

Alcohol-related injury and young males

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Alcohol-related injury and young males

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Abstract

This report aims to describe what is known about the occurrence of alcohol-related injury (ARI) in young males; to outline current knowledge about reducing ARI in young males; to highlight important gaps in the data; and to indicate ways forward.

Most knowledge about alcohol and injury in young males comes from the transport arena and, to a lesser extent, from research on violence. Transport, self-harm, falls, and violence are notable contributors to ARI deaths and hospitalisations. Leisure and recreation, violence, and 'other' household activities seem to make up a large proportion of ARI not resulting in death or hospitalisation. Research indicates that ARI peaks in young males aged 20–24 years and there seems to be a specific subgroup of young males that display a cluster of risk behaviour.

Few interventions specifically address ARI in young males. Current evidence comes mainly from the traffic arena where drink-driving has been addressed. Evidence shows a decline in alcohol-related motor vehicle crashes overall. A comprehensive strategy, which employed legislation, RBT, and ongoing reinforcement through the media, was the key. Other promising approaches to reduce alcohol-related road crashes in young males include low blood alcohol level laws, focusing on a sub-group of high-risk drivers, administrative per se laws, and installing ignition interlock devices.

Evidence about other approaches to reduce alcohol-related harm is increasing. Some strategies are to reduce alcohol availability by decreasing liquor outlet density and banning alcohol in some communities. Responsible beverage service practices and environmental strategies are useful, but seem most effective when combined with other approaches. Evidence from community trials aimed at reducing ARI is not unequivocal, but multi-pronged strategies seem most effective. Brief interventions are useful too.

The risk of injury is often associated with other health risks, which in turn are linked with alcohol use. Young people often engage in risk behaviour and involvement in one risk behaviour increases involvement in others. Interventions should address risk behaviour as a complex of health compromising behaviours. A combination of school-based programs, community wide cessation campaigns for adults, and a strong media component seem most successful.

ARI in young Aboriginal males deserve specific attention. These young males seem to be at increased risk for experiencing alcohol-related problems. A number of approaches have been employed to reduce ARI in Aboriginal people, but the impact on young males is unknown.

There is no simple solution to reduce ARI in young males. Community level interventions that incorporate a number of different effective approaches seem to offer most promise. Another useful avenue may be to focus on a syndrome of risk behaviour, rather than just on alcohol use.

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Abbreviations used

ABS	Australian Bureau of Statistics
AIHW	Australian Institute for Health and Welfare
ARI	Alcohol-related injury
ARPC	Alcohol-related pedestrian crashes
ATSI	Aboriginal and Torres Strait Islander
BAC	Blood Alcohol Concentration
BrAC	Breath Alcohol Concentration
CDC	Centers for Disease Control and Prevention
ED	Emergency Department
GP	General Practitioner
ICD	International Classification of Diseases
NCETA	National Centre for Education and Training on Addiction
NHMRC	National Health and Medical Research Council
NHS	National Health Survey
NISU	National Injury Surveillance Unit
RBT	Random Breath Testing
RCIS	Research Centre for Injury Studies
UK	United Kingdom
US	United States of America
WRI	Work-related injury

1 Introduction

During 1998 and 1999, the Research Centre for Injury Studies (RCIS) and the National Centre for Education and Training on Addiction collaborated with the aim to evaluate and comment on the body of research on alcohol-related injury and young males. This was done to contribute to two key documents, i.e. Directions for Injury Prevention. Report 1: Research Needs (National Injury Prevention Advisory Council 1999) and Report 2: Injury Prevention Interventions – good buys for the next decade (National Injury Prevention Advisory Council 1999). This report resulted from the collaboration and is released as a working paper.

The role of alcohol in injury to young males is under-examined, except for traffic injury and, to a lesser extent violence. Evidence on the prevention of alcohol-related injury (ARI) among young males is also fairly limited.

The aim of the report is:

- to describe what is known about the occurrence of ARI in young males;
- to outline current knowledge about reducing ARI in young males;
- to highlight important gaps and limitations in the data; and to
- indicate ways forward.

Chapter 1 gives a brief overview of injury profiles and alcohol use for young males and highlights alcohol as a risk factor for injury. Chapter 2 gives an overview of current knowledge about the occurrence of ARI for various types of external causes in young males. Chapter 3 highlights evidence about strategies for reducing ARI. The next chapter deals with a specific population at risk, i.e. Indigenous young males. This is followed by the discussion and conclusions.

Precise definition of an age group is arbitrary, although common practice usually specifies five-year age groups. Young people grow up in varying circumstances and cultures and concepts such as ‘childhood’ or ‘youth’ have various interpretations, depending on social, cultural and political circumstances. Qualitatively, the interest is in adolescence and early adulthood, as well as in the transition from one to the other. There are individual variations in maturation (i.e. physical and psychological), but socially defined milestones (e.g. age of legal drinking, age at which driving license can be obtained) mark this process.

Throughout this report we often direct attention to young males aged 15–29 years, sometimes distinguishing three five-year age groups within this broad age category. Rates and proportions change rapidly with age, especially in the late teens. This sometimes warranted attention to smaller age groups. Also, the use of specific age groups in available literature varied. Therefore we used data for the 15–29 year age category when possible, but when these were not available, we drew on data for males and the age group closest to the 15–29 years age group.

1.1 Injury to young males

To set the scene for further discussions about ARI in young males, we give a brief overview of injury profiles in young males. The data come from national mortality and morbidity data collections held by the Australian Bureau of Statistics (ABS). Other data sources are limited.

Injury deaths and hospitalisations

Routine mortality data collected by the ABS show that more than 1,600 young male deaths result from injury each year. Data from the Australian Institute for Health and Welfare (AIHW) indicate that more than 60,000 are hospitalised annually because of injury (National Health and Medical Research Council 1996). Except for the very high rates in the elderly, both death and hospital separation rates are highest for young males in Australia. However, the number of young males in the population is much greater than the number who are elderly, hence young men experience a greater proportion of injury cases than is suggested by the rates.

The overall injury death rate for young males has declined over the last 18 years. In 1979 the injury death rate for young males aged 15–29 years was 115.9 per 100,000 population, whereas it was 80.3 in 1998. Also, since 1979, the death rates from transportation and other injuries have decreased whereas the death rate due to suicide has increased. Overall, suicide is now the leading cause of injury deaths in young males aged 15–29 years, followed by transport (Table 1).

Table 1 : Injury rates for deaths and hospitalisations for young males by age group; Australia.

External Cause	Death rates, 1998 ^(a)				Hospital separations rates, 1997–98 ^(b)			
	15–19 yrs ^(c)	20–24 yrs ^(c)	25–29 yrs ^(c)	15–29 yrs ^(d)	15–19 yrs ^(c)	20–24 yrs ^(c)	25–29 yrs ^(c)	15–29 yrs ^(d)
Transportation	27.3	32.3	22.7	27.4	758.6	677.6	494.5	642.6
Drowning	1.8	2.3	2.4	2.2	4.6	5.9	2.3	4.29
Poisoning, pharmaceuticals	2.5	8.5	12.1	7.8	68.2	97.7	88.3	84.9
Poisoning, other substances	0.4	0.4	0.4	0.4	26.1	21.4	19.4	22.3
Falls	0.3	1.7	1.4	1.1	723.7	564.1	473.1	585.8
Fires/flare/scalds	0.7	0.9	1.4	1.0	43.7	49.0	40.3	44.4
Other unintentional	2.7	5.2	5.2	4.4	1,062.4	1,170.0	1059.1	1,097.4
Self-harm	17.2	35.9	42.6	32.0	110.1	178.8	183.2	157.8
Violence-related	1.8	2.9	3.7	2.8	317.7	400.9	315.8	345.0
Undetermined intent	0.6	1.6	1.2	1.1	6.4	10.0	8.2	8.2
Medical misadventure	0.0	0.1	0.1	0.1	155.9	188.8	219.0	188.20
Total	55.3	91.8	93.1	80.3	3,277.1	3,364.4	2,903.4	3,180.8

Sections highlighted in grey shows three most common causes of injury and poisoning in young males.

(a) Deaths data are from the Australian Bureau of Statistics mortality unit record data collection for the calendar year 1998.

(b) Data on hospital separations are from the Australian Institute of Health and Welfare database of Australian Hospital Statistics for the financial year 1997–98. These figures reflect all episodes of hospital separations and do not refer to incident cases.

(c) Age-specific rates per 100,000 population

(d) Rates for this age-group are age-standardised using the direct method and 1991 as the reference population.

A different pattern of external causes of injury emerges among young men admitted to a hospital bed because of injury. Table 1 shows that, overall, the category 'other unintentional incidents' accounted for one-third of in-patient injury, followed by falls, transport-related injury, and interpersonal violence. Suicide comprised 5% of the hospitalisations in 1997/98, whereas it accounted for 40% of young male deaths in 1998¹.

Other morbidity data

Comprehensive data on young males seeking medical attention for less severe injuries, (i.e. those that do not result in death or hospital admission) are lacking. However, data from a non-probability sample of 50 hospitals which volunteered emergency department (ED) information between 1986 and 1994 indicated that less severe injury may result in more than 760,000 ED attendances for young males per year.² These data indicate yet another causal profile of injury than the patterns for deaths and hospitalisations described above. That is, sports made up 23% of the activity undertaken when injured for males aged 15–29 years presenting to participating EDs, occupational activities formed 22%, leisure/recreation 17%, and transport 13% (Moller 1995).

It is well known that private practitioners treat significant numbers of injured patients. It has been estimated that for each unintentional injury leading to an ED attendance there is at least one general practitioner (GP) consultation (McClure and Douglas 1996; McClure and Douglas 1996). Another estimate based on the ABS' National Health Survey (1995) indicate that for young males aged 15–24 years there are 1.7 GP attendances for every one ED visit (Harrison (In Press)).

Costs and disability resulting from injury

Injury is not only a social burden; it is also a financial one. A report on the total recurrent health expenditures on injury and poisoning for the financial year 1993–94 indicated that \$318 million was spent on the treatment of males aged between 15–24 years, i.e. 22% of the total health system costs for injury and poisoning (Mathers, Penm et al. 1999). Of the \$318 million, 23% went for the treatment of road traffic incidents, 13% for falls, 10% for homicide and violence, and 3% for suicide and self-harm actions (Mathers, Penm et al. 1999).

Injury also contributes to long-term disability in young adults. In 1995, 10% of Australians aged 15–24 years had a long-term condition that appeared to be the result of an injury or a poisoning (Australian Bureau of Statistics 1997).

¹ There is a familiar but still unclear gender paradox in the epidemiology of suicidal behaviour. In many countries where the occurrence of suicide has been studied, it appears that females have higher rates of suicidal ideation and behaviour than males, but mortality from suicide is higher for males (Canetto, S. S. and I. Sakinofsky (1998). "The Gender Paradox in Suicide." *Suicide & Life-Threatening Behavior* **28**(1): 1-23.)

² This estimate is based on the finding that 11% of the young men who had presented to the 50 participating hospitals were admitted.

The burden of injury for young males is not yet comprehensively described, but it clearly is significant. Also, various types of injury appear to have a different impact on this burden.

1.2 Alcohol use among young males

Drinking has long been regarded as part of the Australian culture and is a common practice among young males. In a National Health Survey, 75% of persons aged between 15–24 years reported that they had consumed a drink containing alcohol in the week prior to the survey (Australian Bureau of Statistics 1997). In another survey, 32.9% of young males aged 14–19 years reported that they were regular³ consumers of alcohol and a further 37.4% indicated that they were occasional drinkers⁴ (Australian Institute for Health and Welfare 1999). This same survey showed that 63.1% of young men aged 20–29 years were regular drinkers and another 25.8% consumed alcohol occasionally (Australian Institute for Health and Welfare 1999).

In addition to the frequency of drinking,⁵ the quantity of alcohol consumed is also important. The majority of young men show low to moderate levels of alcohol use, but a notable proportion of young men show high levels of regular alcohol consumption. The National Health Survey (NHS) of 1995 showed that 82.9% of Australian males aged 15–24 years consumed alcohol at a low risk level (i.e. less than 50 ml alcohol per day); 9.7% drank moderately (i.e. between 50–75 ml per day); and 7.4% showed high alcohol risk levels (i.e. more than 75 ml per day) (Australian Bureau of Statistics 1997).

However, risk levels are based on regular alcohol consumption and the NHS indicators do not take into account whether individual consumption varies over time (Australian Bureau of Statistics 1997). Therefore, the figures stated above do not represent the total picture of alcohol use in young males.

Studies indicate that young men show different drinking styles. For example, in a 1993 study of 140 US colleges, various drinking patterns for participating students were distinguished (Wechsler, Davenport et al. 1994). These were *non-drinking* (15% of the men), *non-binge drinking* (35% of the male students), and *binge drinking*⁶ (50% of the men) (Wechsler, Davenport et al. 1994). Binge drinkers were further classified as infrequent binge drinkers (55% of men who binged) and frequent binge drinkers (45% of men who binged). More US research indicates that certain groups appear to be more prone to binge drinking, e.g. athletes (Leichliter, Meilman et al. 1998); white males (Mangus, Hawkins et al. 1998), as well as Hispanic males (Markarian and Franklin 1998).

³ That is, consumes alcohol on at least 1 day per week.

⁴ Occasional: consumes alcohol less often than 1 day per week.

⁵ Frequency of alcohol consumption is often described by distinguishing between 'light' (1.4 -2.4 drinks/day), 'moderate' (2.5 - 3.6 drinks/day), and 'heavy' drinking (3.7+drinks/day)

⁶ Binge drinking: to have more than five standard drinks on one occasion

Frequency of alcohol use and drinking patterns seem to change with age, especially during the transition to adulthood. In adolescence, alcohol consumption seems to increase with age – this is illustrated in several US studies (Escobedo, Chorba et al. 1995); (Kandel 1998)). Chen and Kandel (1995) found in another American study that the peak for alcohol use is at 18 years, thereafter it stabilises and declines slightly in the late 20s. Other literature also indicates that average alcohol consumption reaches a peak by about 21 years that is followed by a downward trend (Pape and Hammer 1996). This may be due to a response to the responsibilities that most individuals encounter in their twenties, but it can also indicate that the developmental tasks in the teenage period have been completed (Pape and Hammer 1996).

This does not imply that all people begin to moderate their drinking habits in their early twenties. It seems as if heavy drinkers limit their alcohol intake more than low to moderate drinkers as they grow older (Pape and Hammer 1996). However, individuals tend to maintain their relative drinking position over time.

Adolescent alcohol use appears to be an important aspect of socialisation to the role of adult, especially in males. Alcohol use may therefore serve several psychological functions. It may express opposition to adult authority and mark one's passage out of childhood. It may also be an ingredient of the separation process and the identity formation that typically occur during the teenage years (Pape and Hammer 1996). Unfortunately, adolescents are more inclined to get drunk and to engage in norm-violating behaviours when influenced by alcohol. This may be because adolescent drinking is a behavioural manifestation of a transitional phase typified by a proneness to test limits and seek excitement (Pape and Hammer 1996). It can also be that adolescent drinking is an effort to master developmental tasks and demands in psychological growth.

There is a large and consistent body of evidence that the age at onset of drinking (Pape and Hammer 1996), as well as cigarette and illicit drug use (Johnson and Gerstein 1998) is a powerful predictor of drug consequences and dependence. It seems as if adolescents who begin to use drugs at early ages tend to use drugs more frequently, escalate to higher levels of drug use more quickly, and are less likely to stop drug use (Pape and Hammer 1996).

1.3 Alcohol as a risk factor for injury

Alcohol is regarded as one of the most important risk factors in injury (Lowenfels and Miller 1984). Drinking can increase the risk of injury by individuals engaging in riskier behaviours (Hingson and Howland 1993), exposing the individual to more hazardous circumstances or by a direct biological effect of reducing perception and responses to hazards (Li and Baker 1994). Alcohol affects body stability, lowers visual acuity; impairs alertness, perception, attention and judgement, increases confidence (which may lead to more risky behaviour); decreases reaction time; and decreases coordination and balance – all of which increase the risk of injury (Cherpitel 1993; Hingson and Howland 1993). Some specific associations between alcohol and injury are highlighted below.

Motor vehicle crashes

Much research has been done on the association of alcohol use and the risk of being involved in a traffic collision. It is well documented that there is an increasing probability of being involved in a motor vehicle crash with increasing BACs (Holubowycz, Kloeden et al. 1994). Blood alcohol levels of 0.05 g/100ml are linked with an increased risk of crash involvement, although it seems as if the role alcohol plays becomes more prominent when BACs are 0.1 g/100ml or higher. However, even low blood alcohol concentrations depress the central nervous system and can make a driver more likely to fall asleep at the wheel, while at higher levels of alcohol, the disruptions to perceptual-motor coordination are probably more important in increasing crash risk than the drowsiness-inducing effect of alcohol (Haworth and Rechnitzer 1993). It has also been established that as crash severity increases, so too does the extent of alcohol involvement (Holubowycz, Kloeden et al. 1994).

Motorcycle crashes

Colburn *et al.* (1993) demonstrated some of the reasons why motorcycle riders who consume alcohol are at increased risk. They tested 14 experienced motorcyclists with different breath alcohol concentrations (BrACs) in a motorcycle simulator. They found that there was a positive association between the total number of rider errors and levels of breath alcohol ($r=0.85$; $p<0.01$). Also, those riders with a BrAC greater than 0.05 g/100ml had a higher tendency to leave the road (this type of crash often results in death for a motorcyclist) and their ability to complete a timed course was reduced. Another worrying finding was that the performance errors of the operators increased when they were 'sobering up' (Colburn, Meyer et al. 1993). Experimental studies with bicyclists also indicated that bicycling requires a higher level of psychomotor skill than driving a motor vehicle, and that a BAC of 0.08g/100ml or greater can result in a decline of riding performance by 80% (Li and Baker 1994).

Falls

Alcohol also seems to be a risk factor for falls. It has been found that on the Romberg test⁷ individuals showed a notable amount of swaying if their BACs were more than 0.1 g/100ml (Hingson and Howland 1993).

Other studies have also found that BACs of 0.10 g/100ml impaired divided attention performance, visual acuity, as well as adaptation to brightness and glare (Hingson and Howland 1993). Also, a case-control study investigating the risk of falls after drinking showed that a person with a BAC of 0.10–0.15 g/100ml was 10 times more likely to sustain a fatal fall injury than a person with a BAC of zero. For a person with a BAC of more than 0.15 g/100ml, the relative risk was 600 (Honkanen 1993).

Water-related injury

Alcohol use has also been linked to aquatic injuries. It has been reported that alcohol impairs the swimming ability of athletes under experimental conditions (Starmer 1980), as quoted in (Nixon, Pearn et al. 1995). Alcohol also tends to influence judgement and is, therefore, an added risk factor for injury or drowning during water-related activities such as swimming, boating or fishing (Nixon, Pearn et al. 1995).

Drinking patterns

Drinking patterns are also associated with injury. For example, Wechsler *et al.* (1994) in their study of 140 colleges in the US found that 23% of frequent binge drinkers reported 'getting hurt or injured' as one of the consequences of their drinking. The percentage for infrequent binge drinkers was 9% and for non-binge drinkers it was 2%.

⁷ The test which measures the ability to stand upright without swaying

2 Occurrence of alcohol-related injury in young males

This Chapter gives a brief overview of what is known about the role of alcohol in regard to transport crashes, other non-traffic unintentional events, interpersonal violence and suicide among young men.

There is a growing body of knowledge on the occurrence of ARI in young males. There is also an increase in literature about reducing ARI. Large gaps still remain and the availability of relevant literature varies. There is an extensive body of knowledge on the occurrence and prevention of transport incidents related to alcohol (specifically drink-driving), as well as an increase in literature on the prevalence, and to a lesser extent, the prevention of alcohol-related violence. For other unintentional injuries such as falls, work, sports and domestic incidents, the literature is scarce in that the areas have not been covered in great depth and well-developed intervention strategies are lacking.

This report also draws on data from the US and other countries to supplement Australian data.

Section 2.1 gives an overview of ARI in regard to young Australian males as defined by attributable fractions established by English, Holman et al. (1995). The limitations of the attributable fractions are presented in Section 2.1.2.

The contribution of alcohol to specific types of injuries is discussed further in Sections 2.2–2.4. These discussions reflect a brief overview of the extensive literature on traffic-related ARI, and to a lesser extent the growing evidence on ARI due to violence. They also reflect the extent and gaps of information available on other subjects.

The headings used in Sections 2.2–2.4 were chosen for convenience, but there is (considerable) overlap between the sections, e.g. ‘falls’, ‘work-related injuries’ and ‘sports-related injuries’ are some of the headings, but many falls in young males are related to work or sports.

