. There are good reasons to attack both the problem of alcohol abuse and that of pedestrian accidents, but there is no reason for optimism about directing countermeasures specifically at drunk pedestrians.

We believe this to be not an original conclusion, but one that is implicit in the literature that we have seen, even though it is not spelled out in quite this way. Overall, we view the literature as being fairly pessimistic, in the sense of presenting the drunk pedestrian problem as a difficult one, and suggesting that the effect of countermeasures on the total number of pedestrian accidents would be quite limited in size. A possible exception is a statutory limit on blood alcohol level in public places, accompanied by enforcement.

4 Evidence about blood alcohol concentration

Blood alcohol concentration (BAC) is measured in grams of alcohol per 100 millilitres of blood (g%). In South Australia, it is illegal to drive with a BAC of .05 g% or more. (The routine practice of the police is to measure this with a breath analysis machine.)

This Section considers the distribution of blood alcohol concentrations of pedestrians killed or injured in South Australia. Three datasets will give some information about this, but first the findings of Holubowycz (1995) will be summarised.

Background: Pedestrians killed or admitted to hospital in the 1980's

Holubowycz (1995) reported on the BAC's of pedestrians aged at least 16 who were either (a) killed in South Australia in the period 1981 to 1992, or (b) admitted to hospital in South Australia in a period of about 23 months from August 1985 to July 1987. For both (a) and (b), BAC was known in 92 per cent of cases. The distributions of BAC were as in Table 4.1.

Table 4.1
Distribution of BAC, as given by Holubowycz (1995, Tables 1 and 4): column percentages

BAC	Fatal	Admitted to hospital
None	54	62
.001 to .199	23	25
.200 and over	22	13

Results in three present-day datasets

Table 4.2 reports on the distribution of BAC in the following three datasets.

TARS (fatal cases). There were 58 pedestrians aged at least 15 killed in the period 2003-2007. BAC was known for 53 cases (91 per cent).

TARS (non-fatal cases). There were 1569 pedestrians aged at least 15 whose injury severity was "treated at hospital", "admitted to hospital", or "fatal", in the period 2003-2007. The BAC data is missing in 61 per cent of cases. It is possible the cases for which it is known are unrepresentative, but we believe they are sufficiently representative for the data in Section 5 below to be useful.

Hospital data. In the course of another study being conducted at CASR, medical records of road accident victims presenting at the Emergency Department of the Royal Adelaide Hospital have been examined. (This hospital is located in the city centre. The proximity to pubs and other places of entertainment might lead to the proportion of cases with a positive BAC being higher than elsewhere.) Among the first 300 cases, 34 were pedestrians. BAC was known for 27 cases (79 per cent).

Table 4.2
Summary of BAC in the three datasets: column percentages

BAC	Dataset		
	TARS fatal	TARS non-fatal	Hospital
None	60	76 (90)	52
.001 to .149	9	9 (4)	15
.150 and over	30	15 (6)	33

The figures are percentages for each dataset. These percentages are of those for whom BAC was known, except that the percentages in brackets assume that BAC was zero for all cases in which it was unknown.

Concerning the TARS data, Figures 2.28 and 2.29 of Anderson (2008) show how the numbers of pedestrian fatalities and casualties have varied over the years 1990 to 2005, classified as BAC less than .050 g%, BAC at least .050 g%, and unknown BAC. There is no clear trend in the relative numbers.

The hospital data may be compared with that of Small et al. (2006), who reported on a series of 180 adult pedestrians admitted as inpatients to a central Sydney hospital. BAC was unknown in 89 cases. Of the remaining 91, BAC's of zero, .001 to .100, and greater than .100 g% were found in 51 per cent, 7 per cent, and 43 per cent of cases.

Conclusion about blood alcohol concentration

There is appreciable uncertainty because of the number of cases for which BAC was unknown and because the datasets are unrepresentative in other ways. Nevertheless, there is a consistent picture: of the pedestrians who had been drinking, the majority had very high BAC's and must have drunk a great deal. This is particularly so among the pedestrians who were killed.

5 TARS data on pedestrian accidents

In South Australia, all road casualties who appear to be over the age of 14 who are treated at a hospital must supply a sample of their blood for analysis. The BAC found is then added to the record of the crash in TARS.

Some tables based on TARS are given below. These refer to pedestrians aged 15 years or older injured in crashes in South Australia in the period 2003-2007, with the exception that those in the most minor severity category ("treated by doctor") were excluded. The tables give column percentages for pedestrians with zero BAC, BAC in the range .001 to .149 g%, and BAC of .150 g% or higher. The following suggestions are made concerning these tables.

- Because of the "Unknown BAC" category, the numbers are a substantial undercount of the casualties with a positive BAC. However, the data has some value in giving a picture of the conditions in which drunk pedestrians are injured.

- The final two columns of each table give column percentages for pedestrians of unknown BAC and known BAC. When these columns of percentages are similar, it suggests that the testing process is approximately a random one.

It should be noted that routine crash data is often viewed as not very helpful in studying the relevance of alcohol to a particular crash. The first reason is the subjectivity of descriptions such as "intoxicated", "under the influence", or "impaired". The second reason is that the collection of objective data on blood alcohol concentrations is fraught with procedural, legal, and medical problems. The third reason is that in practice, as will be seen below, a high proportion of the data is often missing.

The main results will be given in Tables 5.4-5.13 under the heading of "When, where, and who". But first, Tables 5.1-5.3 will compare levels of severity, years, and hospitals.

Comparison of levels of severity, years, and hospitals

The primary purpose of Tables 5.1-5.3 is to provide some background about the process for testing BAC.

- This is biased towards fatalities (Table 5.1). Expressed in another way, BAC was unknown in the case of 9 per cent of fatalities, 60 per cent of those admitted to hospital, and 64 per cent of those treated at hospital but not admitted.

- Casualties with a known BAC are distributed over years in approximately the same way as those for whom BAC was unknown (Table 5.2).

- The process is reasonably similar at different hospitals (Table 5.3). Of the two retrieval hospitals, the ratio of known to unknown BAC's is rather higher for the Royal Adelaide Hospital than for Flinders Medical Centre. This ratio tends to be even lower at country hospitals.

In interpreting subsequent tables, therefore, the major reservation is the overrepresentation of fatalities.

Table 5.1
Distribution of severity of injury for different BAC levels (column percentages)

Severity	Zero	.001 to .149	.150 and over	Unknown	Known
Treated	64.1	42.9	51.1	69.6	60.2
Admitted	29.1	48.2	31.9	29.9	31.2
Fatal	6.8	8.9	17.0	0.5	8.6
Total number	468	56	94	951	618

Table 5.2
Distribution of year of accident for different BAC levels (column percentages)

Year	Zero	.001 to .149	.150 and over	Unknown	Known
2003	20.3	21.4	19.1	18.9	20.2
2004	21.4	14.3	20.2	20.1	20.6
2005	19.4	21.4	20.2	20.3	19.7
2006	20.1	28.6	21.3	20.6	21.0
2007	18.8	14.3	19.1	20.1	18.4
Total number	468	56	94	951	618

Table 5.3
Distribution over hospitals for different BAC levels (column percentages)

Hospital	Zero	.001 to .149	.150 and over	Unknown	Known
Royal Adelaide	50.2	48.2	48.9	32.8	49.8
Flinders	16.9	12.5	13.8	17.6	16.0
Other major Metro	19.4	16.1	13.8	22.2	18.3
Queen Elizabeth	*9.6*	*7.1*	*5.3*	*7.6*	*8.7*
Modbury	*4.5*	*0.0*	*1.1*	*4.6*	*3.6*
Lyell McEwin	*4.1*	*5.4*	*6.4*	*6.4*	*4.5*
Noarlunga	*1.3*	*3.6*	*1.1*	*3.6*	*1.5*
Wakefield	0.9	0.0	0.0	2.4	0.6
Women's and Children's	0.4	0.0	0.0	4.2	0.3
Ashfield	0.0	0.0	0.0	0.7	0.0
Unknown	5.8	7.1	14.9	5.8	7.3
Other (country)	6.4	16.1	8.5	14.3	7.6
Total number	468	56	94	951	618

The named hospitals are all in the Adelaide Metropolitan Area.

The Royal Adelaide Hospital (central city) and the Flinders Medical Centre (southern suburbs) are the two retrieval hospitals.

Figures for "Other major Metro" are the sums of those in small italics.