2.1 Overview

This section presents an overview of ARI in regard to young males as defined by attributable fractions established by English, Holman et al. (1995). There are a number of limitations of these attributable fractions (Carman and Bordeaux *Draft Manuscript*). At the time of writing, there were few other such fractions available and the fractions by English et al (1995) were used in this report despite their limitations outlined in Section 2.2.2.

2.2.1 Attributable fractions for alcohol and injury among young males

Strong associations have been identified between alcohol use and various types of injury (English, Holman et al. 1995). Table 2 shows estimated attributable fractions for alcohol in regard to causes of injury in young males (English, Holman et al. 1995).

Table 2 : Estimated aetiologic fractions for major categories of injuries, males aged 15–29 years

Injury type	Fraction for age group		
	15–19 yrs	20–24 yrs	25–29 yrs
Assault	0.47	0.47	0.47
Fire injury	0.44	0.44	0.44
Road trauma (BAC > 0.05/100ml)	0.33	0.43	0.43
Falls	0.34	0.34	0.34
Drowning	0.32	0.32	0.32
Suicide	0.12	0.14	0.15
Occupational/machine injuries	0.07	0.07	0.07

Source: (English, Holman et al. 1995)

In Table 3, the fractions by English et al (1995) were combined with case count data on injury among young men (as presented in Table 1).

- For **deaths** it seems that, in 1998, transport was the biggest contributor to alcohol-related injury deaths in young males (Table 3). This was followed by self-harm and interpersonal violence.
- When looking at **hospitalisations** for 1997/98, transport also seemed to be the largest contributor to ARI in young males, followed by falls and violence (Table 3). Data were not available for the alcohol-relatedness of 'other unintentional injury', which is a category that made up the largest proportion of hospital separations in young males.

Table 3 : Estimated 'burden' of ARI in young males; Australia

Cause of injury	Deaths in young males, 1998				Hospital separations, 1997/98			
	No. of cases,	Aetiological fractions ^(a)	No. estimated alcohol-related cases (%) ^(b)		No. of cases	Aetiological fractions ^(a)	No. estimated alcohol-related cases (%) ^(b)	
Transportation	574	0.43	246.82	(61.5%)	13,373	0.43	5,750.39	(40.5%)
Drowning	46	0.32	14.72	(3.7%)	89	0.32	28.48	(0.2%)
Poisoning ^(c)	174	..	..	..	2,242	..	..	..
Falls	24	0.34	8.16	(2.0%)	12,198	0.34	4,147.32	(29.2%)
Burns	21	0.44	9.24	(2.3%)	926	0.44	407.44	(2.9%)
Other unintentional	92	..	..	..	22,942	..	..	..
Self-harm	678	0.14	94.92	(23.6%)	3,314	0.14	463.96	(3.3%)
Violence	59	0.47	27.73	(6.9%)	7,207	0.47	3,387.29	(23.9%)

(a) Combined for young men aged 15–29 years. Also see Table 2.

(b) Per cent refers to column per cent, i.e. proportion of all alcohol-related cases

(c) Refers to poisoning by pharmaceuticals, as well as poisoning by other substances

Sources:

Deaths data are from the Australian Bureau of Statistics mortality unit record data collection for the calendar year 1998.

Data on hospital separations are from the Australian Institute of Health and Welfare database of Australian Hospital Statistics for the financial year 1997/98.

Attributable fractions adapted from (English, Holman et al. 1995)

There is a huge economic aspect to ARI as well. Combining the attributable fractions with estimates of health system costs indicates that ARI in young males accounted for at least 37% of the costs for injury in young males in 1993/94 (Table 4). It is more than likely that the burden is larger than this, but attributable fractions were not available for some injury categories.

Table 4 : Application aetiologic fractions to total health systems cost estimates; Australia

Injury type	Fraction for 15–24 yrs group	Total Health systems cost (in millions)	
		Injuries 15–24 yrs	ARI 15–24 yrs
Assault	0.47	\$32.1	\$15.1
Fire injury	..	..	..
Road trauma (BAC > 0.05/100ml)	0.38	\$73.9	\$28.1
Falls	0.34	\$42.0	\$14.3
Drowning	..	..	..
Suicide	0.13	\$8.9	\$1.2
Occupational/machine injuries	..	..	..
Total for estimates available	..	\$156.9	\$58.7 (37%)

No separate cost data provided for fire injury, drowning or occupational/machine injuries. The source used the age grouping 15–24 years.

Source: Attributable fractions adapted from English, Holman 1995 and cost information from Mathers, Penm 1998

2.1.2 Limitations of attributable fractions

There are problems in regard to the attributable fractions of English et al (1995) and to applying these fractions to Australian deaths and hospitalisations data (Carman and Bordeaux *Draft Manuscript*). Main concerns are:

- The methods English et al (1995) used measured the effect of 'unsafe' drinking when compared to 'safe' drinking, as based on NHMRC guidelines for diseases. However, even small amounts of alcohol can contribute to injury. Thus, the authors' attributable fractions for injury are likely to be underestimates of the effect of alcohol on injury.
- English et al (1995) used results from studies that did not differentiate findings for males and females. There is the potential of underestimated male and overestimated female attributable fractions, particularly for attributable fractions that were calculated using a small number of studies.
- Little Australian data are available to calculate attributable fractions. This raises concern about the applicability of the attributable fractions to Australia data, especially in the light of Australia's different demographic profile and dissimilar laws and practices relating to alcohol use (and driving).

Revised attributable fractions were being developed by the AIHW when this report was written (Bruno Ridolfo, personal communication).

2.2 Transport-related injury

The literature on injury related to transport and the role of alcohol in this regard is extensive. This is a selective overview with specific reference to ARI.

According to Table 4, transport appears to be the largest cause of ARI deaths and hospitalisations in young males. Of all transport-related incidents, the majority of deaths and hospital separations occur among vehicle occupants.

2.2.1 Occupants of motor vehicles

Introduction

Evidence shows that crash risk varies with driver age and sex, as well as with driving experience. It is well established that young drivers are over-represented in road crashes in Australia (Catchpole, Macdonald et al. 1994; Macdonald 1994). For example, in NSW, drivers and riders aged 17–25 years held 16% of drivers' licenses in 1992, but accounted for 30% of fatal crashes to drivers/riders, as well as 35% of all driver/rider casualties (RTA-NSW 1993; Catchpole, Macdonald et al. 1994). Other Australian data, as well as studies from Britain, the US, Canada, the Scandinavian and other European countries also indicate that drivers aged 18–24 years are over-involved in crashes (Macdonald 1994).⁸

Evidence of alcohol involvement

In Australia, the highest proportion of alcohol-related fatal crashes appears to be in the 21–29 years age group (Macdonald 1994). Within this group, those aged between 21–24 years appear to have the highest alcohol involvement. Younger drivers (i.e. those aged between 16–20 years) seem to have slightly lower rates of alcohol involvement (Table 5).

Consistent with the above, it was reported that, in South Australia, younger drivers were not over-represented in 'driving under the influence' convictions (Macdonald 1994) (Peck 1985)) also found that, in California, alcohol did not play a large role in teenage crashes, relative to those of other groups.

⁸ However, the extent of this over-involvement varies according to which denominator is used (Macdonald, W. (1994). Young Driver Research Program: a review of information on young driver crashes. Clayton, Monash University Accident Research Centre: 51.

Table 5 : Some evidence of alcohol-relatedness in motor vehicle crashes for young males

Authors	Study population	Findings for various age groups
(English, Holman et al. 1995)	Fatally injured young male drivers Australia, 1990	<20 yrs: 7% had BACs 0.05–0.1; 31% had BACs >0.1 20–29 yrs: 6% had 0.05–0.1; 44% had >0.1
(Baxter, Van Brakel et al. 1990)	Drivers in fatal crashes Western Australia, 1989	17–20 yrs: 60% had BACs=0 28% had BACs ≥ 0.08 21–24 yrs: 55% had BACs=0 28% had BACs ≥ 0.08 25–44yrs: 58% had BACs=0 33% had BACs ≥ 0.08
(Macdonald 1994)	Drivers involved in fatal crashes NSW, 1990	17–20 yrs: 58% had BACs=0 31% had BACs≥0.08 21–25 yrs: 41% had BACs=0 39% had BACs≥0.08 26–29 yrs: 49% had BACs=0 34% had BACs≥0.08

Young drivers aged 16–19 years seem to be less likely to have been drinking prior to driving and to be more likely to have lower BACs than older drivers (Macdonald 1994). However, these young drivers seem to have an increased risk of crash involvement at low BACs relative to older drivers with the same BACs (Macdonald 1994). It seems as if young drivers in general do not drink and drive more than older drivers, but when they do, they have a higher probability of being involved in a collision (Cavallo and Triggs 1995). This may reflect a combination of risk factors, i.e. being inexperienced at driving, inexperienced at drinking, and inexperienced at drinking and driving.

Much of the data available on alcohol-related transport injury come from studies on blood alcohol levels in crashes that resulted in fatalities or hospitalisations. Data on young driver involvement in less serious crashes are inadequate (Macdonald 1994).

Data about exposure and drink-driving in relation to patterns of use are still somewhat limited (Escobedo, Chorba et al. 1995), but offers valuable insight. US data are quoted to illustrate this relationship.

In the 1991 US Youth Risk Behaviour Survey of high school students, 17% of the respondents reported drinking and driving at least once in the month prior to the survey (Escobedo, Chorba et al. 1995). This proportion was similar to that found in the 1997 Wisconsin Youth Risk Behaviour Survey where 16% of the students said that they had driven after drinking at least once in the 30 days before the survey (Kadel 1998).

Wechsler *et al.* (1994) reported that 20% of the male non-binge drinkers included in their survey of 140 colleges, drove after they had drunk some alcohol. However, for both high school and college students the proportion of binge drinkers who drink and drive in the US is much higher. Escobedo, Chorba *et al.* (1995) found that 28% of respondents who had 1–2 binge drinking days in the month prior to the survey drove after consuming alcohol. This

proportion increased as the number of binge drinking days increased and 77% of respondents who had 10 or more binge drinking days reported drinking and driving. This translated to an odds ratio of 14.1 (95% CI: 8.5; 23.4) when compared to those who reported no binge drinking days (Escobedo, Chorba et al. 1995). Wechsler *et al.* (1994) in their study of college students also reported high proportions of drinking and driving in binge drinkers (Table 6).

Table 6 : Alcohol-related behaviour for young male college students for a 30-day period

Driving Behaviour	Infrequent binge drinkers	Frequent binge drinkers
Drove after drinking	47%	62%
Drove after having 5+ drinks	18%	40%

Source: Adapted from (Wechsler, Davenport et al. 1994)

It seems that not only do young persons drink and drive, many of them report riding with a driver who had been drinking. Kadel (1998) found that one-third of the US students included, reported riding with a driver who had been drinking at least once in the past 30 days. Wechsler, Davenport *et al.* (1994) reported that 7% of male non-binge drinkers, 23% of infrequent bingers and 53% of frequent binge drinkers rode with a driver who was ‘high’ or drunk.

This evidence appears to lend support to the suggestion that there is a sub-set of young drivers who have a common set of personal and socio-cultural characteristics and that these individuals exhibit various risky types of behaviour to a much greater extent than other young drivers. In a literature review about the young driver problem, it is noted that a young problem driver sub-group does exist and that the crash risk for young drivers is not homogenous (Crettenden and Drummond 1994). This notion seems to be further supported by Deery, Kowadlo *et al.* (1998) who found that subtypes of young novice drivers could be identified. They distinguished between five clusters. Cluster 1 was a relatively high-risk group with high levels of driving-related aggression, competitive speed and driving to reduce tension, assertiveness, sensation seeking, assaultiveness and hostility. Individuals in Cluster 2 scored moderately on driving-related measures, but they were the most depressed and emotionally maladjusted. They also reported high levels of hostility, resentment and irritability. In Cluster 3, individuals tended to score moderately on all of the measures. Cluster 4 was the group with the lowest risk levels and they reported the highest level of emotional and behavioural adjustment. Cluster 5 was the group that showed most risk and had high levels of the same characteristics mentioned above. However, these individuals reported to be more depressed, aggressive, resentful and irritable than the first cluster. The individuals in both Clusters 1 and 5 showed a significantly higher frequency, quantity and total consumption of alcohol per month than the least deviant group (Deery, Kowadlo et al. 1998).

Driving after drinking has been prevalent among Australians but some improvements are evident. For example, in Victoria the proportion of fatally injured drivers and motorcyclists of all ages with a BAC exceeding the BAC of 0.5 g/100ml declined from 49% to less than 30% after 1989. Also, the proportion of drivers/riders exceeding 0.15 g/100ml dropped from 34% to about 14% for the same period (Vulcan 1995). Unfortunately, it seems as if the effect has been more limited for young persons (National Health and Medical Research Council 1999). Vulcan (1995) noted that between 1992 and 1994, 23% of 18–20 year olds and 43% of 21–23 year olds involved in fatal crashes in Victoria had a BAC over 0.05 g/100ml, compared to 20% of older drivers.

Comments

Exposure to crash risk is determined by two factors, i.e. quantitative factors (e.g. distance driven) and qualitative elements (e.g. nature of physical and social environment) (Macdonald 1994). Alcohol is only one of a complex set of factors that influence the involvement in a collision. This overview does not do justice to the vast field of evidence that exist about other factors, but it was not the aim of this section to do so. However, one particular area that warrants a comment is driving experience. Lack of driving experience seems to play a role in regard to alcohol-related motor vehicle crashes. It is difficult to evaluate the contribution of inexperience as it overlaps to a large extent with driver age and there are few studies that investigate the effects of experience independent of age (Macdonald 1994). Even less evidence is available on the relationship between driving experience, age and ARI.

2.2.2 Motorcycle-related injury

Evidence of alcohol involvement

It has been stated that motorcycle riding demands greater coordination, balance and concentration than that required for driving a motor vehicle (Haworth 1994). Therefore, the effects of alcohol consumption may be more pronounced for motorcyclists. However, evidence on this is not unequivocal (Haworth 1994).

Although uncertainty exists as to whether alcohol plays a greater role in motorcycle than motor vehicle crashes, it is clear that alcohol does increase the risk of having a motorcycle crash. A case-control study comparing 222 motorcycle crashes and 1,195 motorcyclist trips found that a BAC of >0 g/100ml was associated with a five-fold increase in the risk of sustaining a crash compared to having a BAC of zero. This risk increased forty-fold if the rider had a BAC of >0.05 g/100ml (Haworth, Smith et al. 1997).

Diamantopoulou, Brumen *et al.* (1995) reported that, in Victoria between 1984 and 1993, the proportions of motorcycle riders killed with BACs of more than

0.05 g/100ml ranged from about 24% in 1991 to nearly 40% in 1987.⁹ These proportions fluctuated somewhat randomly, but seemed to decline after 1989. (The proportions of other drivers killed with illegal BAC readings varied between about 22% in 1992 and about 40% in 1985 and 1988. After 1988, the proportion of other drivers killed with BACs in excess of 0.05 g/100ml declined, with 1992 being an unusually low year (Diamantopoulou, Brumen et al. 1995).)

In comparison to other drivers injured in crashes, injured motorcycle riders generally seem to have lower proportions of positive BACs. The proportion of Victorian motorcycle riders who were seriously injured with illegal BAC readings varied from just more than 10% in 1986 to about 22% in 1990, whereas for other drivers, the comparable figures varied between about 19% in 1987 to just less than 30% in 1992 (Diamantopoulou, Brumen et al. 1995).¹⁰

There seems to be little difference between younger male groups and those aged more than 25 years (Table 7).

Table 7 : Some evidence of alcohol-relatedness in motorcycle crashes for young males by age

Authors	Study description	Findings
VIC ROADS (1992)	Injured motorcycle riders, Victoria, 1988–90	<p><18 yrs: 87% had BACs =Zero–0.05 10% had BACs = 0.051–0.15 3% had BACs > 0.15</p> <p>18–26 yrs: 85% had BACs =Zero–0.05 9% had BACs = 0.051–0.15 6% had BACs > 0.15</p>
(Haworth, Smith et al. 1997)	Case control study, Melbourne, 1995–96 (BACs were available for 66% of cases and 90% of controls)	<p><25 yrs: 80% had BACs =Zero 4% had BACs ≤ 0.05 10% had BACs = 0.051–0.149 3% had BACs ≥ 0.15</p> <p>25–34 yrs: 89% had BACs =Zero 2% had BACs ≤ 0.05 7% had BACs = 0.051–0.149 2% had BACs ≥ 0.15</p>

Comments

Having a positive BAC was also associated with a number of other risk factors. These included being an unlicensed driver, riding a borrowed motorcycle, carrying a passenger, using illicit drugs (especially marijuana), driving at night (i.e. between 6 pm and 6 am) and speeding (Peek-Asa and Kraus 1996; Haworth, Smith et al. 1997). This indicates that drinking riders have a profile that includes other high-risk behaviours, again pointing to the existence of a subset of young people who exhibit a greater extent of risky behaviours than other subsets of young persons.

⁹ The calculation of proportions excluded motorcycle riders with unknown BACs. Also, the data for 1992 and 1993 used in the report by Diamantopoulou, Brumen *et al.* (1995) was preliminary and should be interpreted with some caution.

¹⁰ It should be noted that the data may have been influenced by inconsistencies in the data set (Diamantopoulou, K., I. Brumen, et al. (1995). Analysis of trends in motorcycle crashes in Victoria. Victoria, Monash University Accident Research Centre: 26+84.)

As with motor vehicle accidents, experience seems to play a role in motorcycle crashes. One study in Victoria indicated that holders of learner permits were more than 3.5 times more likely to be involved in a crash than holders of standard permits (Cameron 1992). However, most holders of learner permits tend to be younger than standard permit holders, and it is unclear what the interaction is between experience, age and intoxication (Haworth 1994). It may be that alcohol exponentially increases the risk of crash involvement for inexperienced riders (Haworth and Schulze 1996).

2.2.3 Injury to bicyclists

Evidence of alcohol involvement

In the US, a definite association between alcohol use and fatal injury among cyclists over 15 years of age have been found (Li and Baker 1994). One such study looked at 2,964 bicycle fatalities reported to a Fatal Accident Reporting System between 1987–1991. Of these, 64% were tested for the presence of alcohol. Of the 1,711 cases, 32% tested positive and one in five had BACs of 0.1 g/100ml or higher (Li and Baker 1994). For males, the proportion of cases with positive BACs was highest for the 25–34 year age group – just less than 50% of them had taken alcohol. Also, about one-third of this age group had BACs \geq 0.10 g/100ml. For cyclists aged 15–19 years, 14% drunk prior to the crash even though drinking is prohibited for this age group in all US states (Li and Baker 1994). Compared with cyclists aged 65 years or more, those between 25–34 years were about five times more likely to test positive for alcohol or to be legally intoxicated.

Another study by Li and co-workers (Li, Baker et al. 1996) looked at the role of alcohol in fatal and non-fatal injury. They compared medical examiner data with information from a trauma registry and found that 30% of the fatalities had positive BACs, compared with 16% of the non-fatal cases ($p < 0.01$). Also, significantly more of the fatalities were legally intoxicated (i.e. having a BAC \geq 0.10 g/100ml): 22% vs. 13%, $p < 0.01$). Intoxication was more prevalent in males, those aged 20–39 years, or those involved in night-time crashes, for both the fatal and non-fatal cases. Also, in cyclists who sustained serious injury, those who were intoxicated had an increased risk of dying (OR=2.8; 95% CI = 1.3 – 6.3). As in motorcycle crashes, this may be related to the rate of helmet wearing because Li *et al.* (1996) found that only 6% of intoxicated cyclists wore a helmet, relative to 31% of sober cyclists ($p < 0.05$). Australian studies on this topic are limited.

Olkkonen and Honkanen (1990) investigated the role of alcohol as a causal factor in bicycle crashes. In an unmatched case-control study in Finland, they compared 140 injured cases with 700 randomly selected uninjured cyclists. BrACs were recorded. Alcohol involvement was 24% for cases and 4% for controls (Olkkonen and Honkanen 1990). They also found that cyclists with BrACs \geq 0.10 g/100ml had ten-fold increase in the risk of sustaining a crash.

Interestingly, alcohol increased cyclists' risk of injury from falling more than from a collision with a vehicle (Olkkonen and Honkanen 1990).

Comment

Australian studies similar to those described above are limited. Much of the work in the area of bicycle crashes concerns the evaluation of the effectiveness of wearing bicycle helmets.