"Unknown" includes cases where a body went to a mortuary rather than a hospital.

When, where, and who

Tables 5.4 and 5.5 show how pedestrian casualties are distributed over the days of the week. It is not surprising that a disproportionate number of pedestrians with positive BAC are injured on Fridays and Saturdays. Table 5.6 shows how pedestrian casualties are distributed over the hours of the day. Some 50 per cent of pedestrian casualties in the high BAC group occur in hours beginning 18, 19, 20, 21, 22 and another 35 per cent occur in the hours beginning 23, 00, 01, 02, 03.

Most pedestrian accidents for which the pedestrian had a positive BAC occurred midblock rather than at intersections (Table 5.7), with no form of traffic control present (Table 5.8), with the speed limit being 50 or 60 km/h (Table 5.9), and with the post code being different from the pedestrian's home post code. (Table 5.10). As an indicator of degree of geographical concentration, only 14 per cent occurred within 1 km of the centre of Adelaide, the GPO (Table 5.11).

Most pedestrians who had a positive BAC were male (Table 5.12), and some 71 per cent were in the age range 20 to 49 (Table 5.13).

Table 5.4
Distribution of day of week for different BAC levels (column percentages)

Day of Week (unmodified)	Zero	.001 to .149	.150 and over	Unknown	Known
Monday	11.8	7.1	7.4	10.1	10.7
Tuesday	13.2	3.6	8.5	13.9	11.7
Wednesday	17.7	8.9	10.6	14.1	15.9
Thursday	18.4	10.7	10.6	15.8	16.5
Friday	18.4	21.4	20.2	19.0	18.9
Saturday	12.2	30.4	22.3	16.2	15.4
Sunday	8.3	17.9	20.2	10.9	11.0
Total number	468	56	94	951	618

Table 5.5
Distribution of day of week for different BAC levels (column percentages)
(In this table, hours 00 to 05 have been counted as the previous day.
For example, "Saturday" refers to 6am Saturday until 5:59am Sunday)

Day of Week (modified)	Zero	.001 to .149	.150 and over	Unknown	Known
Monday	12.0	5.4	8.5	9.9	10.8
Tuesday	13.2	7.1	9.6	13.6	12.1
Wednesday	17.7	8.9	9.6	14.8	15.7
Thursday	18.2	7.1	10.6	16.0	16.0
Friday	19.0	37.5	30.9	21.0	22.5
Saturday	12.4	26.8	23.4	16.6	15.4
Sunday	7.5	7.1	7.4	8.1	7.4
Total number	468	56	94	951	618

Table 5.6
Distribution of hour of day for different BAC levels (column percentages)

Hour of Day	Zero	.001 to .149	.150 and over	Unknown	Known
0	0.6	14.3	10.6	2.0	3.4
1	0.4	10.7	5.3	2.9	2.1
2	0.2	3.6	6.4	1.8	1.5
3	0.6	7.1	5.3	1.2	1.9
4	0.0	0.0	0.0	0.7	0.0
5	0.2	1.8	2.1	0.2	0.6
6	1.5	0.0	2.1	1.2	1.5
7	3.2	0.0	0.0	2.8	2.4
8	7.3	0.0	1.1	6.3	5.7
9	5.6	0.0	0.0	4.6	4.2
10	4.1	1.8	0.0	5.3	3.2
11	7.7	0.0	0.0	6.1	5.8
12	6.6	1.8	1.1	5.9	5.3
13	5.6	0.0	1.1	4.8	4.4
14	5.8	1.8	0.0	5.5	4.5
15	10.9	1.8	2.1	8.7	8.7
16	8.5	0.0	1.1	8.7	6.6
17	11.3	5.4	4.3	7.2	9.7
18	6.0	12.5	14.9	5.7	7.9
19	5.6	8.9	7.4	3.5	6.1
20	5.3	8.9	4.3	3.7	5.5
21	1.7	7.1	10.6	3.8	3.6
22	1.1	3.6	12.8	3.8	3.1
23	0.2	8.9	7.4	3.7	2.1
Total number	468	56	94	951	618

Table 5.7
Distribution of road type for different BAC levels (column percentages)

Road Type	Zero	.001 to .149	.150 and over	Unknown	Known
Intersection	48.1	28.6	33.0	47.2	44.0
Midblock	51.9	71.4	67.0	52.8	56.0
Total number	468	56	94	951	618