2.2.4 Pedestrian injury

Introduction

A study on pedestrian crashes in Victoria between 1983 and 1989 indicated that the largest number of pedestrian crashes involved middle-aged pedestrians (Corben and Diamantopoulou 1996). However, it seems as if children up to the age of 17 years were over-represented in pedestrian casualty crashes and that pedestrians aged between 9 and 17 years (as well as those aged more than 71 years) were among the highest risk groups by age (Corben and Diamantopoulou 1996). Pedestrians aged 17–24 years comprised 18% of all pedestrian crashes (Corben and Diamantopoulou 1996). This proportion was significantly greater than for those age groups over 35 years.

Alcohol involvement

Little specific information is available on alcohol-related pedestrian crashes in young males aged 15–29 years, but in general, intoxicated pedestrians are at high risk for injury (Cameron 1992). International and Australian research indicate that almost 50% of adult pedestrians who were killed or injured had been consuming alcohol (Corben and Diamantopoulou 1996). In an Australian study of 6,547 pedestrians aged 18–59 years involved in casualty accidents between 1984–89, 45.5% had known BACs and of these, more than one-third had BACs of more than 0.01 g/100ml (Cameron 1992). Data on pedestrian crashes in Victoria between 1983 and 1989 indicated that about one-third of casualties involving pedestrians aged 14 years or more had BACs of 0.10 g/100ml or more (Corben and Diamantopoulou 1996). In another Victorian study of records for all pedestrian casualty crashes that occurred in metropolitan Melbourne between 1985 and 1994, a total of 18,840 pedestrian casualty crashes were identified. Of the 4,400 cases (23%) for which BACs were available, 1,169 (26.6%) had BACs of 0.10 g/100ml or more.

In the study by Corben, Diamantopoulou *et al.* (1996) the 1,169 alcohol-related pedestrian crashes (ARPC) were compared with the 3,231 non-alcohol related pedestrian crashes (NARPC). They found that male pedestrians were over-represented in both alcohol-related and non-alcohol related pedestrian crashes. Also, more than 80% of the ARPC occurring at night involved males, compared to about 60% of NARPC. A larger proportion of pedestrians aged 17–54 years had some alcohol involvement, but there were no statistically significant differences for the various age groups when ARPC and NARPC were compared. Among the ARPC, there were significantly more young adults aged 17–34 years involved than pedestrians aged 35 years and older, although this was also true for pedestrians with no alcohol involvement (Corben, Diamantopoulou *et al.* 1996).

Comment

Corben, Diamantopoulou *et al.* (1996) identified several factors that seemed to be linked with ARPC, e.g. almost 80% of ARPC occurred between 6 pm and 6 am; 79% happened in dark conditions with street lights on; 74% resulted in a fatal or serious injury; and 77% were struck while crossing a carriageway during night hours. Significantly more ARPC occurred on Friday, Saturday and Sunday nights than on weekday nights and there were variations in crash frequencies during the year, i.e. more ARPC occurred in February and December and fewer in May, but the highest crash frequencies occurred in winter.

Another factor that may play a role is the presence of hotels, nightclubs and restaurants. Corben and Diamantopoulou (1996) stated that they found a clustering of night-time crashes involving pedestrians of 17–34 years and that these may have been related to alcohol. Other factors such as characteristics of the road and surroundings, intersections, traffic control, traffic volume, engineering innovations (e.g. one-way streets) and visibility and conspicuity issues also play a role in pedestrian crashes (Corben and Diamantopoulou 1996).

2.3 Other unintentional non-traffic injury

2.3.1 Sports injury

Introduction

Comprehensive national data are unavailable for participation rates and sports injury. It can, however, be assumed that sports injury has the greatest impact on young males due to their seemingly higher participation rates compared to other age and gender groups. It has been estimated that organised sports involve about two-thirds of 13–18 year old Australians and that more participants appear to be male (Australian Sports Commission 1993). It is estimated that about 1 in 17 Australians sustain a sports injury annually (Egger 1990).

Alcohol involvement

Most of the evidence on the relationship between sports and alcohol reports on drinking patterns among sports participants or spectators (National Health and Medical Research Council 1996). One New Zealand study found that in 348 rugby players the consumption of large quantities of alcohol and a high frequency of heavy drinking sessions were normative (Quarrie, Feehan et al. 1996). A US survey of 125 colleges also found that male athletes consumed notably more alcohol per week and engaged in more frequent binge drinking than males who were not athletes (Leichliter, Meilman et al. 1998). It seems that higher risk-taking behaviour is more prevalent among an athletic population (Iven 1998) and that these behaviours include alcohol use.

Very little information is available on the use of alcohol just prior to engaging in a sports event.

Comment

English, Holman *et al.* (1995) did not come up with an attributable fraction for sports injury, perhaps because the project was limited to categories that are well defined in the International Classification of Diseases (ICD), of which sports injury is not one.

In Australia, alcohol consumption is very much associated with the attendance or viewing of sporting activities, a link that is strongly reinforced by media advertising (National Health and Medical Research Council 1996).

2.3.2 Work-related injury

Introduction

Limited data are available on the national incidence of work-related injury in Australia. It is currently not possible to identify work-related injury (WRI) reliably in either the national death or hospitalisation data collections.

A recent study on work-related fatalities that occurred in Australia between 1989 and 1991 reported that 2,389 persons were fatally injured while working or commuting to and from work (National Occupational Health and Safety Commission 1998).¹¹ This yielded an overall rate of 7.5 deaths per 100,000 persons for workers and commuters. Most of the fatalities occurred in males and the highest number of working deaths was for persons in the age range 25–34 years (National Occupational Health and Safety Commission 1998). However, there were 103 fatalities where the deceased was aged less than 20 years. Of these, 87 were aged 16–9 years.

Alcohol involvement

Limited information is available on the association between work-related injury and alcohol. It is thought that alcohol-related fatalities in the workplace do not occur frequently (Hollo, Leigh et al. 1993).

The recent Australian study on work-related fatalities (National Occupational Health and Safety Commission 1998) provides valuable insight as information on BACs was available for 1,235 (70.1%) of 'working' fatalities, but data for young males were not presented separately. In this study, 133 cases had BAC levels of > 0g/100ml and for 75 of the 133 cases (i.e. 6.1% of 1,235 cases) the BAC was 0.05 g/100ml or more. Table 7 shows this, as well as the proportions for the other types of work-related injury.

Table 8 : BACs for various types of WRI, Australia, 1989–1992

BAC (g/100ml)	Working		Workplace		Work-road		Commuting	
	N	%	N	%	N	%	N	%
Zero	1,102	89.2	726	91.0	376	86.0	425	84.5
0.010 – 0.049	58	4.7	34	4.3	24	5.5	23	4.6
0.050 – 0.099	24	1.9	16	2.0	8	1.8	14	2.8
0.10 or more	51	4.1	22	2.8	29	6.6	41	8.2
Total	1,235	100%	798	100%	437	100%	503	100%
BAC not measured *	497		401		96		123	
BAC not known **	29		21		8		2	
Total	1,761		1,220		541		628	

* No BAC estimated

** BAC estimated, but result not known

Source: (National Occupational Health and Safety Commission 1998).

¹¹ Of the 2,389 fatalities, 1,761 were 'working' deaths (i.e. deceased was performing expected tasks at work), 1,221 were injured in the workplace, 541 were injured in traffic crashes on public roads, and 628 died while commuting to or from work National Occupational Health and Safety Commission (1998). Work-related traumatic fatalities in Australia, 1989-1992. Canberra, National Occupational Health and Safety Commission: 249.

For some of the cases where BACs were determined, it appeared as if the alcohol use contributed to the occurrence of the injury event (National Occupational Health and Safety Commission 1998). This was the case for:

- 5.3% of the cases where the person was working and where BACs were available;
- 3.8% of deaths for which BACs were available and that occurred in the workplace;
- 8.0% of work-related road deaths for which BACs were available; and
- 10.9% of deaths where BACs were available and where the deceased was commuting to or from work.

For 25 of the 65 'working' deaths (i.e. 38.5%) alcohol was consumed, at least partly, in connection with work, e.g. alcohol was used at work during normal duties or at work-sponsored functions (National Occupational Health and Safety Commission 1998). Moreover, it appeared that alcohol had been consumed at work or at work-related social functions in 25 of the 57 commuting deaths (43.9%).

The figures shown in Table 8 seem to be in keeping with other estimates. For example, as reported in Hollo, Leigh *et al.* (1993), measurable BACs have been found in 3–13% of work-related deaths. Also, 3–4% of occupational injuries in the USA shows evidence of alcohol involvement (Stallones and Kraus 1993). A previous Australian study on 1,737 work-related deaths occurring between 1982 and 1984, indicated that, of the 1,044 fatalities where BACs were measured, 163 cases (16%) were considered to have positive BACs. The median BAC for these latter cases was 0.104 g/100ml and 65% of the 163 deaths had BACs of more than 0.5 g/100ml (Hollo, Leigh *et al.* 1993).

Phillips, Vincent *et al.* (1997) conducted a critical literature review of Australian research on the role of alcohol and other drugs in the workplace. They found it difficult to infer much from the 16 prevalence studies they identified. This was largely due to the wide variety of ways in which alcohol consumption was reported (Phillips, Vincent *et al.* 1997). Also, these studies tended to measure general alcohol use and did not attempt to assess whether employees were drinking alcohol before or during working hours (Phillips, Vincent *et al.* 1997). A study of 2,202 Australian coal miners showed that 0.8% of the miners had blood alcohol levels of >0.05 g/100ml while on duty (Phillips, Vincent *et al.* 1997). The other 15 studies reported on findings from a variety of settings that concerned drinking patterns as opposed to acute alcohol use. Most of these studies employed the NHMRC's scale for harmful (i.e. 4–6 drinks per day) and hazardous drinking (i.e. >6 drinks per day) in men. Phillips, Vincent *et al.* (1997) stated that there 'was some consistency within the estimates of harmful and hazardous drinking in the general population, with the prevalence of harmful drinking around 7% (range 5–8.8% for both men and women) and hazardous drinking around 15% (range 10–23.8% for both males and females)'. The studies also showed that about 20% of workers (i.e. for males and females

combined) could be classified as presumptive or actual problem drinkers, based on the Mortimer-Filkins questionnaire (Phillips, Vincent et al. 1997).

2.3.3 Unpaid work

Introduction

These activities (including 'Do-It-Yourself' and maintenance activities) seem to account for a large proportion of injury morbidity in young males. Data compiled from collections undertaken at 50 Australian hospitals between 1986 and 1994 showed that about one in five of all injury presentations occurred at private homes or residential institutions and that injury resulting from unpaid work peaked in 20–34 year olds (National Injury Surveillance Unit (NISU). Unpublished data from the Injury Surveillance Information System data, 1986–1994).

Alcohol involvement

Limited information is available on the role alcohol plays in injury related to unpaid work. Data held by NISU showed that 'recreation or hobby' activities formed 13% of all the alcohol-related attendances in young males to ISIS hospitals during the study period, but no cases were identified as alcohol-related injuries during maintenance activities in this data set (NISU). Unpublished data from the Injury Surveillance Information System data, 1986–1994).

2.3.4 Falls

This section overlaps somewhat with the ones on work and sports-related injury.

Introduction

In Australia during 1998, 24 young men between 15 and 29 years died because of a fall-related injury and another 12,198 were hospitalised during the 1997/98 financial year because of falls. Falls among young males occur in a variety of settings, but many of the fatal falls involved 'falling on different levels' or falls involving 'buildings/structures'. For hospitalisations, the falls were frequently related to same level falling due to collisions in sport, slipping, tripping or stumbling on the same level or falling on different levels. It seems as if at least some of the fatal falls may be work-related and that in non-fatal falls a notable proportion may be due to sports.

This is confirmed by other literature. For example, an American study showed that in 224 falls among people aged between 18 and 64 years, 36% were work-related (Mosenthal, Livingston et al. 1995) – the remaining adult fall victims had a high rate of unemployment and alcohol and drug use. Another US study reported that falls from heights occurred mostly in young males with a mean

age of about 34 years. These falls were most commonly related to jobs or recreation and resulted in higher injury severity scores (Rozycki and Maull 1991).

Alcohol involvement

There are strong indications of a relationship between alcohol consumption and fall-related injury (Hingson and Howland 1993) and there are a number of studies that provide a physiological basis for this association (Hingson and Howland 1993).

Two literature reviews of international literature looking at the presence of alcohol among fall injuries have been done. These are highlighted in the next table. However, specific data for young males are limited, as are data for Australia.

Table 9 : Summary of findings from reviews on fall-related injury

Authors	Description of review	Proportion where alcohol was present
(Hingson and Howland 1987) as quoted in (Hingson and Howland 1993)	English language literature published between 1955–1985, included 17 studies	Fatal falls: 21–77% Non-fatal falls: 17–53% Overall average: 28%
(Hingson and Howland 1993)	English language literature published between 1985–1991, included eight studies	Fatal falls: 35–63% Non-fatal falls: 13–37% Overall average: 24%

Cherpitel (1996) in a study of 3,109 patients from four merged ED studies in the US reported that injuries resulting from violence and falls had the greatest association with positive breathalyser readings and with self-reported drinking before the injury. Also, frequent heavy drinking and drunkenness, as well as a larger number of drinks consumed before the injury were over-represented in injuries due to violence and falls (Cherpitel 1996)

One study on self-reported injury in US high school students aged 14–18 years, indicated that alcohol and other drugs were reported notably often for injuries resulting from falls, cuts, and violence (Spirito, Rasile et al. 1997). In another study on persons attending a US trauma centre, it was reported that alcohol was detected in 44% of fall-related injuries in adolescents (Spain, Boaz et al. 1997). This was much higher than the proportion for violence-related injury, which was 25%.

2.3.5 Aquatic injury, including drowning

Introduction¹²

Young males mainly drown in natural bodies of water such as creeks, rivers and lakes, particularly in unsupervised and/or remote locations (Nixon 1994). In NSW, surf beaches accounted for about 20% of drowning deaths, compared to boating (15%) and fishing, especially rock fishing, (5%) (Nixon 1994). There are indications that adolescent drownings were associated with rescues of swimmers in trouble (Orlowski 1988) (it was not clear whether the adolescents were being rescued or whether they were the rescuers).

A related but neglected aquatic problem is diving into shallow water as a significant cause of spinal cord injury (SCI). Such incidents rank third after motor vehicle crashes and falls as a cause of SCI and is predominantly a problem of young men in their twenties (Nixon 1994; NISU. Unpublished data from the Australian Spinal Cord Injury Register, 1999). In the 15–24 year age group, diving or water-related incidents were second only to transportation as the cause of SCI (O'Connor and Cripps 1998).

Some drownings in young males may also be intentional. However, very little information is available for young males, maybe at least partly because it is not a frequent suicide method employed by young Australian males.

Alcohol involvement

Alcohol is a risk factor for water-recreation fatalities (Copeland 1984; Howland and Hingson 1988), but specific data for young males are limited.

In a review of English language literature up to 1985, Hingson & Howland (1993) reported that 27–47% of drownings involved alcohol. In a subsequent review on studies published between 1985 and 1991, they reported similar findings; i.e. 21–47% of drownings were alcohol-related (Hingson and Howland 1993).

It has been estimated that about one-fifth of the 5,000 annual drowning deaths in the US involve boating mishaps (Hingson and Howland 1993). In a US study on 370 drownings resulting from boating incidents, BACs were positive for 45% of fatalities. About one in five of the 370 cases had BACs of more than 0.10 g/100ml (*ibid.*).

English, Holman *et al.* (1995) estimated that 32% of drownings in males aged 15–29 years in Australia could be attributed to alcohol. A study in Sacramento County, California also found that young males aged between 15–19 years had a high drowning rate and that at least 38% of these drownings were alcohol-related (Wintemute, Kraus *et al.* 1987).

¹² Drowning differs somewhat from other unintentional injury in that it results in a relatively high proportion of deaths compared to serious immersion incidents. However, it is likely that near drownings are under-reported in hospital morbidity data.

Some information on exposure is available. One American study reported that 50% of men consumed alcohol during aquatic activities (Howland, Hingson et al. 1993). It seemed that the average number of alcoholic drinks consumed on one occasion near the water for males aged 16–20 years old was eight drinks, whereas it was six drinks for those aged 21–30 years (Howland, Hingson et al. 1993). This seems to indicate that alcohol consumption is common among recreational boaters in the US and that consumption for young persons in these circumstances tend to be high. It is quite likely that alcohol use during recreational water-related activities is also quite common in Australia.

In regard to suicidal drownings, a study among males and females of all ages in Newfoundland found that alcohol was rarely present in these suicides (Avis 1993). This was confirmed by a Finnish study (Auer 1990). Also see Section 2.2.1 on suicide.

2.3.6 Poisonings

Introduction

There are two groups of poisonings, i.e. unintentional poisonings (including accidental overdoses) and intentional poisonings (which can be either self-inflicted or inflicted by others). In regard to fatal poisonings it is often problematic to distinguish between unintentional poisonings and those resulting from suicide.

In this section, the focus is on unintentional poisonings as intentional self-harm is discussed later in this report.

Alcohol involvement

Little is known about the relationship between alcohol and unintentional poisonings. Also, alcohol is sometimes the drug causing the poisoning.

Zador, Sunjic *et al.* (1996) in a study of all heroin-related deaths in NSW in 1992 detected alcohol in 45% of cases, with a mean BAC of 0.14 g/100ml. They also reported that the deceased had a mean age of 29.7 years, that 82% were male, and that for 71% of cases two or more drug classes were detected (Zador, Sunjic et al. 1996). In a US study of deaths in 10–19 year olds due to poisonings, unintentional exposures accounted for 48% of cases and of these cases, only 2% were alcohol-related (Shepherd and Klein-Schwartz 1998).

Alcohol may play different roles in unintentional poisonings. It may contribute to persons using more than the required dosage of a particular drug because of impaired judgement, or it may be that alcohol increases the toxic effect of other drugs taken (Anonymous 1991).

Comment

Heroin poisoning has received a lot of attention in recent times and an increase in opioid-related deaths has been reported since the early 1980s (Darke and Zador 1996). This increase has accelerated in recent years (Australian Institute for Health and Welfare 2000). Evidence indicates that there has been an increase in use, a decline in age of initiation and an increase in overdose deaths.

2.3.7 Burns

Introduction

Injury due to fires/flames or scalds was a minor cause of injury death in 1998. It also did not result in many hospitalisations among young males during 1997/98. Most of the deaths resulted from house fires but, for hospitalisations, many were caused by the ignition of highly flammable material or controlled fires outside of buildings. Data on cases attended to at some emergency departments in Queensland indicated that the majority of burns in young persons aged 15–24 years were caused by hot liquids, mostly hot fat/oil or hot water (Hockey and Brady 1999). About 25% of these scalds were to workers in the food or hospitality sector. Other important factors involved in these burns were petrol and ‘other chemicals’, typically being used to light a fire (Hockey and Brady 1999).

Alcohol involvement

Howland and Hingson in their review of English language literature, reported in 1987 that alcohol was present in 9–86% (median 46.5%) of burn fatalities. They also found that in patients with non-fatal burn injury who attended EDs or who were hospitalised, the range of alcohol-relatedness was 1–50% (median value of 17%) (Hingson and Howland 1993). These data suggest that alcohol is more likely to be present when a burn fatality occurs than when a person sustains a non-fatal burn injury.

In a more recent review by the same authors, five studies from the US found that between 33–61% of burn fatalities were related to alcohol use and that in two additional studies of non-fatal burns, 22% and 27% of patients had been drinking, respectively (Hingson and Howland 1993).

There are few Australian studies on the role of alcohol in burns to young males. One study in NSW of patients admitted to an adult burn unit found that nearly 80% of the 184 patients (admitted over a 30-month period) were male and that they were most likely to be aged between 25–34 years with an 11–20% total surface burn due to flames (Duggan and Quine 1995). This mostly resulted from using an accelerant in and around the home. They were also more likely to smoke tobacco and drink alcohol to hazardous levels than the general population (Duggan and Quine 1995).

Assault by burning is often not recognised as a cause of thermal injury. A US study on 3,678 adults admitted to a burn centre indicated that 4% sustained their burns because of assault and that black persons and alcohol abusers were two high-risk groups for this type of assault (Purdue and Hunt 1990). Very little Australian data are available for this type of assault and little information is available on the role of alcohol in these injuries.

Comment

It should be noted that some burns result from self-immolation, which is a method sometimes used to commit suicide. It is not a very common mechanism used by young Australian males. Also see section 2.2.1.

2.3.8 Leisure and other injury

Introduction

This is a heterogeneous group and includes unintentional injuries that result from firearms, excessive heat or cold, exposure or neglect, foreign bodies, cutting or piercing, explosion, etc. These injuries are mostly less dramatic and have shown less change over time (Honkanen 1993). It can be assumed that young males have a reasonably high risk for these types of injuries, due to their exposure and seemingly high rates of participation in leisure activities, etc.

Alcohol involvement

Little information is available on the role that alcohol plays in these injuries, especially in regard to young males. One thing that is obvious is the greater variability in alcohol involvement. In a review of ED studies (Honkanen 1993) it was indicated that 26–54% of fatal home and leisure injury was related to alcohol use.

Comment

This section overlaps with those dealing with transport injury, unpaid work or sports activities, and firearm injury (which is addressed in the section on violence).

2.4 Intentional Injury

2.4.1 Suicide¹³

Introduction

In Australia during 1998, nearly 700 young males committed suicide and about another 3,300 were admitted to hospitals for intentional self-harm. The rate of suicide for young males between 15–24 years has trebled since the early 1960's (Dudley, Kelk et al. 1997). In recent years this rate has not risen further since 1990, but it remains high (Harrison, Moller et al. 1997). It should be noted that the suicide rate for males aged 15–19 years have remained stable, whereas the rate for males aged 20–24 years has increased (Steenkamp and Harrison 2000).

Hanging and shooting are the most common methods of suicide by young males. The rate of suicide by means of hanging has risen greatly, while shooting suicide has declined (Harrison, Moller et al. 1997).

Alcohol involvement

There is a definite association between alcohol and suicide. For example, in a cohort study of 50,465 Swedish men, a BAC of more than 0.10 g/100 ml was reported for 34% of the suicide deaths (Allebeck, Allgulander et al. 1991). A US study on 200 suicides in Alaska between 1983–4 found that 79% of the Indigenous and 48% of the non-Indigenous suicides had detectable BACs (Hlady and Middaugh 1988). Brent, Perper *et al.* (1987) investigated 159 cases of definite suicide and 38 cases of likely suicide deaths in 10–19 year olds over a 24-year period for a county in Pennsylvania, US. They recorded a marked increase in the suicide rate over the study period, particularly among white males aged 15–19 years. Moreover, the proportions of suicides, which had positive BAC levels, rose from 12.9% in 1968–72 to 46% in 1978–83 (Brent, Perper et al. 1987). English, Holman *et al.* (1995) estimated the aetiological fraction for suicide in Australia between 12–15% for young males between 15 and 29 years (Table 2).

Alcohol is also linked to specific mechanisms of suicide. Hlady & Middaugh (1988) indicated that suicide due to firearms was weakly associated with detectable levels of blood alcohol of more than 0.10 g/100ml (OR=1.3; 95% CI: 1.11 – 1.47).

¹³ There is some controversy about the most appropriate term to use in regard to intentionally self-inflicted injury. Numerous terms are applied to suicide and related behaviour. These include 'deliberate self-harm', 'attempted suicide', 'para-suicide', and 'self-destructive behaviour'. Although some progress has been made, there is no standard and well-established nomenclature. For this report, we refer to 'suicide' (i.e. deaths resulting from self-harm) and 'attempted suicide' (i.e. incidents of self-harm that did not result in death).

Alcohol appears to play a definite role in suicidal behaviour and some researchers state that the role is both causal and conductive, i.e. alcohol seems to be a direct contributor to suicide, but it also seems to be an intermediate factor by provided 'dutch courage' (English, Holman et al. 1995); (Miller, Mahler et al. 1991).

Others are of the opinion that there is not enough evidence to support a causal relationship. Powell, Mercy *et al.* (1998) reported on a population-based case-control study of near-miss suicide attempts among people 13–34 years in Houston between 1992 and 1995 attending Level I and II trauma centres. They found that acute ingestion of alcohol appears to increase the risk of near-miss suicide attempts for both dependent drinkers and non-dependent drinkers: crude odds ratio = 8.99 (95CI: 5.07; 15.93). When stratified by alcoholism status, the odds ratio was 7.5 (95CI: 2.88; 19.55) for non-dependent drinkers and 13.60 (95CI: 5.28; 35.06) for dependent drinkers.

It appears that on the one hand alcohol assists in making the decision to commit suicide and the act of doing it (Commonwealth Department of Human Services and Health 1995). Hawton *et al.* (1989), in a study on attempted suicide patients referred to a general hospital over 10 years, found that alcohol consumption shortly before a suicide attempt and as part of the act was extremely common, especially among alcohol dependants. In addition to increasing the risk of an attempt, alcohol may add considerably to the danger of overdoses (Hawton, Fagg et al. 1989).

It may also be that alcohol can cause suicide, especially in respect to chronic harmful use. This may largely be because alcohol, which is a depressant, can induce a depression that is similar to depressions from other causes. Alcohol can sometimes produce a depression during intoxication (Miller, Mahler et al. 1991). Moreover, chronic use of large volumes of alcohol¹⁴ seems play a primary causative role in the emergence of suicidal thinking and actions (Miller, Mahler et al. 1991). For chronic drinkers of high amounts of alcohol, alcohol has particular pharmacological effects that impair judgement and cognition, as well as severely depress mood. This, at least in part, seems to bring about suicidal thinking and behaviour. The subjective state of hopelessness also seems to be a key factor in committing suicide and alcohol appears to be influential in providing a feeling of hopelessness because of its toxic effects (Miller, Mahler et al. 1991). Moreover, interpersonal relationships and social supports are often disrupted because of chronic alcohol use and this can add to the feelings of hopelessness and can contribute to the development of suicidal impulses (Miller, Mahler et al. 1991). Also, persons dependent on alcohol may often have co-morbid psychiatric disorders that are also significant risk factors for suicide (Miller, Mahler et al. 1991).

Suicidal behaviour, including completed suicides, is highly prevalent among persons dependent on alcohol. This statement is derived from various studies of

¹⁴ The association between alcohol and suicide is also relevant for other drugs, but in this report we only refer to alcohol.

both adult and adolescent populations of alcohol dependents (Miller, Mahler et al. 1991). In their review, English, Holman *et al.* (1995) stated that 84% of 'addicts who commit suicide are both dependent on alcohol and drugs'. They also indicated that the mean number of drugs used among those who committed suicide was 3.6 and that the most commonly detected drugs were alcohol, opiates, sedatives, amphetamines, cocaine and marijuana (English, Holman *et al.* 1995). A number of studies in San Diego, US, found, in a general survey of hospital admissions, that 58% of suicides were associated with drug and alcohol dependence (Miller, Mahler et al. 1991). Moreover, studies among alcohol and drug dependents found that at least 25% of such dependents succeed in committing suicide (Miller, Mahler et al. 1991). Another study has indicated a lifetime prevalence of 18% for suicide among persons dependent on alcohol and drugs in the general population (Miller, Mahler et al. 1991).

It also appears as if as many as 70% of adolescent suicides are associated with alcohol or drug problems (Miller, Mahler et al. 1991). In a recent review of the literature it was reported that there is a definite link between substance abuse disorders and suicide (Beautrais 1999). Four studies that examined the link between substance use disorders and suicide in young people found that odds ratio estimates ranged from 3.3 to 10.7 (median 5.5) (Beautrais 1999).

2.4.2 Interpersonal violence

Introduction

It is well known that young males in the US experience high rates of interpersonal violence. For example, in 1995 homicide rates for American young males between 15 and 29 years were more than 25 per 100,000 population in 1995 (Dahlberg 1998). Similar Australian rates for young males are much lower. In 1998 the young male death rate due to violence was 2.8 per 100,000 population and interpersonal violence resulted in about 10% of hospitalisations in young Australian males in 1997/98. The death rate overall has shown a 25% increase over the last 18 years, but the increase was largest for the 25–29 year age group, slightly lower for 15–19 year olds and actually decreased for the 20–24 year old males. In regard to mechanism, death rates due to injuries resulting from unarmed fighting, as well as those due to firearms have decreased for all three age groups. However, for the 15–19 and 25–29 year olds rates due to cutting or stabbing have doubled.

Despite the data on deaths and hospitalisations due to violence, the current level of knowledge about the incidence and prevalence of violence in Australia is fragmentary and inadequate (Keys Young 1994).

Alcohol involvement

Alcohol is an important risk factor for violence (Rivara, Mueller et al. 1997), but the relationship between alcohol use and violence is very complex (Keys Young 1994).

Studies on both populations and individuals, as well as research on drinking contexts have lent support to the finding that alcohol use is predictive of aggression and violence (Victorian Community Council Against Violence 1998).

Borges, Cherpitel *et al.* (1998) conducted an American case-control study on 445 males attending an ED because of an assault injury, as well as 320 controls attending because of work-related injury, animal bites or recreational incidents (excluding near-drowning). They found that drinking prior to the event, as well as usual drinking patterns or drinking problems were predictive of violence-related injury. The study indicated that those persons who reported that they had consumed more than 0.10 g /100ml alcohol in the six hours prior to the injury event were 30 times more likely to have sustained violence-related injury. Those with positive BrACs were 10 times more likely to have sustained violence-related injury (Borges, Cherpitel *et al.* 1998). They also found that alcohol consumption prior to the injury was a more important risk factor than usual drinking for violence-related injuries, but that the quantity of usual alcohol consumption was more predictive of violence-related injury than frequency of drinking (Borges, Cherpitel *et al.* 1998).

Cherpitel (1994) reviewed eleven cross-sectional studies from over the world. She found that alcohol-relatedness (as measured by breath or blood alcohol levels) for assault injury attended to in EDs ranged between 17–64%, whereas the range for non-violent injuries was 7–32%. Substantial proportions of the violence cases (0–50%, mean=28%) had levels of more than 0.05 g/100ml (for non-violence injury the range was 2–18%) (Cherpitel 1994). An Israeli study on fatalities showed that 12% of violence cases screened positive for BACs (Hadidi, Battah *et al.* 1998). Also, 55% of them had BACs of more than 0.05 g/100ml.

In Australia, more is known about the role of alcohol in homicides than in other types of violence, even though the most reliable source of deaths data, i.e. the Australian Bureau of Statistics' national mortality database, do not include any data on alcohol use. A review of seven Australian studies on alcohol use and homicide reported that between 16–70% of homicide victims had used alcohol at the time of the offence (Keys Young 1994). The same review found that 30–86% of alcohol use among homicide offenders at the time of the offence. However, these figures should be treated with caution as there were great variations in regard to the years studied, geographical coverage, data sources, and alcohol indicators (Keys Young 1994). The association between violence and alcohol clearly holds for young males. For example, in a US study on adolescents attending a trauma centre, it was found that alcohol was present in 25% of violence-related injuries in young males (Spain, Boaz *et al.* 1997).

Violence in licensed drinking venues has received much attention in recent years and is particularly relevant to young males. No national collection of data on this type of violence exists, but a number of recent studies attempt to examine the issue. Much of this research does not rely on official statistics and provides a refreshing perspective on violence and alcohol use.

An analysis of nearly 1,600 crime reports of serious assaults for the period March 1987 to March 1989 showed that one in five of the total reported serious assaults occurred in or around licensed premises. Incidents peaked in number between 22:00 and 03:00 and 25% of the reported assaults involved bouncers as either perpetrators or victims (Keys Young 1994). A study by Homel, Tomsen *et al.* 1992 reported on 300 hours of unstructured observation in 23 licensed premises in Sydney. They investigated aspects of management, security staff, patrons and environment in a qualitative manner (Homel, Tomsen *et al.* 1992). They concluded:

‘Violent incidents in public drinking locations do not occur simply because of the presence of young or rough patrons or because of rock bands, or any other single variable. Violent occasions are characterised by subtle interactions of several variables. Chief among these are groups of male strangers, low comfort, high boredom, high drunkenness, as well as aggressive and unreasonable bouncers and floor staff.’ (Homel, Tomsen *et al.* 1992:688)

It should be pointed out that young people may be both perpetrators and victims of violence (Victorian Community Council Against Violence 1998) and that alcohol involvement has been reported for assailants as well (Dahlberg 1998). It does appear as if the victims and perpetrators of violence share many characteristics (Victorian Community Council Against Violence 1998). These include being a young male, unemployed, having a low socioeconomic status and self-esteem, as well as feeling bored. A US case-control study also indicated that non-drinkers living in a home with alcohol users seemed to be at increased risk of homicide (Rivara, Mueller *et al.* 1997).

The relationship between violence and alcohol is very complex and it is unclear whether alcohol plays a causative role. English, Holman *et al.* (1995) estimate the aetiological factor of alcohol in violence at 44% for Australia. This is similar to an ecological study in Sweden. Here the authors found a statistically significant association between the assault rate (as measured from police statistics) and a combined measure of on-premise sales of beer and spirits. The attributable fraction was estimated at about 40%. The authors also found that the homicide rate was significantly linked with retail sales of spirits and here the attributable fraction corresponded to 50% (Norstrom 1998). It is, however, clear that violence is not merely a direct pharmacological consequence of alcohol, but that it is also influenced by other factors such as the social context of male group drinking and the achievement of masculine identity (Victorian Community Council Against Violence 1998).

The relationship between alcohol and violence is further teased out by Dahlberg’s analysis of substance abuse. She states that demographic patterns for youth violence do not match those for substance abuse. A recent review on the role of alcohol in violence indicated that aggressive behaviour has an earlier onset than substance use and also tends to decline before drug use does (Dahlberg 1998). Also, males tend to use substances more than females, but this difference is relatively small when compared with the difference in rates of violence victimisation and perpetration between the two genders (Dahlberg 1998). African-Americans also have much higher rates than their white peers,

but they have much lower rates of substance use (Dahlberg 1998). It does appear as if those factors that predispose young persons towards the perpetration of violence may also put them at risk for becoming victims of violence (Dahlberg 1998). Obviously, alcohol is one such factor.

It has been suggested that the relationship between violence, alcohol and other drugs will become clearer if various consequences are separated out, i.e. the influence of substances on behaviour (the psychopharmacological effects), the economic effects (e.g. violence committed to obtain money to purchase drugs), and systemic consequences (i.e. violence arising from the sale and distribution of drugs) (Dahlberg 1998). Osgood (1995), as quoted in Dahlberg 1998, reviewed the research on each of these and indicated a moderately strong relationship between violence and substance abuse. However, it seems as if this association has more to do with shared influence on a range of deviant behaviour than with any causal relationship between the two (Osgood 1995) as reported in Dahlberg 1998). The small number of longitudinal studies investigating the link between violence and substance abuse have also failed to support a causal association between the two (Dahlberg 1998).

In general the literature does not provide strong support for a unique association between alcohol use and aggressive behaviour during adolescence (Rivara, Mueller et al. 1997). The observed relationship between alcohol consumption and aggression seems to be spurious because both behaviours are predicted by a similar set of individual, family, and environmental factors (White 1997). It would also be incorrect to assume that violence is simply 'alcohol-related'. Although some violence does involve alcohol, much violence has no involvement in alcohol (Keys Young 1994).

Comments

Research has indicated that there are various factors that place young people at risk for violence. These include *individual* factors (e.g. a history of early aggression, beliefs supportive of violence); *family* factors (problematic parental behaviour, low emotional attachments to parents); *peer or school* factors (including negative peer influences, academic failure, and low commitment to school); and *environmental or neighbourhood* factors (e.g. high concentrations of poor residents, high levels of transiency, low community participation and access to firearms) (Dahlberg 1998).

Crime victim surveys and recent Australian data on homicides also highlight particular environmental or situational factors that play a role in interpersonal violence, especially for young people. In general, those who go out for entertainment at night, particularly to hotels and clubs, have a higher than average risk of being assaulted (Hauritz, Homel et al. 1998). This also applies to teenagers. Studies have indicated that about half of male and female victims were assaulted in places they go to regularly (i.e. away from a home environment) which provide leisure facilities or entertainment. Many of these are licensed venues (Hauritz, Homel et al. 1998). Males with an active nightlife are more likely to witness and participate in violent encounters (Felson 1997)

3 Reducing ARI in young males

It is clear that alcohol plays a significant role in injuries to young males. It is, therefore, very useful to examine what is known about the prevention of ARI, in order to establish practical strategies for young males.

In the following sections, we discuss the current state of knowledge of effective interventions regarding ARI. The first part of this chapter follows the pattern of Chapter 2 and highlights the extensive literature on preventing alcohol-related traffic injury. Information on the prevention of other causes of ARI is more limited. Therefore, the section following the one dealing with alcohol-related traffic injury takes a different approach. That is, subsections are not defined according to causes of ARI, but according to different strategies to prevent ARI, such as alcohol availability, responsible beverage serving, environmental changes, community-based action projects, mass media strategies, and brief interventions. There is also a large body of evidence regarding the prevention of other health risks, such as unsafe sexual practices. Section 3.3 deals with the literature in this regard.

3.1 Addressing alcohol-related traffic injuries

3.1.1 Drinking and driving

In Australia, as in many other countries, the traditional approach to this problem has been to place emphasis on individual road users to separate drinking and driving activities (Zaal 1994). The aim of this strategy is to deter road users from driving with BACs exceeding the legal driving limit by modifying their behaviour through education or persuasion. This approach is, however, backed up by a law enforcement system of apprehension and punishment (Zaal 1994).

Evidence shows that there has been a decline in alcohol-related motor vehicle crashes in Australia (Vulcan 1995). For example, in Victoria, there has been a progressive drop in the percentage of drivers and motorcyclists killed with BACs exceeding the legal driving limit of 0.05 g/100ml. The rate in Victoria has dropped from 49% in 1977 to below 30% in recent times (Vulcan 1995). In New South Wales, random breath testing (RBT) operations (introduced in December 1982) coincided with a reduction of 36% in alcohol-related fatalities (Homel 1988). This evidence also indicated that long-term and sustained reductions in drink-driving behaviour may be possible (Zaal 1994).

It seems that elements that contribute significantly to the success of random screening strategies are:

- high levels of exposure to random screening (e.g. in the NSW RBT program at least one random test was carried out for every three licensed drivers (Zaal 1994)). Also, Victoria increased the number of RBT checkpoints from about 19,000 in 1978 to more than 1.5 million in 1993 before it seemed to have had an effect (Vulcan 1995);
- highly visible policing activities, that are unpredictable and difficult to evade, thus increasing the perceived probability of apprehension (Zaal 1994);
- increased penalties, such as fines and a doubling in the period of mandatory license cancellation for exceeding various BACs such as those introduced in Victoria in 1978 (Vulcan 1995);
- extensive formal and informal publicity focussed specifically on random screening and the probability of detection (Zaal 1994);
- significant increases in anti-drink driving publicity (Vulcan 1995);
- the promotion of alternative strategies to drink-driving (Vulcan 1995), e.g. appointing a designated driver for the evening, etc; and
- the introduction and promotion of low alcohol beer as in Victoria in 1979, followed by lower licensing fees and reduced excise duty (Vulcan 1995).

Random screening

Random screening refers to two types of screening, i.e. random breath testing (RBT) and having sobriety checkpoints. RBT refers to a process where cars are stopped at checkpoints or by roving units, and, a breath alcohol test is administered, regardless of any suspicion of alcohol consumption. This type of screening is done in Australia. Sobriety checkpoints (used in *inter alia* the US) stop cars randomly, and breath alcohol tests are administered only if alcohol use is suspected through odour, actions, presence of containers, or other means.

A systematic review of 14 American and Australian studies indicated that random screening effectively reduces fatalities and injuries (Peek-Asa 1999). Although such decreases in the studies reviewed by Peek-Asa (1999) varied widely, they did not depend on the size of the population. The greatest decreases (ranging from 8–71%) were found for alcohol-related *fatalities*. Multivariate analyses in these studies also indicated that random screening significantly reduced *crashes* and *injuries*. There were limitations to the reviewed studies, such as the difficulty in determining alcohol involvement, the inability to control for the presence of other drink-driving reduction programs and the fact that most of the evidence was ecologic in nature. However, Peek-Asa (1999) concluded that random screening seems to be effective in a wide range of both American and Australian populations.

Few cost-benefit studies of RBT have been conducted, but those that have been done on the cost of implementing RBT indicated that the costs of such a strategy are not prohibitive and that the costs were offset by reductions in crashes and injuries (Peek-Asa 1999). Vulcan (1995) also stated that it was estimated that the cost savings represented by the reduction in crashes were about 12 times greater than the costs of the RBT operations, including subsequent legal actions. In NSW, it was estimated that the cost-benefit ratio of the RBT Program for 1990 was more than 1:50 (Zaal 1994).

Police commitment and activity are essential to the continued success of RBT (Zaal 1994). However, there may be some challenges in sustaining the results of RBT in the future because:

- police resources are currently strained;
- RBT procedures can be very boring and offer little immediate reinforcement for the police officers as low numbers of offenders are usually apprehended (Zaal 1994);
- researchers seem unable to convey the message of the deterrence value of RBT strategies to authorities (Zaal 1994); and
- there are questions about the level of enforcement necessary, and whether the public will become desensitised.