Table 5.8
Distribution of traffic control for different BAC levels (column percentages)

Traffic Control	Zero	.001 to .149	.150 and over	Unknown	Known
No Control	72.0	85.7	86.2	80.5	75.4
Traffic Signals	21.6	12.5	9.6	13.8	18.9
Stop Sign	2.8	0.0	0.0	1.7	2.1
Give Way Sign	1.7	0.0	4.3	1.5	1.9
Other	1.1	0.0	0.0	0.2	0.8
Roundabout	0.6	1.8	0.0	2.1	0.6
Rail Xing - Boom	0.2	0.0	0.0	0.2	0.2
Total number	468	56	94	951	618

Table 5.9
Distribution of speed limit for different BAC levels (column percentages)

Speed Limit	Zero	.001 to .149	.150 and over	Unknown	Known
5	0.0	0.0	0.0	0.6	0.0
10	1.9	3.6	0.0	6.6	1.8
15	0.9	0.0	1.1	1.3	0.8
20	0.6	0.0	0.0	1.3	0.5
25	0.4	0.0	0.0	1.8	0.3
30	0.0	0.0	0.0	0.1	0.0
40	1.5	0.0	1.1	1.8	1.3
50	37.8	41.1	35.1	41.6	37.7
60	50.0	44.6	48.9	38.5	49.4
70	1.9	0.0	3.2	1.5	1.9
80	2.1	5.4	4.3	1.5	2.8
90	0.2	0.0	1.1	0.4	0.3
100	0.9	3.6	1.1	1.3	1.1
110	0.9	1.8	3.2	0.5	1.3
Unknown	0.9	0.0	1.1	1.3	0.8
Total number	468	56	94	951	618

Table 5.10
Whether or not the crash was in the same postcode as the pedestrian's home, for different BAC levels (column percentages)

In Home Postcode	Zero	.001 to .149	.150 and over	Unknown	Known
No	59.6	58.9	58.5	54.5	59.4
Yes	37.6	35.7	31.9	38.1	36.6
Unknown	2.8	5.4	9.6	7.5	4.0
Total number	468	56	94	951	618

Table 5.11
Distribution of distance from the Adelaide GPO for different BAC levels (column percentages)

Distance from GPO	Zero	.001 to .149	.150 and over	Unknown	Known
Within 1km	13.0	12.5	14.9	12.0	13.3
1 km+	7.1	8.9	10.6	3.8	7.8
2 km+	3.8	7.1	5.3	3.3	4.4
3 km+	5.3	0.0	4.3	3.8	4.7
4 km+	5.6	0.0	1.1	4.0	4.4
5 km+	6.8	3.6	1.1	3.2	5.7
6 km+	3.4	1.8	6.4	3.7	3.7
7 km+	6.4	5.4	2.1	6.0	5.7
8 km+	4.1	5.4	4.3	3.3	4.2
9 km+	4.9	7.1	5.3	4.4	5.2
10 km+	18.6	8.9	12.8	15.7	16.8
20 km+	5.6	16.1	10.6	8.7	7.3
30 km+	1.5	3.6	2.1	3.2	1.8
40 km+	0.4	3.6	0.0	0.4	0.6
50 km+	0.2	0.0	1.1	0.5	0.3
60 km+	0.4	1.8	2.1	1.3	0.8
70 km+	0.2	0.0	0.0	0.5	0.2
80 km+	0.2	0.0	0.0	0.3	0.2
90 km+	0.2	0.0	0.0	0.3	0.2
100 km+	4.5	8.9	10.6	6.9	5.8
Unknown	7.7	5.4	5.3	14.8	7.1
Total number	468	56	94	951	618

The GPO is considered to be the centre of Adelaide; very roughly, the Metropolitan Area extends some 30 km from there.