Mass media

Another important issue in drink-driving strategies is the level and type of publicity related to RBT strategies. Mass media seems to have become the main channel for influencing knowledge, attitude and behaviours of the modern society. Yet, firm and detailed about the benefits or detrimental effects that mass media may have is still limited (Wilde 1993).

It is evident that mass publicity plays an important role in increasing the effectiveness of drink-driving countermeasures (Zaal 1994). An evaluation of television advertising about road safety in Victoria found that there were clear links between levels of advertising supporting the speed and alcohol enforcement programs and reductions in casualty crashes when other confounders are taken into account (Cameron, Haworth et al. 1993). Effects of advertising with themes not related to enforcement (e.g. Concentration) were less clear (Cameron, Haworth et al. 1993).

The primary functions of drink-driving publicity is to introduce information, raise community awareness, set drink-driving agendas and increase the perception that the risk of detection is great (Homel 1988). The increase in risk perception in turn contributes to the process of creating a deterrence effect (Zaal 1994).

Mass publicity may alone be able to bring about changes in drink-driving behaviour (Zaal 1994), but it seems to be most successful when used in association with legislation and enforcement. It has been shown that publicity

does bring about initial changes, but these are not sustained if they are not supported by visible enforcement (Zaal 1994).

It also appears as if the content of the publicity also plays a role. Homel (1988) indicated that there is some evidence that publicity which emphasises the social harm caused by drink-driving or the moral culpability of the offender may at best be ineffective and at worse harmful. This may be because such publicity fails to reinforce the deterrent impact of RBT, but also because drink-drivers know from their own experience, as well as from those of friends and the wider society, that their behaviour is neither particularly dangerous nor immoral (Zaal 1994).

Laws for younger/inexperienced drivers

One specific measure to reduce ARI in young or inexperienced drivers is to set very low BAC limits for driving in young or novice drivers. This is based on the assumption that alcohol is an additional risk factor to inexperience and age that already dispose novice riders to greater risk. In Australia most States and Territories have legislated for a nominal zero BAC limit for young drivers during their first year after obtaining a driver's license (Zaal 1994).

A recent review of six studies that investigated whether low BAC laws for younger drivers reduce traffic injuries indicated that all of them showed a reduction in injuries or crashes after the implementation of such laws (Zwerling and Jones 1999). However, for three studies the reductions were not statistically significant. The studies had several limitations in that the data were ecologic, but even so, the six studies represent accumulating evidence in support of the effectiveness of these laws (Zwerling and Jones 1999). The evidence is also strengthened because reductions were found in different countries (i.e. in Australia and the US); when different laws were used (e.g. some were aimed at young drivers while others focussed on inexperienced drivers); when different outcome variables (fatalities, injuries, and crashes) were studied, and even when different research methodologies (e.g. interrupted time series and pre- and post-studies) were employed (Zwerling and Jones 1999). Also, the largest American study showed a 'dose-response' effect, in that laws with lower BAC limits resulted in greater casualty reductions (Zwerling and Jones 1999).

Attempts to reduce the crash risk to young drivers to acceptable levels necessarily rely on identifying factors that make a large contribution to that risk. A variety of factors may contribute to this high-risk level, the most obvious is lack of driving experience. Research in Victoria (Catchpole, Macdonald et al. 1994) has shown that the rate of casualty crash involvement per distance driven decreases steadily with increasing driving experience. One hypothesis is that younger drivers drive more and therefore are more involved in crashes. However, studies have shown that this is not the case, in fact younger drivers tend to drive shorter distances per annum than drivers in middle age (Catchpole, Macdonald et al. 1994).

Another measure to reduce alcohol-related crashes is the use of graduated licenses. This entails a range of restrictions (e.g. number of passengers,

nighttime curfews, etc.) so that novice driving occurs in less dangerous circumstances until the young driver has had the opportunity to gain experience. Graduated license strategies are in place in most Australian States and Territories, as well as in New Zealand. Evaluation of this program in New Zealand has indicated that it is effective in reducing the number of crashes involving younger drivers (Zaal 1994).

Other strategies to reduce drink-driving

Other specific countermeasures may contribute to decreasing the problem even further. Although RBT strategies have been effective in reducing alcohol-related traffic crashes, there appears to be a problem in regard to recidivist drink-drivers.

Several strategies are proposed to deal with recidivist drink-drive offenders. These include behaviour control through education, enforcement and technology, such as interlocks, as well as separating the offender from his vehicle when behaviour approaches have proved ineffective.

One specific measure to address the problem is the implementation of administrative per se laws, i.e. legislation that enables the suspension of the right to drive as a penalty for drink-driving whether or not the defendant was found to be guilty or innocent of other offences (McArthur and Kraus 1999). In the US, a study indicated that one state experienced a 33% reduction over three years in repeat drink-driving arrests among those arrested under administrative per se laws, relative to recidivism seen in a comparison cohort of drivers prior to administrative per se laws (McArthur and Kraus 1999). However, two other states did not show any change. Another study indicated that drivers who had licenses suspended under administrative per se laws were nearly 40% less likely to be rearrested on the charge of drink-driving during the first year following suspension, compared with a control cohort (McArthur and Kraus 1999). This differential persisted into the second year of follow-up, but disappeared by the third year. A third study found that both first and repeat offenders arrested under the administrative per se laws were 34% less likely to be involved in a subsequent motor vehicle crashes during the year following their arrest, compared with those in the comparison cohort (McArthur and Kraus 1999). Also, drivers with administrative per se suspensions were 21% less likely to be involved in additional drink-driving offences and 27% less likely to be involved in reckless driving offences related to alcohol (McArthur and Kraus 1999). Although it does appear as if administrative per se laws have an effect, more evidence is clearly needed.

Another strategy employed in preventing recidivist drivers from offending is to install ignition interlock devices for convicted drink-driving offenders. Many states in America have passed legislation authorising the use of such devices.

A review of six eligible studies found that five studies indicated that interlocks were effective in reducing drink-driving recidivism while the interlock was installed in the vehicle (Coben and Larkin 1999). In these studies participants in the interlock programs were 15–69% less likely than controls to be re-arrested

for drink-driving (Coben and Larkin 1999). The only reported randomised control trial included in the review found a 65% reduction in re-arrests compared with controls. Interlocks are currently being trialed in Australia, but no findings are available yet.

3.1.2 Preventing other types of alcohol-related traffic problems

Most attention in preventing alcohol-related crashes has focussed on drivers of motor vehicles. However, it is necessary to consider alcohol-related problems in regard to other road users.

Motorcycle crashes

Prevention of motorcycle crashes in general concerns two aspects, i.e. interventions to reduce the risk of an injury occurring and countermeasures to reduce the severity of injury when a crash does occur. Interventions to prevent an injury from occurring include: improving conspicuity, training of riders, awareness training for drivers of other vehicles, restrictions on carriage of pillion passengers, improvements to riders field of view, engine capacity and power restrictions, and modifications of the road environment. Measures such as helmets, protective clothing, lower limb protection and airbags may reduce the severity of injury.

Measures to reduce alcohol-related motorcycle crashes should incorporate the strategies mentioned above, while also including other strategies. These relate mostly to RBT for motorcyclists as part of random screening for all vehicles. There are, unfortunately, few alcohol specific strategies for motorcyclists. Most of the existing measures have been designed for motor vehicle drivers. Interventions such as the designated driver programs are less applicable to motorcyclists. Motorcycle training programs include information about the risks of drink-driving, but many motorcycle drivers do not participate in these programs, e.g. in a longitudinal New Zealand study, it was found that only 36% of 217 motorcyclists aged 18 years had licenses (Reeder, Chalmers et al. 1995). Also, these programs occur mostly during licensing and, therefore, do not provide repeated messages that are essential to modify behaviour.

Another promising intervention is the lowering of legal alcohol levels for motorcycle operators (Colburn, Meyer et al. 1993). As stated above, many Australian states have introduced zero BACs for novice drivers, but these apply to motorcyclists as well. It has been calculated that a successful implementation of this measure would result in a probable benefit:cost ratio of 3:1 (Torpey, Ogden et al. 1991).

Other measures to reduce the role of alcohol in motorcycle crashes include identifying, treating and rehabilitating hard-core drinkers; introducing alcohol interlocks for all motorcycles, especially for multiple drink-riding offenders; and general anti-drink driving and drug publicity campaigns aimed specifically at motorcyclists.

Pedestrian injuries

There are few existing pedestrian safety strategies that clearly stand out as successful. While there has been progress in reducing serious pedestrian crashes since 1990, these reductions seem to have resulted from the general reduction in serious crashes, mostly due to drink-driving and speed reduction initiatives, rather than from programs specifically targeted at pedestrians (Corben and Diamantopoulou 1996). As a matter of fact, the role of alcohol in pedestrian crashes has largely been ignored and the lack of relevant data may have contributed to this (Corben and Diamantopoulou 1996).

Corben *et al.*, 1996 have suggested a wide range of potential countermeasures to reduce alcohol-related pedestrian crashes. These include measures to reduce the incidence and degree of intoxication in pedestrians by working with key elements of the liquor industry; responsible serving practices; installing coin-in-the-slot breath testing machines; working with selected welfare agencies which are situated in high risk locations (e.g. issuing reflective clothing). Others include:

- Developing and implementing local and mass media campaigns aimed at pedestrians.
- Countermeasures to reduce the exposure of intoxicated pedestrians to arterial road traffic.
- Strategies to increase the likelihood of safe driver responses to high-risk circumstances, such as providing above-standard street lighting and above-standard skid resistant pavement surfaces.
- Undertaking police enforcement of safe pedestrian and driver behaviour during high-risk times of day and days of the week.
- Measures to encourage greater pedestrian use of signals.
- Measures to increase the likelihood of safe driver responses at and near intersection signals.
- Measures to simplify the road-crossing task for intoxicated pedestrians, e.g. providing highly responsive pedestrian-operated signals, providing well-maintained lane line markings.

3.2 Other approaches to reduce ARI

There are other recent trends in the public health approach to reduce alcohol-related harm, these include:

- Making alcohol less available;
- Responsible service of alcohol strategies;
- Environmental or situational changes;
- Community-based action projects (which may include targeting of licensed premises and addressing alcohol availability); and
- Minimal, early or brief interventions; .

3.2.1 Making alcohol less available

This comprises three types of alcohol availability. **Retail availability** refers to general retail availability of alcohol both for on and off-premise consumption. This is done by regulating the types of beverages sold, setting a minimum age for purchasing alcohol and by addressing the density of alcohol outlets (Holder 1993). **Economic availability** forms part of retail availability but is related to the regulation of the price of alcohol relative to income and other goods (Holder 1993). **Social availability** refers to access to alcohol through other means than formal retail sales. These include parties, friends, social acquaintances, as well as parents and friends of underage drinkers.

There is evidence that assaultive violence is associated with alcohol outlet density, but little inference can be drawn as to the direction of this relationship. Scribner, *et al.* (1995) assessed the geographic association between city-specific rates of assaultive violence and alcohol-outlet density in 74 larger cities in Los Angeles. They indicated that higher levels of alcohol-outlet density were associated with higher rates of assaultive violence and this finding was independent of the effect of a number of potential confounders (Scribner, MacKinnon *et al.* 1995). However, a replication of this ecological study by Gorman *et al.* (1998) in New Jersey indicated the opposite. They found that alcohol-outlet density was not geographically associated with rates of assault (Gorman, Labouvie *et al.* 1998). The evidence, therefore, remains equivocal and it should be kept in mind that ecological studies are not suited to test hypotheses. Even so, public health officials are prompted to recommend that localities use measures that address the physical availability of alcohol to reduce alcohol-related problems.

Other studies that investigated alcohol availability in Indigenous and isolated communities, such as in Alaska, shed further light on the topic. Such studies have indicated that measures limiting access to alcohol, e.g. local alcohol prohibition in certain communities or limiting serving hours, may decrease alcohol-related injury deaths. For example, local prohibition has been used in

approximately half the villages in remote Alaska to reduce alcohol availability (Landen, Beller et al. 1997). From studies of Indian reservations in several western states in the US, the relationship remains unclear.

One study that did throw some light on the issue was done in Barrow, Alaska (Chiu, Perez et al. 1997). Here an isolated community underwent a 33-month period where possession and importation of alcohol were legal for some time, followed by a period where alcohol was completely banned, then made legal again and then banned again. A retrospective review of outpatient records over the entire period was done to determine whether the policy changes had any impact on alcohol-related outpatient visits at the area hospital (Chiu, Perez et al. 1997).

The authors found a substantial decrease in the number of alcohol-related outpatient visits when the ban was imposed compared to baseline. When the ban was lifted, outpatient visits increased. When the ban was reimposed the number of outpatient visits again decreased. An interrupted time-series analysis indicated that the alcohol ban, its lifting and its reinstatement had a statistically significant and negative effect on the number of outpatient visits ($P < .05$) (Chiu, Perez et al. 1997). The authors concluded that in a geographically isolated community, the prohibition of alcohol can be an effective public health intervention (Chiu, Perez et al. 1997). Landen et al (1997) looked at the association between injury death, particularly alcohol-related death and alcohol availability in remote Alaska. This survey of using death certificate data and medical examiner records investigated mortality rates for total injury and ARI during 1990–1993 among Alaskans aged 15 years and older. A comparison was done between ‘wet’ villages (i.e. those without restrictive alcohol laws) and ‘dry’ villages (i.e. those with laws that prohibited the sale and importation of alcohol) (Landen, Beller et al. 1997). Although insufficient data existed to adjust for the effects of all potential confounders, residence in a ‘wet’ village was associated with ARI among Alaska Native residents of remote villages (Landen, Beller et al. 1997). These findings indicate that measures limiting access to alcoholic beverages in this region may decrease ARI deaths. However, prohibition of alcohol may be an unacceptable approach for some communities. Moreover, the introduction of such a strategy, if acceptable to a community, should be done with careful planning and consultation. A strategy of prohibition may have unintended negative outcomes or may increase harm in others (Gordis 1997). For example, people may drive long distances to other communities, drink there and then drink-drive, which may lead to increased rates of traffic-related injuries. Another outcome may be that alcohol was being smuggled into communities and sold at high prices, which may have an impact on other areas of health.

The social and subjective perception of availability of alcohol have found to be related to drinking patterns among adults and adolescents (Abbey, Scott et al. 1993) quoted in (Holder, Slatz et al. 1997) and clearly is more difficult to control.

3.2.2 Responsible beverage serving strategies

Responsible beverage service approaches aims to reduce the likelihood of customer intoxication at licensed establishments by responsible serving of beverages, as well as by preventing already intoxicated patrons from driving or engaging in other risky behaviour while impaired (Holder 1993). This is one of the most common ways aimed at reducing the alcohol-related harm in licensed premises and usually focuses on changing the set of serving practices among alcohol licensees within a community with an emphasis on the managers' responsibility. Other targets may include professional hospitality associations and beverage wholesalers.

However, research suggests that while such programs are of importance, especially if they are combined with external enforcement (Putnam, Rockett et al. 1993), regulations of alcohol-related disorder must utilise other strategies as well, including the introduction of procedures that empower stakeholders to resolve problems with licensed establishments (Gilling 1993); (Lakeland and Durham 1993) both quoted in (Hauritz, Homel et al. 1998). These additional strategies are of particular importance because civil law suits are very seldom used against licensees, thus removing one of the major incentives for licensees to introduce server training programs, and because liquor licensing laws are not very effectively enforced on a routine basis (Homel and Tomsen 1991).

3.2.3 Environmental/situational changes

Crime victim survey data, as well as recent data on homicide, highlight the importance of environmental or situational factors as risk factors, especially for young people. In general, those who go out for entertainment at night, particularly to hotels and clubs, have a higher than average risk of assault. The same pattern applies to teenagers, about half of male and female victims are assaulted in places they go to regularly (away from a home environment) which provide leisure facilities or entertainment. Many of these are licensed venues.

Environmental changes seem to be a useful strategy for reversing the trend towards higher rates of violence. The aim is to increase the safety of leisure and entertainment venues, such as hotels and nightclubs, especially for young patrons. There is a range of features of physical and social environments of bars that may help to reduce rates of aggression or limit the harm caused by aggressive incidents. These include having attractive, nicely furnished, well-maintained bars that provide comfortable uncrowded surroundings that promote enjoyment and reduce irritability in patrons; creating a social atmosphere with clear social rules and practices that discourage drinking to intoxication, as well as foster a positive social atmosphere; and employing of trained, peace-loving barworkers and security staff (Hauritz, Homel et al. 1998).

These strategies are important, but apparently not enough to sustain change in the long run. Such strategies are often most useful when they are employed in combination with other countermeasures.

3.2.4 Community-based action projects

Most knowledge of community-based public health interventions derives from programs to reduce high-risk medical conditions. A number of community trials aimed at the prevention of alcohol problems have been done (Holder 1993) and there is an increasing amount of evidence from community trials aimed specifically at reducing ARI. However, the number of such studies that have been evaluated thoroughly is still limited, and so far the results are mixed (Holder 1993).

Many of the earlier community prevention programs emphasised knowledge about alcohol, as well as attitudes and values about drinking and self-reported drinking. These projects often focussed on drinking initiation (particularly by teenagers) and drinking in general, and did not pay much attention to alcohol-related injury (Caswell 1995). Other community trials were aimed to make structural or environmental changes.

Most community trials approach the problem of ARI from various fronts and seem to incorporate at least two or more countermeasures. These often include addressing drink-driving, mass publicity, responsible beverage serving strategies and addressing underage drinking (Table 3). Underage drinking strategies mostly focuses on reducing sales and access to alcohol as a means to decrease adolescent drinking. This is achieved through enforcement of underage alcohol sales laws, training of off-sales clerks, owners and managers, and media advocacy. However, although underage drinking strategies may reduce drinking on licensed premises, they may also contribute to young people drinking in more hazardous places and this may increase injury risk.

With the exception of a few studies, community-based alcohol prevention projects to date have not produced reductions in community aggregate indicators of alcohol-related injury. The more effective trials seem to be those that employ a comprehensive approach. That is, more than one approach is used in such ways that they support each other.

The model of the community change process roughly parallels behaviour change techniques at the individual level. There seems to be certain antecedent conditions, such as a political environment emphasising deregulation of liquor licensing. These conditions lead to problem behaviours, such as cutthroat competition between venues and irresponsible drinks promotions. These conditions and problems create a climate conducive to community mobilisation and to the development, in collaboration with the community, of a range of intervention strategies at each of the three levels of regulation. (Hauritz, Homel et al. 1998)

These interventions produce outcomes, such as reduced violence that can be reinforced if key players and organisations are rewarded through career enhancement or positive publicity. The reinforcers of positive change are more likely to have a continuing effect if key reforms are institutionalised through legislation or community-based monitoring systems.

A guiding philosophy is to be situationally specific in the analysis of problems and the development of interventions, particularly at the level of venues.

Table 10 : Summary of community trials to reduce alcohol-related problems

Where	No. of communities	Description of project	Findings of evaluation
San Francisco (Wallack 1984-85)	1	Researchers worked with representatives of local agencies and interest groups to increase community leader's awareness of alcohol problems. Workshops were conducted to raise concern about alcohol problems and to develop a detailed plan of action. These efforts, which included the establishment of server training and related hospitality standards, resulted in several policy-related changes.	There was no formal evaluation of the effectiveness of the project, but the capacity of such programs to involve key leaders in enacting policy changes was demonstrated.
New Zealand (Casswell and Gilmore 1989)	6, (2 exposed to mass media and community organisation, 2 exposed to the mass media only, 2 controls.	In the mid-1980s a project was initiated and this involved both mass media and community organisation to support alcohol policy changes. The media part of the project made use of 'social marketing approaches', i.e. traditional persuasion techniques, but also addressed policy changes to a small degree. The other component focussed on community organisation in regard to alcohol availability and advertising, as well as related alcohol policy issues.	Evaluation of the project found that mass media and community organisation programs in local communities could be used to increase support for environmentally based interventions.
Woonsocket, Rhode Island (Stout 1992)	3, i.e. Woonsocket and 2 control communities	Was based on the 'Community Gatekeeper Model'. This program used the media and community organisation to influence community gatekeepers (i.e. police and alcohol outlet owners/managers) to adopt specific policies in order to reduce ARI. Two other communities within the state served as controls. A community coordinator mobilised support throughout the broader community, secured the cooperation of community gatekeepers and provided training for the gatekeepers in regard to the effects they could have in reducing ARI. Support and cooperation were elicited from key leaders in the early stages of the project.	Process evaluation indicated that the mobilisation was eventually successful in influencing most establishments to adopt Responsible Beverage Service policies and server training. Also, the project resulted in encouraging local police to establish universal training in recognising intoxicated individuals and to implement RBT, additional radar patrols and selective enforcement patrols. There also seemed to be increased knowledge about ARI and changed attitudes toward enabling drinking, as well as modest effects in lower ED cases (Stout, 1992, 1994).
Massachusetts, US (Hingson, McGovern et al. 1996)	6	A project to reduce alcohol-involved driving crashes and deaths was conducted in six communities. The project called 'Saving Lives' provided a structure for community organisation that enabled private citizens and public officials from various departments to develop their own initiatives. Local news media and purposeful public information campaigns to increase awareness of safety issues and local increased law enforcement efforts to deter drink-driving, as well as driving and speeding. Other efforts included speed watch hotlines, high school peer-led education, alcohol-free youth activities, beer keg registration and licensed liquor outlet surveillance.	Evaluation found that the community interventions produced a 25% reduction in fatal crashes (comparing 5 years before and 5 years of the program) and a 42% decrease in fatal crashes involving alcohol. The proportions of vehicles observed speeding and adolescents who drove after drinking were reduced by 50%.

<p>Minnesota, US (Perry, Williams et al. 1996)</p>	<p>6</p>	<p>The project aimed to prevent or reduce alcohol use among young adolescents by using a multi-level, community-wide approach, which included parent involvement and education programs, behavioural curricula in local schools, peer participation in program planning, implementation and community task force activities. The task force accomplished the passing of five alcohol-related ordinances and three resolutions. This included a requirement for Responsible Beverage Service training to prevent the sale of alcohol to minors and intoxicated patrons.</p>	<p>At the end of three years, students in the intervention school districts reported a lower rate of drinking initiation and a lower prevalence of alcohol use than students from the control districts. The differences were particularly notable among those who were non-users at baseline. The results suggest that multilevel, targeted prevention program for young adolescents are effective in reducing alcohol use.</p>
<p>Lahti, Finland (Holmila 1997); (Holmila and Simpura 1997)</p>	<p>1</p>	<p>The project consisted of multiple prevention components which included the use of local approaches to increase key leader's perception of alcohol as a social problem, the increase of brief interventions in primary health care, the establishment of educational events to raise awareness about heavy drinking, the increase of knowledge about strength of different drinks and level of drunkenness through youth community activities, the education of parents about drinking norms, the provision of counselling for families of alcohol dependent individuals, the surveillance of conduct retail sales, and beverage server training to reduce public violence related to drinking.</p>	<p>The project seemed to have increased local newspaper attention to alcohol issues, public perception of alcohol as a social problem and knowledge of alcohol contents and the limits for risky drinking. There was a decline in self-reported heavy drinking, but this may have been a statistical artefact. Overall, there were no clear changes in drinking patterns or problem drinking that could be attributed to the program.</p>
<p>Surfer's Paradise Safety Action Project, Gold Coast, Australia (Hornel, Hauritz et al. 1997)</p>	<p>1</p>	<p>A community-based initiative designed to reduce violence in and around licensed venues in the central business district of the main tourist area. Key features included channelling funding through local government; creating a representative steering committee and community forum; forming task groups to address safety of public spaces, management of venues, and security policing; encouraging nightclub managers to introduce a Code of Practice regulating serving and security staff, advertising, alcohol use, and entertainment; and regulating managers through risk assessments and through a community-based monitoring committee. Other aspects were: rehabilitating the image of nightclub managers and integrating them into the local business community; using managers committed to the reform process from another city to encourage and bring pressure to bear on local licensees; employing a very skilled Project Officer; and balancing the conflicting political agendas of participating agencies.</p>	<p>The evaluation showed a marked initial impact of the project with dramatic improvements in levels of violence, publicity to patrons about house policies and associated improvements in server practices, the physical environments and security practices. However, there are indications that two years after the project, much of the impact has 'worn off', with levels of aggression and risky drinking practices being approximately at pre-project levels.</p>

<p>Surfer's Paradise Safety Action Replication Projects, (Hauritz, Homel et al. 1998)</p>	<p>3, Cairns, Townsville, Mackay</p>	<p>The project in each community used the original Surfer's Project as a template, with slight differences being applied in each location.</p>	<p>There are many pathways to the same destination, with perhaps some common steps. Essential ingredients for success are the formation of a steering committee; the conduct of a community forum; the employment of a project officer; the formation of task groups; the conduct of a safety audit; and the development of a Code of Practice. It seems as if the safety action model is robust as a technique for reducing alcohol-related crime and violence, though not all the specific techniques used in Surfers Paradise appear to be essential. The model still needs refinement through further research on the situational factors that cause violence, better analysis of the community processes that make for successful implementation, and through improved understanding of what 'responsive regulation' means for the retail alcohol industry.</p>
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3.2.5 Brief interventions

Brief interventions (also called minimal or early interventions) have mainly been used in primary health care settings and involve two broad steps: (1) screening for hazardous or harmful alcohol consumption and (2) the provision of brief counselling, information, advice or referral in order to reduce alcohol-related harm.

Early intervention involves screening to detect and intervene before problems develop. Brief intervention can either form part of mini-treatment conducted over a few sessions, or a brief once-only contact lasting several minutes (Reilly, Van Beurden et al. 1998). There are two types of brief interventions. The first called specialist brief intervention that is provided by specialist services to people seeking help for alcohol problems. Another kind is opportunistic or primary care brief interventions delivered to people at a primary care level who are not seeking help for alcohol problems, e.g. to injured people in an ED. This type of opportunistic intervention can also be used in community settings, e.g. in a study by Reilly, Van Beurden *et al.* (1998) where the intervention took place in licensed venues.

Two major reviews of the literature concluded that brief interventions in clinical settings were effective in reducing alcohol consumption and were more effective than no intervention and as effective as more intensive treatments. A feasibility study describing the use of brief intervention strategies to intervene with at risk drinkers in licensed premises indicated that a program of brief intervention had high acceptance among licensees and their patrons and that patrons who are ready to change their at risk drinking behaviour may benefit from this type of minimal intervention when presented in an interesting way in their drinking environments (Reilly, Van Beurden et al. 1998).

3.3 Evidence regarding risk behaviour

3.3.1 Introduction

Use of alcohol by young people has been linked to a number of other risk behaviours¹⁵, such as smoking tobacco, using other drugs (including anabolic steroids), and engaging in unprotected sex (Hewitt, Elliott et al. 1995) (Stanton, Fang et al. 1997) (Warren, Vanderveen et al. 1997) (Wechsler, Dowdall et al. 1995). Many of these behaviours, like alcohol use, are mostly established during youth, are interrelated, and extend into adulthood (Kann, Kinchen et al. 1998). Resnick *et al.* (1997) states that health risk behaviours and the choices adolescents make are the main threats to their health.

There is an increasing number of studies on intervening in risk behaviour. Some interventions have been shown to be capable of reducing at least some risk factors – even though the effects are often complex.

The following section does not present an extensive review on different risk taking behaviour. It aims to highlight specific research about particular risk behaviours, as well as to identify some interventions that appear useful in addressing these behaviours. This research may provide valuable insight and directions to reduce ARI and it may be that risk of ARI can be reduced by means of such interventions, even though they may not have been designed to achieve that end.

Also, because most of the studies do not focus specifically on males, this section refers to young persons.

3.3.2 Current knowledge about risk behaviour

Much of the current knowledge about the extent of risk behaviour in young persons comes from the US. In particular, a series of Youth Risk Behaviour Surveillance System (YRBSS) surveys, conducted by the CDC at regular intervals, provide valuable information on six categories of priority health risk behaviours. These are: tobacco use; alcohol and other drug use; sexual behaviours that contribute to unintended pregnancy and sexually transmitted diseases; unhealthy dietary behaviours; and physical inactivity.

The 1997 YRBSS survey showed that 36.4% of high school students in the US had smoked cigarettes in the 30 days prior to the survey (Kann, Kinchen et al. 1998). It also appears as if cigarette smoking among US teenagers has

¹⁵ Risk behaviour can be divided into two groups, i.e. conscious and unconscious as young persons may not always be aware of the potential dangers of the behaviours they engage in Hewitt, N., B. Elliott, et al. (1995). A review of risk behaviours among 15-24 year olds. Canberra, Commonwealth Department of Human Services and Health: 183.

increased since 1992, when 19% of high school seniors reported smoking (Resnick, Bearman et al. 1997). In Australia, in 1995, one out of every three persons aged 18–24 years was a current smoker (Australian Bureau of Statistics 1997). Another Australian survey among secondary students, indicated that in 1996, 8% of boys aged 12 were current smokers and that the prevalence rose to a peak of 28% among boys aged 17 years (Hill, White et al. 1999). For currently smoking males aged 17 years, the mean number of cigarettes smoked per week was 37 and for those aged 12 it was 11 per week (Hill, White et al. 1999). Comparisons with previous surveys indicated that fewer 12–15 year olds were current smokers in 1996 than in 1984, but that the proportion was greater than that in 1987 or 1990 (Hill, White et al. 1999). Also, for 16–17 year olds the proportion of current smokers was greater than in the previous two surveys. Hill, White *et al.* (1999) therefore concluded that the decline in prevalence of adolescent smoking seen in the late 1980s had stopped. This is not unique for Australia, as research from the US shows (Resnick, Bearman et al. 1997).

Two Canadian researchers, Thomas and Busby (1998), stated that children begin to think about smoking as early as age 5. Also, by age of the 10 years, 30–50% of children will have experimented at least once with a cigarette (Thomas and Busby 1998). After this age, initiation rates accelerate rapidly and children who begin smoking at age 12 or younger have a higher risk of becoming regular and heavy smokers (Thomas and Busby 1998).

A number of different environmental, sociodemographic, behavioural and personal factors are associated with the onset of smoking. These include low academic achievement, alienation from school, rebelliousness, low self-esteem, 'independent-mindedness', low resistance or poor refusal skills, low self-efficacy, as well as smoking by parents and siblings (Thomas and Busby 1998). Having friends who smoke is also strongly associated with the initiation of smoking, but it is unclear whether this is a cause or effect. A study that formed part of a longitudinal study in Minnesota, US, involving high school students, aimed to identify particular risk and protective factors at school, family and individual levels as they relate to emotional health, violence, substance abuse, and sexuality (Resnick, Bearman et al. 1997). The researchers found that, in regard to smoking, protective family context measures were high levels of connectedness to parents and family members. Frequent parental presence in the home, a greater number of shared activities between parents and young persons, and higher perceived levels of parental expectations related to school completion were also protective, but to a lesser degree (Resnick, Bearman et al. 1997). High self-reported levels of school connectedness was the only school related factor associated with less frequent cigarette use. Several individual characteristics increased the risk of smoking. These were self-reported perception of appearing older than peers and low grade point average, and in older students, working more than 20 hours per week. However, high levels of personal importance placed on religion and prayer and high levels of self-esteem were associated with a decreased risk of smoking (Resnick, Bearman et al. 1997).

Young people's use of substances is of ongoing and growing concern. The use of these drugs is typically initiated in adolescence (Lynskey, White et al. 1999). As noted in section 1.3 in regard to alcohol use, the prevalence of other substances also increases as a cohort ages (Stanton, Fang et al. 1997) and that the patterns of heaviest use occur most often during late adolescence (Lynskey, White et al. 1999). Chen & Kandel (1995) found in a longitudinal study on the natural history of drug use that peak use for cannabis occurs at 18 years of age, whereafter use declines continuously from ages 23–24 years. The usage patterns for other drugs are similar (Chen and Kandel 1995). The use of prescribed psychoactive drugs is rather low and remains so throughout adulthood. It also does not show any peak or decline (Chen and Kandel 1995).

The age of onset seems to play an important role in the development of problems related to substance use. Chen and Kandel (1995) stated recency and frequency of use at an earlier period are strongly associated with persistence of use throughout adulthood. One possible explanation is that the completion of developmental tasks is disrupted by drug use (Lynskey, White et al. 1999). Overall, most active patterns of change in drug behaviour, whether initiation or cessation, occur by the late 20s (Chen and Kandel 1995). It seems as if the major risk periods for initiation of alcohol, cigarettes and other illicit substance use are largely over by age 20 and after age 29 years it is very rare for individuals to initiate the use of any legal or illicit drug (Chen and Kandel 1995).

In a national survey of Australian school children in 1996, it was found that 44.1% of males aged 12–17 years reported having used at least one illicit drug in their lifetime (Lynskey, White et al. 1999). Marijuana was the most widely reported drug and fewer students reported the use of other drugs such as hallucinogens, cocaine, and steroids. The majority of those who reported having used an illicit substance had used it only on a few occasions, but nearly 7% of males reported that they had used cannabis on at least 40 occasions during the 12 months prior to the survey (Lynskey, White et al. 1999). The authors also found a strong association between regular cannabis use and the use of other illicit drug use, while moderate associations were found for illicit drug use and both alcohol and tobacco use (Lynskey, White et al. 1999). Comparisons with other surveys indicated that there might have been an increase in the prevalence of cannabis use among Australian school children (Lynskey, White et al. 1999). Resnick *et al.* (1997) found that 25% of the respondents in their longitudinal study (briefly described above) had ever smoked cannabis and that 13% had smoked at least once during the month prior to the survey.

Resnick *et al.* (1997) have identified risk factors for cannabis use. These were easy household access to the substance, appearing older than peers, a low grade point average, and a perceived risk of an untimely death. For older students working more than 20 hours per week and same-sex attraction were also associated with increased cannabis use. Protective factors were

high connectedness to family and school, as well as a higher reported importance of religion and high self-esteem (Resnick, Bearman et al. 1997).

Adolescence is also the period in which many young people start sexual activity (Peersman, Sogolow et al. 1998). There is evidence that the age of first intercourse continues to go down (Peersman, Sogolow et al. 1998). However, some cultures delay sexual intercourse until later and there is no single standard for sexual conduct among young people and no one pattern of risk taking (Peersman, Sogolow et al. 1998).

The 1997 YRBSS survey in the US found that 48.5% of high school students had ever had sexual intercourse (Kann, Kinchen et al. 1998). Resnick *et al.* (1997) in their study found that about 17% of 7th–8th graders and nearly 50% of 9th–12th graders indicated that they had ever had sexual intercourse.

Significant factors associated with delayed sexual debut include family factors, such as high levels of family-parent connectedness, parental disapproval of an adolescent being sexually active, and parental disapproval of an adolescent's use of contraception (Resnick, Bearman et al. 1997). Higher levels of connectedness to school, attending a parochial school and attending a school with high overall average daily attendance were also linked with delaying sexual debut. Moreover, adolescents who reported that they have taken a pledge to remain a virgin were at significantly lower risk of early age debut (Resnick, Bearman et al. 1997). In the study by Resnick, Bearman *et al.* (1997) nearly 16% of females and 10% of males reported making such pledges. A higher level of importance ascribed to religion and prayer, self report of appearing younger than peers, and a higher grade point average were individual factors associated with later initiation of sexual activity (Resnick, Bearman et al. 1997). Self-report of looking older, working 20 or more hours per week, same-sex attraction or behaviour and perceived risk of untimely death were associated with earlier sexual debut. The authors concluded that 'to be out of sync with peers' appears to put a person at risk and that those who are academically at risk, are at risk in other ways as well (Resnick, Bearman et al. 1997).

Unprotected intercourse seems to be fairly prevalent among young persons. In the 1997 YRBSS, 43.2% of the sexually active respondents had not used a condom during the last sexual intercourse (Kann, Kinchen et al. 1998). It seems that although rates of condom use by young people have generally increased since the early 1980s, reported rates of consistent condom use have remained low (Peersman, Sogolow et al. 1998). One reason for this is that many young people begin by using condoms as contraception, but progress to oral contraception when a relationship becomes established (Peersman, Sogolow et al. 1998).

The use of alcohol and marijuana has also been linked to unsafe sex and inconsistent condom use, but the direct nature of the association remains ambiguous (Fergusson and Lynskey 1997). Some studies suggest that alcohol and drug consumption increase the likelihood of young people

engaging in high-risk sexual behaviour, perhaps due to impaired decision-making, mood elevation, and the reduction of inhibitions. Other research suggests that drinking motives rather than drinking itself predicts sexual practices. Hazardous and harmful alcohol use seems to increase the odds of an early onset of sexual activity by about 3–6 times, even when allowances are made for family, individual and peer factors (Fergusson and Lynskey 1997). Alcohol also increases the likelihood of having unprotected intercourse by about 5–7 times (Fergusson and Lynskey 1997). Moreover, there is a correlation between substance abuse and delinquency, homelessness, and runaway status. These factors are in turn associated with high HIV-risk, in part because they bring young people into settings and social networks where HIV is prevalent and thereby increase the opportunity for HIV infection.

Stanton *et al.* (1997) stated that youths do not remain equally involved in all risk behaviours. Certain risk behaviours seem to pass through an experimental phase. Many young people appear to experiment with cigarettes and illicit drugs, but a significantly smaller proportion engage in long-term or sustained use. However, some risk factors appear to be more enduring. Sexual intercourse and aggressive or violent activities are two of these (Stanton, Fang *et al.* 1997). However, even these behaviours show long latency periods and little is known about the stability of these risk behaviours.

3.3.3 Theories about risk behaviour in young persons

There is clearly an interaction between many of the risky behaviour exhibited by young persons (Warren, Vanderveen *et al.* 1997), but the exact nature of the relationship between the behaviours is unclear. There is also an increasing body of knowledge on how to reduce risk behaviour in young persons. Several theoretical models have been put forward in an effort to not only explain risk behaviour, but also to guide intervention. The Gateway Theory postulates that some behaviour acts as a gateway to more serious behaviour (Hewitt, Elliott *et al.* 1995). The typical example is that using cannabis leads to escalating involvement in other (usually ‘hard’) drugs. The Problem Behaviour Theory states that youth who are attracted to one risky behaviour will be attracted to others (Hewitt, Elliott *et al.* 1995). Four theories seem especially important in regard to young males (Hewitt, Elliott *et al.* 1995).

The Theory of Sensation Seeking has an underlying personality approach and proposes that risk taking is a personality trait, i.e. an individual has a need for varied, novel, and complex sensations and experiences (Hewitt, Elliott *et al.* 1995). These individuals are, therefore, willing to take the necessary risks to experience the desired sensations. The theory has been criticised and while there are young people who engage in such behaviour

for the sake of sensational experiences, they seem to be in the minority (Hewitt, Elliott et al. 1995).

The Risk Homeostasis Theory is very applicable to the road safety area and was developed to account for the relative stability of accident rates (Hewitt, Elliott et al. 1995). The theory proposes that people take risks to reach a variety of goals and that people operate at an accepted target level of risk (Wilde 1982). The way to reduce the target level of risk is, therefore, to motivate people to behave in a less risky fashion (Hewitt, Elliott et al. 1995).

A third theory is the Risk Motivation Theory (Trimpop 1994). This extends the previous model and postulates that risk-taking is an inevitable behaviour, which is probably genetically programmed. Also, the two motives that drive the behaviour is extrinsic benefits (e.g. saving time) and intrinsic pleasures (e.g. emotional pleasure) (Hewitt, Elliott et al. 1995). It is further stated that risk-taking tendencies are likely to be distributed in the form of a bell-shaped curve for the population.

A useful model for explaining adolescent risk behaviours is the Problem Behaviour Theory (Jessor and Jessor 1977). This model adopts a public health approach and also recognises that risk behaviours are a means to an end, e.g. adolescents may consume alcohol to affirm their independence or to demonstrate their membership of a specific group. A significant aspect of the theory is that risk behaviour is seen as interrelated and that involvement in one risk behaviour is likely to increase engagement in other such behaviours (Hewitt, Elliott et al. 1995). Therefore, there appears to be a syndrome of adolescent risk behaviours (Hewitt, Elliott et al. 1995) (Warren, Vanderveen et al. 1997). The implication has been that risk behaviours can be explained by a single common factor. However, there is a growing body of evidence that common developmental processes and pathways lead to different problem behaviours in young persons (Hewitt, Elliott et al. 1995) (Fergusson, Horwood et al. 1994).

3.3.4 Reducing risk behaviour in young persons

In the past, prevention studies have typically focused rather narrowly on specific problems (e.g. HIV infection) and particular outcomes (such as increased rates of reported condom use). Moreover, many interventions, especially during the 1970s, were based on the rational approach, i.e. the giving of information (Thomas and Busby 1998). Programs based on broader theories of behavioural change followed and many of included psychological inoculation techniques and behavioural rehearsal (Vartiainen, Paavola et al. 1998). Also, because of the apparent paradox that some adolescents who appear to be at high risk for health-compromising behaviours successfully negotiate adolescence, while others who appear to have more fortunate circumstances, do not, a lot of research has been done on identifying risk and protective factors (Resnick, Bearman et al. 1997).