Table 5.12
Sex of pedestrian, for different BAC levels (column percentages)

Sex	Zero	.001 to .149	.150 and over	Unknown	Known
Male	47.6	71.4	81.9	53.9	55.0
Female	52.4	28.6	18.1	46.0	45.0
Unknown	0.0	0.0	0.0	0.1	0.0
Total number	468	56	94	951	618

Table 5.13
Age of pedestrian, for different BAC levels (column percentages)

Age	Zero	.001 to .149	.150 and over	Unknown	Known
15-19	13.9	19.6	7.4	14.9	13.4
20-29	16.0	30.4	29.8	19.1	19.4
30-39	11.3	14.3	26.6	12.2	13.9
40-49	11.5	16.1	20.2	11.3	13.3
50-59	11.3	7.1	9.6	7.9	10.7
60-69	9.4	5.4	0.0	7.7	7.6
70-79	12.6	5.4	0.0	6.7	10.0
80-89	6.0	1.8	0.0	6.4	4.7
90-99	0.6	0.0	0.0	0.7	0.5
Unknown	7.3	0.0	6.4	13.0	6.5
Total number	468	56	94	951	618

6 Concluding discussion

The main findings may be summarised as follows.

- From the routine crash data analysed in Section 5, there was found to be a concentration of pedestrians with positive BAC on Fridays and Saturdays, and in the evenings. Most pedestrian accidents for which the pedestrian had a positive BAC occurred midblock rather than at intersections, with no form of traffic control present, and with the speed limit being 50 or 60 km/h. Some 14 per cent occurred within 1 km of the centre of Adelaide. Most pedestrians who had a positive BAC were male, and 71 per cent were in the age range 20 to 49.

- Reports of pedestrian fatalities, and in-depth investigations, have less missing data on BAC and more details about events and circumstances of the accidents, and add two important points to that picture. Many of the fatalities have very high BAC's. And many of those with very high BAC's have serious longstanding health, mental health, and social problems connected with alcohol and other drugs.

Turning now to countermeasures, three groups may be distinguished: those specifically aimed at improving the safety of drunk pedestrians, those aimed at alcohol abuse, and those aimed at promoting pedestrian safety. Let us consider these in turn.

Measures specifically aimed at improving the safety of drunk pedestrians.

Train bar staff to better detect intoxication, and enforce the law against serving alcohol to intoxicated people much more vigorously.

Encourage licensed premises to take some measures to get their customers home safely (providing a minibus, or at least information about public transport and taxis).

Public health messages aimed at drinkers, reminding them that they are in danger as pedestrians if they are drunk.

Public health messages aimed at drivers, reminding them that drunkenness is not uncommon in pedestrians.

Provision to traffic engineers of better information about where accidents to drunk pedestrians are happening.

Such measures have often been put forward, and would be expected to be of some benefit. However, the literature reviewed in Section 3 above is, overall, fairly pessimistic, in the sense of presenting the drunk pedestrian problem as a difficult one, and suggesting that the effect of these measures on the total number of pedestrian accidents would be quite limited in size.

Measures against alcohol abuse.

In the case of chronic abuse, treatments of several different classes (self-help, various forms of psychotherapy, various pharmacological interventions) are effective to a useful degree, once the patient has sought medical help.

In the case of episodes of drunkenness, policing of existing laws could be more vigorous, and the law could be changed to make drink walking illegal.

For the first of these, the benefits to the individual and to society are much broader than only pedestrian road safety. Similarly, for the second, wider considerations than pedestrian road safety would be likely to be dominant in public debate.

Measures to promote pedestrian safety.

> The measure that would be expected to have the greatest effect quickest is a reduction of speed limits --- especially where there is a lot of traffic and a lot of pedestrians.
>
> Improved street lighting may be beneficial, as will be attention to the details of traffic engineering. Availability of better information about where accidents to pedestrians (drunk or sober) are happening will aid this.
>
> Improving pedestrian conspicuity (e.g., by wearing of retro-reflective markings on clothing at night) will similarly help.

We consider that improved safety of drunk pedestrians will come about largely by making the environment safer for all pedestrians, drunk or sober.

Acknowledgements

This study was funded by the Motor Accident Commission (South Australia) through a Project Grant to the Centre for Automotive Safety Research. The Project Manager at MAC was Ross McColl.

The Centre for Automotive Safety Research receives core funding from both the South Australian Department for Transport, Energy and Infrastructure and the South Australian Motor Accident Commission.

The views expressed in this report are those of the authors and do not necessarily represent those of the University of Adelaide or the funding organisations.

References

Anderson RWG 2008. Pedestrian collisions in South Australia. Report 039, Centre for Automotive Safety Research, University of Adelaide.