Research has shown that information-orientated prevention programs aimed to reduce smoking behaviour in school-going children had little effect (Vartiainen, Paavola et al. 1998). Intervention strategies based on broader theories of behavioural change have proven to be more successful. For example, short-term results indicated that groups participating in such programs had 30–50% fewer smokers than control groups (Vartiainen, Paavola et al. 1998). Results over the longer term are more equivocal as some studies had shown positive results for at least a few years, while in others positive results had disappeared soon after the end of the intervention (Vartiainen, Paavola et al. 1998).

As stated, research has been done on protective and risk factors for risk behaviour. Two important contexts that influence adolescent risk behaviour have been identified. These are family and school. As highlighted in Section 3.3.2, high levels of connectedness¹⁶ to family and to school, protect adolescents from engaging in many risk behaviours. Yet, how these connections shape health-risk behaviour are not fully understood (Resnick, Bearman et al. 1997). Another question is how connectedness is developed. Hawkins *et al.* (1999) propose one underlying theory, i.e. the Social Development Model. This model postulates that some social groups produce strong bonds of attachment and commitment in members, and they promote clear standards for behaviour and that these two factors increase behaviour consistent with those standards and prevent behaviour that violates them (Hawkins, Catalano et al. 1999). Therefore, the interplay between specific factors during development influences the degree to which children develop strong bonds to specific contexts, such as school (Hawkins, Catalano et al. 1999). The important factors are the degree of opportunity for active involvement in the family and school, the skills of children that can be applied in specific contexts, and the reinforcement provided to children in response to their behaviour (Hawkins, Catalano et al. 1999).

A non-randomised control trial based on this model was conducted in public elementary schools serving high crime areas in Seattle, Washington. The aim was to investigate whether an intervention that combined teacher training, parent education and social competence training for children during elementary grades could influence health risk behaviours exhibited by young persons at age 18 years (Hawkins, Catalano et al. 1999).

Three groups were involved. In the full intervention group, the intervention comprised a long-term process which started in grade 1 and which involved a follow-up six years after the last intervention. In each intervention year (i.e. during grades 1–3 and 5–6), teachers of these children were trained on how to teach and manage their classrooms in ways that promote bonding to school. Parents were trained to manage their families in ways to promote

¹⁶ Family connectedness refers to closeness to mother and/or father, perceived caring by mother and/or father, satisfaction with relationship to mother and/or father, feeling loved and wanted by family members. School connectedness refers to feelings that teachers treat students fairly, of closeness to people at school, feeling part of the school.

bonding to family and school. The children themselves were trained in skills for social interaction in order to improve their attitude towards school, their behaviour at school and their academic achievement. A second intervention group only received intervention in grades 5–6, and a control group did not receive any intervention (Hawkins, Catalano et al. 1999). A follow-up study was conducted at age 18 years.

Hawkins, Catalano *et al.* (1999) reported that in the full intervention group (when compared to the control group), fewer students reported delinquent acts (48.3% vs. 59.7%, $P=.04$), heavy drinking (15.4% vs. 25.6%, $p=.04$), sexual intercourse (72.1% vs. 83.0%), having multiple sex partners (49.7% vs. 61.5%, $p=.04$), and pregnancy or causing pregnancy (17.1% vs. 26.4%, $p=.06$). The full intervention group also reported more commitment ($p=.03$) and attachment ($p=.006$) to school, better academic achievement ($p=.01$) and less school misbehaviour (.02) (Hawkins, Catalano et al. 1999). The intervention during grades 5–6 only did not appear to have any effect. The authors concluded that intervention through the elementary grades could have enduring positive effects on academic development and health risk behaviours of urban children (Hawkins, Catalano et al. 1999).

The most popular setting for sexual health promotion in young people has been the formal education system, such as in the study described above. At the same time, many young people who are at risk are in settings and life circumstances that offer little intersection with formal education or health services. Community-based programs, usually involving one or more service providers such as health clinics, social service agencies, and non-governmental organisations are specifically targeted to reach these young people (Peersman, Sogolow et al. 1998). The following study illustrates how such interventions can be done.

A study by Stanton and colleagues (1997) aimed to reduce the risk of HIV infection in a community-based cohort of 383 low-income African-American preadolescents and young adolescents. The intervention was based on the protection motivation theory and focused on decision-making (Stanton, Fang et al. 1997). The study was done at nine recreation centres serving 3 public housing developments. The intervention consisted of eight weekly sessions, followed by monthly booster sessions for 6 months. It was evaluated through a randomised control trial, i.e. 206 youths were randomly assigned to the intervention group and 177 to the control group.

The authors found that, overall, the prevalence of 4 of the 10 risk behaviours studied increased as the cohort aged. These were sexual intercourse (from 28 to 42%); cigarette smoking and alcohol use (both from 14 to 23%); and drug use (from 2 to 27%) during a 2 year period (Stanton, Fang et al. 1997). The prevalence of other risk behaviours, i.e. truancy, weapon carrying, drug trafficking, remained fairly constant. Stanton, Fang *et al.* (1997) also found that failure to use a condom did not differ between control and intervention youths at baseline, at 6 months or at 18 months. They did, however, find that control youths were notably more likely than intervention youth to

engage in this risk behaviour and that, cumulatively in the post intervention period, youths were less likely to have engaged in unprotected sex than control youths and drug use among intervention youths tended to be lower in all post intervention rounds, especially at the 18-month follow-up (Stanton, Fang et al. 1997). It seemed as if the intervention had a destabilising effect on some behaviour, such as truancy and drug use, but the mechanism of this action is not well understood. Moreover, it seemed as if the intervention had a stabilising effect on the non-risk behaviour. That is intervention youths who did not participate in unprotected sexual intercourse at baseline were more likely to continue to refrain from involvement in this type of risk behaviour than control youths who were not participating at baseline (Stanton, Fang et al. 1997). The intervention seemed to have affected the stability of four risk behaviours, i.e. truancy, unprotected sexual intercourse, drug use and possibly fighting. For sexual intercourse, the intervention was more successful in preventing the adoption of a risk behaviour than necessarily preventing experimentation (Stanton, Fang et al. 1997).

Another promising avenue is interventions based on the social influence theory. There is evidence that such strategies can significantly delay the onset of tobacco, alcohol, and other drug use and that it can slow the increase in substance use prevalence among entire populations of early adolescents (Chou, Montgomery et al. 1998).

Vartiainen and colleagues (1998) had studied the long-term effects of a school- and community-based smoking prevention program in Finland. The intervention was based on the social influence theory and taught 12-13 year old school students about social pressures to smoke. These could come from peers, adults and the mass media. The students were trained in how to deal with these pressures and they were informed about the short- and long-term effects of smoking (Vartiainen, Paavola et al. 1998). Four intervention schools were involved. In two of these, health educators and trained peer leaders led the program. In the other two schools, trained teachers led the program. The program was run over two years. The school-based intervention was combined with a community-based cardiovascular disease prevention program for adults, as well as with an intense mass media campaign. A pair of schools, in different villages was chosen as controls (Vartiainen, Paavola et al. 1998).

Immediately after completion of the program in 1980, in both of the intervention groups, about 33% less students reported smoking at least once a month (Vartiainen, Paavola et al. 1998). At the six-month and two-year follow-up, the results were the same. However, at the eight-year follow-up, the preventive effect persisted only in those schools with the teacher-led programs and at 15 years, the differences between the program and control schools were no longer statistically significant (Vartiainen, Paavola et al. 1998).

By the time youths are 28 years old, the advantage of having had an intervention in the early teens was no longer significant. This is because of a reduction in smoking was greater in control groups than interventions groups. However, a preventive effect was seen among those who were non-smokers at the outset. This raises the possibility that greater effects could be achieved if preventive programs were begun before children were likely to take up smoking (Vartiainen, Paavola et al. 1998).

Another study based on the social influence model was conducted by Chou, Montgomery and co-workers (1998). This study involved a cohort of 57 schools in 12 districts in Indianapolis. Middle and junior high schools within each school district were randomised to either a social influence-based drug abuse prevention program or a 'health-education-as-usual' control group. The students were sixth or seventh graders at baseline in fall 1987 (Chou, Montgomery et al. 1998).

The program demonstrated that significant reductions were achieved in reductions of cigarette use at the six-month follow-up, as well as for alcohol use for up to 1.5 years (Chou, Montgomery et al. 1998).

The studies presented here are not extensive or conclusive, but it does show that there is promising evidence that theory-based prevention programs can reduce risk behaviour.

4 Young Indigenous Australians

4.1 Introduction

Alcohol is one of the complex of factors that contribute to the severe health disadvantage of Indigenous Australians. In the following section we draw attention to the extent of alcohol use in the Indigenous community and in Section 4.3 we highlight knowledge on reducing alcohol-related problems in this population. This section overlaps with Section 3.2.1, which deals with reducing the availability of alcohol.

4.2 Alcohol use

A 1994 survey of drug use among urban Indigenous Australians indicated that a smaller proportion of urban Aboriginal and Torres Strait Islander persons consumed alcohol compared to the general population, i.e. 62% vs. 72%,¹⁷ respectively (Commonwealth Department of Human Services and Health 1994). However, it seemed as if those Indigenous persons who did use alcohol, consumed much higher quantities of alcohol. More than two-thirds of current urban Indigenous drinkers usually consumed alcohol at harmful levels, compared to about one-tenth of the general population (Commonwealth Department of Human Services and Health 1994). Males tended to have more hazardous drinking patterns, as is the case in the general population. Also, in the general population young males aged less than 25 years tended to display more hazardous drinking patterns, these patterns seem to be more prevalent in urban Indigenous males aged 25–35 years (Commonwealth Department of Human Services and Health 1994).

A study by Gladman, Hunter *et al.* (1997) of a remote community with a canteen selling beer in Cape York found that 93% of the 442 Indigenous persons aged 15 years or more were regular drinkers and that they each consumed, on average, about 508 litres¹⁸ of alcohol annually (i.e. 1,356 cans). This high percentage of regular drinkers differs from other findings that indicate that the proportion of drinkers in the Indigenous community is notably less than in the wider society (Hunter Hall & Spargo, 1991; National Drug Strategy, 1996).

¹⁷ From the 1993 National Drug Household survey.

¹⁸ These figures only take account of legal alcohol sales and were obtained from the local Aboriginal Community Council.

Information about Indigenous adolescent drug and alcohol use, its determinants and associated factors is still limited. An article by Forero, Bauman *et al.* (1999) investigated the Indigenous data from population-based school surveys done in 1989, 1992, and 1996 in New South Wales. They found that the proportion of Indigenous students in the surveys ranged from 2.5–3.8%. Table 12 shows the results for alcohol use from these surveys.

Table 11 : Prevalence rates and odds ratios of Indigenous students vs non-Indigenous students, adjusting for age, sex, spending money, family type, missing school days

	Prevalence		Adj OR	95% CI	p
	Indigenous adolescents	Non-Indigenous adolescents			
1996 survey					
Weekly alcohol use	33.9	32.4	1.0	0.7; 1.4	>0.05 ns
Hazardous drinking	53.4	34.5	2.1	1.6; 2.8	<0.001
1989–92					
Weekly alcohol use	33.7	20.3	1.4	0.9; 2.1	>0.05 ns

**To increase the sample size of Indigenous youth, data from the 1989 and 1992 surveys were pooled.*

ns = not significant.

Source: Forero, Bauman et al. 1999.

In the 1996 survey, 59% of the Indigenous males aged 12–17 years reported hazardous drinking, compared to 33% of non-Indigenous males. In the 1989–92 data, 28% of Indigenous males reported that they regularly consumed alcohol, compared to 14% of non-Indigenous males (Forero, Bauman *et al.* 1999). The authors also found, that after adjusting for a number of variables, Indigenous students were 1.9 times more likely to have smoked, 1.8 times more likely to have used cannabis, 2.6 times more likely to have used narcotics, and 2.9 times more likely to have used stimulants. They concluded that in-school Indigenous students seem to be at increased risk of developing drug-related problems. It should be noted that actual prevalence rates of substance use among Indigenous youth might be even higher as the estimated proportion of school-aged Indigenous youth not attending school is very high (Forero, Bauman *et al.* 1999).

A cross-sectional study of drug use among 110 Indigenous people aged 8–17 years in the town of Albany, WA, indicated that alcohol, tobacco and cannabis were the most commonly used drugs and that the use of other drugs was mostly experimental (Gray, Morfitt *et al.* 1997). Many Indigenous young people have, however, never drunk alcohol (apart from an occasional sip) (Table 13).

Table 12 : Alcohol use, by age among young Indigenous people in Albany, WA

Frequency of use	Age group – counts			Total
	8–12 years	13–14 years	15–17 years	
None	49	12	3	64
Occasional	0	8	11	25
Frequent	0	3	13	16

Source: Gray, Morfitt *et al.* 1997.

Of the 16 frequent drinkers, nine had consumed alcohol on one or two occasions in the previous week and seven on three or four occasions. Frequency of alcohol use was not linked to sex, but it was significantly associated with age, i.e. as age increased, alcohol use also increased (Gray, Morfitt *et al.* 1997). Frequent alcohol use was not common among those under 15 years.

Also among those who did consume alcohol, the use was mostly experimental (Gray, Morfitt *et al.* 1997). It did appear as if the age 15 years was a pivotal point and that after this age alcohol was used more frequently. Data on the age of onset of drinking illustrates this. The mean age of onset for drinking was 11.5 (mode 13 years) and 24% had had their first drink as young as 6–9 years. However, 54% of the young people drank their first drink between 12–14 years (Gray, Morfitt *et al.* 1997).

Gray, Morfitt *et al.* (1997) found that whisky was the usual drink, although some reported drinking full-strength beer and some of the females drank low-alcohol beer and wine. The preferred way of drinking was to share a 700 ml bottle of whisky. This complicated estimations of quantity, but it was estimated that drinkers consumed about 6.5–9 standard drinks per session. It seemed that for the frequent drinkers, most drank to get intoxicated (Gray, Morfitt *et al.* 1997). The authors noted that they were one of the first to report on the use of drugs in young Indigenous people. They pointed out that Indigenous communities are not homogenous and that extrapolation of results should be done with great caution. They concluded that alcohol (together with tobacco) is one of the greatest risks to the future health of Indigenous people and that the proportions of 15–17 year olds in WA who use alcohol (and tobacco) are greater than among 15–29 year old Indigenous people in the Great Southern region as a whole (Gray, Morfitt *et al.* 1997).

4.3 Alcohol-related problems

The important role that alcohol plays in injury occurrence in Indigenous communities has been demonstrated by Gladman, Hunter *et al.*, 1997, as well as Chiu, Perez *et al.*, 1998 and Landen, Beller *et al.*, 1998.

In the study by Gladman, Hunter *et al.* (1997) just more than half of the injuries sustained during the study period of 12 months were alcohol-related. These involved 172 individuals with 346 injury events. For males, 65% of the injuries were associated with alcohol compared with 35% for females (i.e. the patient had consumed some alcohol). However, when alcohol was considered a contributing factor (i.e. the alcohol use of another person contributed to a patient's injury), 57% of the injuries incurred by females was alcohol-related. Alcohol was also implicated in 65% of the injuries sustained by person aged between 16 and 44 years (Gladman, Hunter *et al.* 1997).

In the Cape York community, no legal alcohol was available on Sundays. Also, there were fewer visits to the canteen on Mondays and Tuesdays. Most alcohol was, therefore, consumed on the remaining days of the week (Gladman, Hunter *et al.* 1997). For both males and females, clinic attendances for injuries showed a similar pattern, i.e. there were less injuries on Mondays, Tuesdays, Wednesdays and Sundays, whereas there were an increase in injuries on Thursdays, Fridays and Saturdays (Gladman, Hunter *et al.* 1997).

The community with a canteen was also compared with another community, which had no local canteen.¹⁹ Overall, age-specific and alcohol-relatedness were determined for each community and compared. The overall injury and age-specific injury rates for the community with a canteen were about double those for the community without a canteen. The rates for ARI were also higher in the community with the canteen but the proportions of ARI were similar in both communities (Gladman, Hunter *et al.* 1997). The number of initial injury consultations as a proportion of total clinic consultations was significantly higher in the community with a canteen (8.8%) than the one without one (6.8%) ($p < 0.05$). However, it may be that a notable proportion of injury patients in the community without the canteen did not present at the clinic, but attended treatment facilities in the urban centre close to the community. Although it is not possible to attribute a causal relationship between alcohol use and higher injury rates in Indigenous communities, it is clear that alcohol does contribute to injury.

The 1994 survey mentioned in the previous section found that alcohol emerged as an overriding concern for Indigenous people (Commonwealth Department of Human Services and Health 1994). Ninety-five per cent of

¹⁹ It should be noted that the comparison community was larger and close to a major urban centre.

the urban population regard it as a serious problem. Also, nearly two-thirds regard either alcohol or alcohol-related violence as the most serious social issue facing the Indigenous community (Commonwealth Department of Human Services and Health 1994).

Alcohol-related crime is nearly twice as prevalent in the Indigenous community than in the general community, with nearly half of the survey respondents reporting that they had had something stolen or damaged in the previous 12 months. Also more than 25% had been physically abused by someone who had consumed alcohol, while more than 33% had been verbally abused or threatened by someone affected by alcohol (Commonwealth Department of Human Services and Health 1994). Urban Indigenous persons' involvement in crime-related incidents while affected by alcohol was also proportionally double that of the general urban community.

4.4 Reducing ARI

This has been addressed to some degree in the discussion about limiting the availability of alcohol in isolated communities. (See Section 3.2.1)

In the last few years many changes have occurred in regard to opinions about Indigenous use of drugs and alcohol. These have resulted in strategies such as changes in licensing, setting up more community and town-based night patrols, and the acceptance and expansion of sobering-up shelters and proclaimed places for the intoxicated (Brady 1997). Also, there have been some administrative changes, such as recent reviews of licensing laws (Brady 1997). More importantly, Indigenous women seem to have become more outspoken and better organised in their dealings with problems resulting from alcohol use. Entrenched positions on the ways of understanding drug and alcohol dependence are also changing, as younger Indigenous people become more aware of the process of dependence and the multiplicity of perspectives in the field (Brady 1997).

Interventions in Indigenous communities take on various forms. An alcohol-specific environmental approach applied quite widely, particularly in remote communities, is the restriction of access to alcohol. These approaches range in intensity with community-initiated banning of any access forming one extreme. There is evidence of effectiveness, though not without risk of unintended consequences, such as just shifting the problems to other communities or increasing drink-driving rates. As stated earlier, this type of approach may not always be acceptable to Indigenous communities.

The most appropriate intervention strategy for any community will be one that deals with the use of all drugs in a manner appropriate to the expressed needs of the community. This is especially true for young Indigenous people. Any approach that is not planned and implemented with relevant Indigenous community involvement (Gray, Morfitt et al. 1997) or without

community support frequently fail. Moreover, they sometimes have adverse outcomes.

One specific suggestion in response to Indigenous alcohol use problems, especially in northern Australia, was the establishment of licensed clubs for Indigenous communities (d'Abbs 1998). Most of the Indigenous communities in the Northern Territory have used the NT Liquor Act and have imposed total or partial bans on alcohol. By 30 June 1995, 90 communities had officially imposed such restrictions and eight other communities have established licensed clubs (d'Abbs 1998). The NT government has already commissioned three reviews of the provisions of the Act, and although each review had identified shortcomings, the conclusions were that the benefits outweighed the costs (d'Abbs 1998).

5 Discussion and conclusions

5.1 Introduction

Young males aged 15–29 years have very high rates of injury and injury results in large numbers of deaths, hospitalisations, ED attendances and GP visits in this age group. Alcohol use is a common practice among young males and it seems that young men aged 20–24 years consume more alcohol more regularly than teenagers and young men in their late twenties. A notable proportion of young males engage in binge drinking. This type of drinking seems to be especially common in certain subgroups, like athletes and students living in fraternities. Drinking patterns change over time. In the teenage years, alcohol use increases with age, it then reaches a peak at about 21–22 years, whereafter it declines. Age of drinking onset seem to play a role – those who start at an early age use drugs more frequently at higher levels and are less likely to stop. Injury seems to be associated not only with alcohol use prior to an injury event, but also to general drinking patterns.