Archer J, Candappa N, Corben BF 2008. Effectiveness of the Dwell-on-Red signal treatment to improve pedestrian safety during high-alcohol hours. In: Anderson R (Editor), Proceedings of the Australasian Road Safety Research, Policing and Education Conference, pp. 527-539. Walkerville, South Australia: Department for Transport, Energy and Infrastructure. (ISBN of CD: 1 876346 56 6.)

Austroads 1998. Alcohol-Impaired Pedestrian Crashes. Sydney: Austroads.

Baldock MRJ, Long AD, Lindsay VL, McLean AJ 2005. Rear end crashes. Report 018, Centre for Automotive Safety Research, University of Adelaide.

Bergmark A 2008. On treatment mechanisms --- What can we learn from the COMBINE study? Addiction 103: 703-705.

Brooks C 1998. Alcohol, speed and pedestrian safety. In: Smith KP, Aitken BG, Grzebieta RH (Editors), Proceedings of the Conference on Pedestrian Safety, pp. 111-121. Canberra: Panther Publishing & Printing, and Australian College of Road Safety.

Cairney P, Coutts M 2003. Behaviour patterns associated with fatal crashes involving intoxicated pedestrians --- An analysis of the ATSB Coronial Database, 1999-2001. Presented at the 2003 Road Safety Research, Policing and Education Conference, held in Sydney. http://www.rsconference.com/pdf/RS030022.pdf.

Cairney P, Stephenson W, Macaulay J 2004. Preventing crashes involving intoxicated pedestrians. Stage 2 --- An analysis of Australian coronial records, 1999-2001. In: Austroads Research Report AP-R260/04, pp. 63-119. Sydney: Austroads.

Coxon C 2005. Interlocks in all vehicles. In Beirness DJ and Robertson RD (Editors), Alcohol Interlock Programs: Pushing Back the Frontiers. Proceedings of the Fifth International Symposium on Alcohol Ignition Interlock Programs, pp. 17-18. Ottawa: Traffic Injury Research Foundation. The slides contain further information, see http://trafficinjuryresearch.com/whatNew/newsItemPDFs/Coxon_C.pdf.

DeJong W 2002. The role of mass media campaigns in reducing high-risk drinking among college students. Journal of Studies on Alcohol, Supplement 14: 182-192.

Gonzales TA, Gettler AO 1941. Alcohol and the pedestrian in traffic accidents. Journal of the American Medical Association 117: 1523-1525.

Government of Victoria 2000. Government response to the Report of the Road Safety Committee of Parliament on the incidence and prevention of pedestrian accidents. http://www.parliament.vic.gov.au/rsc/government_responses/PedestrianAccidents.pdf.

Graham K 2000. Preventive interventions for on-premise drinking: A promising but underresearched area of prevention. Contemporary Drug Problems 27: 593-668.

Haddon W, Valien P, McCarroll JR, Umberger CJ 1961. A controlled investigation of the characteristics of adult pedestrians fatally injured by motor vehicles in Manhattan. Journal of Chronic Diseases 14: 655-678.

Hamad A 2005. The intoxicated pedestrian: Tortious reflections. Tort Law Review 13: 14-39.

Harris A 1998. Intoxicated pedestrians. Discussion of possible behavioural interventions. In: Smith KP, Aitken BG, Grzebieta RH (Editors), Proceedings of the Conference on Pedestrian Safety, pp. 134-143. Canberra: Panther Publishing & Printing, and Australian College of Road Safety.

Hawks D 2006. Why not a statutory blood alcohol level for drinking in public places? Addiction 101: 609.

Heise HA 1934. Alcohol and automobile accidents. Journal of the American Medical Association 103: 739-741.

Holubowycz OT 1995. Age, sex, and blood alcohol concentration of killed and injured pedestrians. Accident Analysis and Prevention 27: 417-422.

Hutchinson TP 1987. Road Accident Statistics. Adelaide: Rumsby Scientific Publishing.

Hutchinson TP, Lindsay VL 2008. Pedestrian and cyclist crashes in the Adelaide Metropolitan Area. (In preparation. This will be a Report from the Centre for Automotive Safety Research, University of Adelaide.)

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

Kypri K, Paschall MJ, Maclennan B, Langley JD 2007. Intoxication by drinking location: A web-based diary study in a New Zealand university community. Addictive Behaviors 32: 2586-2596.

Lang CP, Tay R, Watson B, Edmonston C, O'Connor E 2003. Drink walking: An examination of the related behaviour and attitudes of young people. Presented at the 2003 Road Safety Research, Policing and Education Conference, held in Sydney. http://www.rsconference.com/pdf/RS030022.pdf.

Langham MP, Moberly NJ 2003. Pedestrian conspicuity research: A review. Ergonomics, 46, 345-363.

Lenné MG, Corben BF, Stephan K 2007. Traffic signal phasing at intersections to improve safety for alcohol-affected pedestrians. Accident Analysis and Prevention, 39, 751-756.

Loxley W, Toumbourou JW, Stockwell T 2004. The Prevention of Substance Use, Risk and Harm in Australia: A Review of the Evidence. Summary. http://www.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-publicat-document-mono_prevention-cnt.htm

McLean AJ, Brewer ND, Sandow BL 1979. Adelaide In-Depth Accident Study 1975-1979. Part 2: Pedestrian Accidents. Report from the Road Accident Research Unit (now the Centre for Automotive Safety Research), University of Adelaide.

Ministerial Council on Drug Strategy 2006. National Alcohol Strategy 2006-2009. http://www.alcohol.gov.au/internet/alcohol/publishing.nsf/Content/nas-06-09.

Moyer A, Finney JW, Swearingen CE, Vergun P 2002. Brief interventions for alcohol problems: A meta-analytic review of controlled investigations in treatment-seeking and non-treatment-seeking populations. Addiction 97: 279-292.

Oxley J, Lenné M, Corben B 2006. The effect of alcohol impairment on road-crossing behaviour. Transportation Research, Part F 9: 258-268.

Perham N, Moore SC, Shepherd J, Cusens B 2007. Identifying drunkenness in the night-time economy. Addiction 102: 377-380.

Raistrick D, Heather N, Godfrey C 2006. Review of the effectiveness of treatment for alcohol problems. London: National Treatment Agency for Substance Misuse. http://www.nta.nhs.uk.

Retting RA, Ferguson SA, McCartt AT 2003. A review of evidence-based traffic engineering measures designed to reduce pedestrian-motor vehicle crashes. American Journal of Public Health 93: 1456-1463.

Road Safety Committee, Parliament of Victoria 1999. Walking safely. Inquiry into the incidence and prevention of pedestrian accidents. Melbourne: Victorian Government Printer. http://www.parliament.vic.gov.au/rsc/walking/walking%20safely.pdf.

Ryb GE, Dischinger PC, Kufera JA, Soderstrom CA 2007. Social, behavioral and driving characteristics of injured pedestrians: A comparison with other unintentional trauma patients. Accident Analysis and Prevention 39: 313-318.

Small TJ, Sheedy JM, Grabs AJ 2006. Cost, demographics and injury profile of adult pedestrian trauma in inner Sydney. ANZ Journal of Surgery 76: 43-47.

Strecher VJ, Bauermeister JA, Shope J, Chang C, Newport-Berra M, Giroux A, Guay E 2006. Interventions to promote safe driving behaviour: Lessons learned from other health-related behaviours. In: Behavioural Research in Road Safety 2006, Sixteenth Seminar, pp. 28-38. London: Department for Transport.

Texas Alcoholic Beverage Commission 2005. TABC cracks down on public intoxication in an effort to reduce DWI's. Press release, 26th August 2005. http://www.tabc.state.tx.us/pubinfo/pressreleases/2005/20050826.htm.

Wilson J, Fang M, LeBrun D 2003. Locations for collisions involving alcohol and drug impaired pedestrians in urban areas. ICTCT-extra Workshop (held in Vancouver), International Cooperation on Theories and Concepts in Traffic Safety. http://www.ictct.org/workshops/03-Vancouver/Wilson.pdf.

Wood JM, Owens DA 2005. Standard measures of visual acuity do not predict drivers' recognition performance under day or night conditions. Optometry and Vision Science, 82, 698-705.

Wood JM, Tyrrell RA, Carberry TP 2005. Limitations in drivers' ability to recognize pedestrians at night. Human Factors 47 644-653.