5.2 Occurrence of ARI in young males

5.2.1 Discussion

In 1998, more than 1,600 young males aged 15–29 years died because of injury and a further 62,000 were hospitalised in the financial year 1997–98. Data on attributable fractions indicate that alcohol contributed between 12–47% of these injuries. Current data further indicate that certain types of ARI stand out, although this depends on which data source is considered. However, it is clear that transport, self-harm, and violence are important contributors to ARI injury *deaths*. Transport, falls, and violence are the leading causes of alcohol-related *hospitalisations*. For *injury not resulting in death or hospitalisation*, leisure and recreation, violence, and other miscellaneous household activities seem to make up large proportions of ARI in young males.

Transport

In regard to alcohol-related transport injury, alcohol plays a role in at least one-third of the fatal crashes involving young males aged 15–29 years.

Within this age category, young males aged 20–24 years seem to be a higher risk group than teenagers and young men in their late twenties (Macdonald 1994). Males in their early twenties engage in drinking and driving more often and a higher proportion are involved in fatal alcohol-related motor vehicle collisions. Teenagers and young men aged 25–29 years have a slightly lower risk for both, although teenagers seem to be at increased risk for being involved in a collision at lower BACs. This overall profile is in keeping with what is known about alcohol use in this age group and as was stated above. Alcohol use increases with age during the adolescent years and involvement in fatal traffic crashes also increase with age.

Patterns of alcohol use also play a significant role in transport-related injuries. Young males who binge drink seem to be at increased risk for being involved in motor vehicle collisions. One explanation (at least in part) is that binge drinkers are more likely to drive after drinking than non-binge drinkers (Kadel 1998). In addition to this, binge drinkers also seem to be more likely to ride with a driver who had been drinking (Wechsler, Davenport et al. 1994).

It seems as if there is a specific subgroup of drivers that display a cluster of risk behaviour. Work by Deery *et al.* (1998) indicates that further distinction of subcategories within the subgroup may be appropriate. It is uncertain what implications the identification of a subgroup and subcategories will have for intervention. It might not be worthwhile to focus on this subgroup for intervention as this subgroup comprises a small proportion of total young driver crash involvement; the false identification rate of such drivers may be high; effective programs need to be developed (if indeed possible); and such programs are unlikely to be cost-beneficial (Crettenden and Drummond 1994). However, Deery *et al.* (1998) suggests that it may be appropriate to identify novice drivers who exhibit particular driving behaviour and to match them to applicable training programs to enhance their precautionary behaviour. One example of such training is personal computer-based training programs, together with opportunities to practice learned skills and the ability to obtain feedback.

In regard to other transport-related injury, alcohol appears to play a lesser role in motorcycle collisions, but as with motor vehicle collisions, those in their early twenties seem to have a slightly higher risk of being involved in an alcohol-related crash (Haworth, Smith et al. 1997).

Although little Australian data are available on alcohol-related bicycle collisions, data from the US indicate that alcohol is an important contributor to these types of collisions as well (Li, Baker et al. 1996).

Alcohol seems to be an important factor in pedestrian deaths. About half of adult pedestrian deaths involve alcohol (Cameron 1992). The context where a collision occurs also plays a role, i.e. dark conditions, while crossing a road and in the presence of entertainment areas (Corben, Diamantopoulou et al. 1996).

Sports injury

The association between sports injury and alcohol in general is unclear. For young males it is even more equivocal. It seems that alcohol consumption directly before participation in sports is low, but that drinking after the event is common and that athletes, in general, are more likely to engage in harmful drinking patterns. It is unclear to what level of sports participation this applies. It may be that it only applies to more professional levels, such as at college level and higher. However, anecdotal evidence seems to indicate that athletes on all levels appear to realise that alcohol affects performance negatively and, therefore, refrain from drinking before the event, but that drinking after sports events is common. Further consideration of anecdotal evidence indicates that drinking after the event may be more common for team sports.

Work-related injury

We have some insight into the relationship between alcohol and work-related injury (WRI) in general, but specific data for young males are limited. Overall, between 3–16% of fatal WRI seem to be alcohol-related. This appears to vary depending on the precise definition of WRI, e.g. whether commuting deaths are included. Also, an Australian study on fatal WRI indicated that in 3–11% of cases alcohol contributed directly to the death – again the proportions vary according to the context (National Occupational Health and Safety Commission 1998). This study also showed that those deaths where travelling was involved seem to have higher proportions of alcohol-relatedness, and that at least for some of these deaths, alcohol had been consumed at work or at work-related social functions (National Occupational Health and Safety Commission 1998).

Research has been done on the prevalence of harmful drinking among workers and it is estimated that between 5–9% of working males engage in harmful drinking²⁰ and that about 10–24% shows hazardous drinking.²¹ It is, however, unknown what these proportions are for young males (Phillips, Vincent et al. 1997).

In regard to unpaid work, the role of alcohol has not yet been elucidated.

Falls

The contribution of alcohol in relation to falls is less clear, especially for young males. For falls in all ages it is estimated that alcohol contributes between 13–77% of falls (Hingson and Howland 1993). For young males, one estimate is that about 44% of falls are associated with alcohol (Spain, Boaz et al. 1997). The context in which a fall takes place appears to play a role. Many of the falls in young males are work or sports-related. For these

²⁰ That is 4-6 drinks per day.

²¹ That is more than 6 drinks per day.

injuries, alcohol may play a lesser role, especially in light of earlier discussion on these topics. It is not very clear what types of falls remain and what the role of alcohol in these are. From available research, which is still limited at this stage, it seems as if alcohol plays a more important role in falls that are not related to work or sports.

Water-related injury

Alcohol is a well-known risk factor for aquatic injuries. It is estimated that overall between 21–47% of drownings involve alcohol and that for boating accidents about 45% of fatalities are due to alcohol (Hingson and Howland 1993). In young males it seems that about one-third of drownings are alcohol-related. It also seems as if many men in general combine aquatic activities and alcohol. At least one in nearly every five young males does the same and they seem to drink substantial amounts during the activity.

Unintentional poisoning

There is a clear association between alcohol and unintentional poisonings, but it appears that alcohol plays different roles in this association. Alcohol may cause a person to use more than a required drug dose, or it may enhance the effect of the drug(s) taken.

Fires/burns/scalds

Alcohol seems to play a role in thermal injury in young males. Many of the burns in young males seem to be associated with the use of accelerants and fire around the home. It is quite likely that these burns are alcohol-related.

Other unintentional injury

In regard to other types of injuries, there is greater variability in alcohol involvement.

Intentional injury

There is a definite association between alcohol and suicide, but estimates as to the prevalence vary, also in regard to young men. It is estimated that about 12% of suicides are alcohol-related (English, Holman et al. 1995), but there are indications that this may be increasing and that the proportions for particular groups, e.g. Indigenous peoples, may be higher.

There is a difference of opinion as to whether alcohol causes suicide. Some argue that alcohol consumption before the event assists in making the decision to commit suicide. Others emphasise the fact that alcohol causes depression during intoxication. Also, chronic use of alcohol seems to play an important role in the emergence of suicidal thinking. Furthermore, chronic alcohol abuse appears to produce feelings of hopelessness and adds to this by the disruption it often causes in interpersonal relationships.

Alcohol is an important risk factor for violence, also for young men. One estimate is that at least one in every four violence-related injuries in young males involves alcohol. This is likely to be an underestimate. Young males are often the perpetrators of violence and as such may have used alcohol, which may not be apparent when data are collected, e.g. at EDs. The relationship between violence and alcohol is complex and it is not clear whether alcohol plays a causative role.

Summary

Most of our knowledge about the role of alcohol in injury to young males comes from the transport arena. This research indicates that the ARI peaks in young males in their early twenties. Research from other areas do not show the same peak, but specific data for young males in regard to these injuries are limited. It is quite likely that the same peak occurs here. Overall, alcohol seems to play a significant role in injury to young males. The question that remains is whether the extent of this problem is increasing. We know that the injury death rate for young males has decreased by about one-third since 1979 and that fatalities resulting from motor vehicle collisions are also declining. Improvements in drink-driving for the general population are evident (Vulcan 1995), but there is limited evidence on whether current strategies, such as RBT, are working sufficiently in the young male age group. The proportions of young males involved in fatal crashes remain high when compared with older drivers (Vulcan 1995). Data on trends regarding other types of ARI are very limited, although there is some evidence from the US that the proportion of alcohol-related suicides may be increasing. We need to obtain a better understanding of why young men exhibit particular drinking patterns, such as binge drinking, and how such patterns of alcohol use affect their risk for injury. Increased knowledge and insight would allow for improved strategies to reduce ARI in young males.

5.2.2 Main issues and gaps in knowledge about ARI and young males

Alcohol-related?

In this Report the concept 'alcohol-relatedness' has been used as if it is a coherent and well-defined entity. This was done for convenience, but the term encompasses many concepts and issues and precise definition thereof is difficult.

The term as it is used in current literature frequently refers to evidence that an injured person had consumed alcohol at the time of the injury event. This 'acute' alcohol use, often stated as alcohol consumption in a certain number of hours before the injury event, is usually measured by blood or breath alcohol levels and/or self-report by patients.

Alcohol-relatedness can refer to alcohol use by other parties, such as an assailant or the driver of another car involved in a crash. Information on this type of alcohol-relatedness is rarely collected. The concept also incorporates other aspects regarding alcohol use. These refer to drinking patterns, e.g. binge drinking, and/or alcohol dependence.

Another aspect to consider is whether alcohol-relatedness only refers to the 'presence of alcohol' or whether it contributed to the occurrence of an injury due to impairment. It is often problematic to demonstrate that intoxication leads to impairment. Confounding factors should be considered. These include polydrug use, the nature of activity (i.e. how learned the activity is), hangover effects, and the psycho-physiological consequences from repeated alcohol use.

Alcohol appears to be a potent risk factor for young males, but there is only limited information about the development of alcohol use, hazardous and harmful use, and management strategies during the transition to adulthood or how this influences risk patterns in middle to late adulthood. For most unintentional injury categories attributal fractions of .34-.37 are measured. While this broad estimate can be made, there is a lack of evidence about the role of alcohol in specific types of injury and limited understanding of how hazardous and harmful use of alcohol develops and contributes to injury risk.

A major challenge in regard to establishing and understanding (causative) relationships between alcohol use and injury is the use of meaningful and accurate measures of intoxication and impairment. There is a danger that poor representations of intoxication, e.g. self-report or estimated blood alcohol levels (Sommers, Dyehouse et al. 1997) will be used. There are also temporal problems with measurement, i.e. time delays between injury and measurement. Self-report in those who use alcohol in a hazardous and harmful way is generally veridical if the interview is conducted in a clinical research setting, the respondent is alcohol-free, and there is an assurance of confidentiality (Sommers, Dyehouse et al. 1997).

Various disciplines

The topic of alcohol-related injury in young males is of interest to several disciplines such as epidemiology, mental health, health care, health promotion, etc. This has resulted in differences in the concepts and the language currently used in research on alcohol use (as highlighted above). Also, the contribution from other public health disciplines has been poorly linked with injury research. Injury researchers have often focussed on the relationship between 'acute' alcohol use and injury. In contrast, researchers from other disciplines seemed to have emphasised patterns of alcohol use and only sometimes did they include injury as an outcome measure. Available evidence reflects this, but there is a growing number of injury studies that include measures of drinking patterns. Also, injury is now often included as an outcome in studies from other disciplines.

Available data

Routine data, especially those on fatalities and hospitalisations, are the most substantial sources of data on injury in this country. Identification of a subset of the injury cases as 'alcohol-related' is not straightforward. Broadly, two approaches can be taken. One is to assess alcohol-relatedness case by case. The other is to estimate the fraction of cases (of all injuries, or of particular types) and use available evidence to estimate the proportion of that type that can be attributed to alcohol.

The attributable fractions approach was introduced in Chapter 2. Case-by-case identification is outlined here.

It is, in principal, possible to assess injured people, case by case, to determine whether alcohol might have contributed to the occurrence of each injury case. In essence, that can be done by obtaining evidence that the injured person, or some other person involved in the event that resulted in injury, had a significant level of blood alcohol at the time of occurrence.

In practice, obtaining such information is often difficult for practical and other reasons. It is particularly unusual to obtain information on alcohol levels of potentially relevant persons other than the injured person, with the exception of some drivers involved in motor vehicle crashes (O'Connor & Trembath, 1995).

Even if case by case evidence of the presence of alcohol is obtained, it does not necessarily imply a causal role (e.g. a car driven by a sober person hits a tree, resulting in injury of an alcohol-affected passenger).

The potential for obtaining case by case information on injury cases is greatest for deaths, as blood alcohol measurement is a normal part of post mortem examination (National Occupational Health and Safety Commission 1998). Access to this information has been difficult, as it has not formed part of the routine national deaths data collection provided by the Australian Bureau of Statistics.

An important development in regard to deaths data is the establishment of the National Coroners Information System. This system is expected to provide much more detailed information on most injury deaths than is now available. Special attention has been given to a 'drugs module', the scope of which includes alcohol.

Other developments that will improve current national injury data are:

- Transition to ICD-10 (for deaths) and ICD-10-AM (for hospital separations) for coding national injury data. ICD-10(-AM) contain more numerous and more specific categories related to alcohol than did ICD-9 and ICD-9-CM.
- The introduction of multiple-cause coding of deaths. A consequence is some additional specificity concerning factors identified as contributing to deaths, one of which is alcohol.

- The introduction of a 'drugs' flag in the ABS deaths data collection. This summary flag is derived from other data in the case record. Alcohol is one of the types of substances that it is designed to identify. It remains unclear how useful the flag is concerning alcohol-related injury and how reliable the data are.

In Australia, much of the data on alcohol use come from national surveys, but these have limited information on injury. Relevant publications do not crosstabulate alcohol use with the information on injury occurrence. Other useful sources of data on alcohol use in young persons are surveys done among high school students. These provide valuable insight, but the generalisability of these data is not known. These sources often do not include information on the association between alcohol use and injury and the very nature of these surveys introduces a bias in that young persons attending school may differ from those not attending school.

Although there is an extensive body of research that indicates the association between alcohol and injury, especially in regard to transport, this literature has particular limitations and we still lack insight into the nature and distribution of the association. This was highlighted in Section 2.1 of this report, as well as the first part of this discussion.

Much of our knowledge regarding ARI comes from data on fatalities. We know less about non-fatal ARI, but the number of studies is increasing. These studies, as well as those on fatal ARI, tend to focus on acute alcohol use and few include data on usual drinking patterns. Random breath analysis data has more recently contributed to epidemiological studies (Hollo, Leigh et al. 1993).

Clearly we need more comprehensive data on the role of alcohol in relation to work, sports, leisure and recreational injuries.

For sports injuries, very little information is available on the link with alcohol. Although some evidence is available on the drinking patterns of more professional athletes, very little is known about the drinking patterns of less professional players or about drinking before the event. Moreover, more elucidation of the difference (if any) between team and more individually based sports is necessary.

Studies of the role of alcohol with injuries in the workplace have tended to focus on selected populations, such as known or suspected dependent drinkers. These studies lacked a standardised definition of a 'dependent drinker' and therefore compromised the comparability of data obtained across studies. Reliance on supervisors or managers to identify dependent drinkers has been shown to underestimate the true number of cases (Stallones and Kraus 1993). Also, the risk of injury by specific industry and occupation has not yet been elucidated. Analytic studies which include control groups and which assess confounding variables are needed so as to aid in the design of effective countermeasures. Even when alcohol is detected, its role in the causal pathway from the worker-energy interaction

to injury onset has not been studied (Stallones & Kraus, 1993). Studies that show evidence of alcohol-relatedness and work-related injury suffer methodological flaws that may greatly diminish the precision of alcohol prevalence estimates. One reason for the lack of complete assessment of the problem is the difficulty in measuring BAC levels in non-fatally injured workers or in obtaining blood samples soon after death in fatalities (Stallones and Kraus 1993).

Although, the number of longitudinal and case-control studies on injury appear to be increasing, too few give special attention to ARI in young males. Also, of the existing longitudinal studies involving adolescents many are mostly done in white, middle-class youths and few have been done in Australian youth. In the US, a few studies were done in low-income African-Americans, but these were conducted some years ago and follow-up intervals during adolescence spanned months rather than years (Stanton, Fang et al. 1997). Fortunately, there is an increasing number of longitudinal studies across the world, often involving various adolescent populations, but still the generalisability to Australian youth remain uncertain and ARI is not often included as an outcome measure.

Another problem is the use of correct denominators. For example, it has been stated that young drivers are over-represented in fatal crashes, but the extent of this varies according to which denominator is used.

Information about the cost of injury is lacking. Costs are known for group and all injury but distribution across age groups is not well understood. The proportion of the cost of injury attributable to alcohol has not been reliably measured. Most importantly, cost-benefit information is mostly limited to road related injury.

5.2.3 Ways forward

Many questions about the extent, distribution and other characteristics of alcohol as a risk factor for injury in young males remain unknown. Some known factors that impact on injury in young males are location of drinking, demographics, age, gender, specific settings (transport, work, sport), confounders (risk-taking style, tolerance, risk environment, other drugs), as well as cultural and sub-cultural factors. These should receive serious consideration in research about the topic. Four broad research questions that remain are:

- What is the complete profile of ARI? That is, to what extent does alcohol cause injury, e.g. what are the attributable fractions in specific settings and for particular types of injury?
- How is injury predicted by quantity, frequency, and other patterns of alcohol use (e.g. location of and time spent drinking)? What is the relationship between the setting, alcohol use/intoxication and injury occurrence?

- How is the use of alcohol and injury risk determined during the transition from childhood to adulthood?
- Given that certain usage patterns are predictive, and alcohol contributes to injury, what predicts the adoption of these patterns?

Injury research directions for the health sector are to investigate the role of alcohol in regard to home, leisure, sports, consumer products, with special emphasis on falls in young persons, as well as to assess to a greater extent the role of alcohol in violence.

In order to achieve these goals, cooperative work is necessary between the health sector (across various disciplines) and the transport sector, as well as those working in occupational health and safety.

A possible approach to improve data on ARI in young males would be to review samples of hospital records to determine whether patterns between alcohol use and injury cases can be established using this source. If this is the case, it will also be useful to determine whether the extent to which alcohol contributes to injury can be established. Numerous hospital records exist but currently there is uncertainty about how useful they might be. Should they prove useful, they might provide valuable information relatively cheaply.

If hospital records are found to not be useful, screening by self-report may be incorporated in clinical investigations. In the US, fewer than 25% of trauma centres routinely test for alcohol and other drugs or obtain patients' histories of alcohol use (Soderstrom and Cowley 1987) in (Soderstrom 1994). In Australia there is no routine screening done in hospitals, but there are compelling reasons to do so for acute alcoholics and patterns of drinking behaviour. Not only will this provide useful information for researchers, but screening has a distinct clinical value. It will allow intoxicated patients to be identified. This is important as, for example, intoxicated patients with brain injury are at greater risk of developing pneumonia and respiratory distress than are non-intoxicated patients. Moreover, patients who are intoxicated on admission or those screened to be severely dependent drinkers are more than twice as likely to be readmitted for injury (Soderstrom, 1994). Therefore, screening may enhance opportunistic interventions.

Another avenue for improving data on ARI in young males is to do case-control studies to determine the association between patterns of alcohol use and injury. Currently we know that there is a global association between alcohol and injury. However, the association is complex and is likely to vary across domains. Current knowledge does not adequately inform us about these dynamics. Case-control studies will enable numerous known and suspected factors for ARI to be measured and analysed to determine the relationships between them (e.g. which are independent risk factors). This would provide a guide towards effective interventions and inform us about the likely consequences of interventions. This latter aspect is very important. Often interventions have no effect or, in a worse scenario, have negative

consequences, e.g. enforcing liquor licensing laws in pubs may not reduce alcohol use among youth but shift consumption into riskier environments such as parks or other public places. Case-control studies would provide insight into a range of potential interventions and their likely effects.

Another possibility is to do cohort studies to determine the association between patterns of alcohol use and injury during transition to adulthood. An important method for establishing causation with respect to alcohol and injury is conducting prospective longitudinal studies. Most research on ARI to date has reported cross-sectional designs that reveal the prevalence of alcohol use within certain settings, but show little in the way of causative factors. Case-control designs (such as outlined above) provide a time dimension, but suffer from the limitation that information about risk factors is obtained retrospectively. It is likely to be difficult or impossible to obtain valid information on some important factors in this manner. Longitudinal designs allow the researcher to measure factors (e.g. type of alcohol use, setting, risk-taking, personality, and injury type) as they develop over time, and help elucidate their interrelationships (Fergusson, Horwood et al. 1994; Stanton, Fang et al. 1997). This is critical for understanding the dynamics of risk behaviour and environment as young men emerge from childhood.

5.3 Reducing ARI and injury due to drinking in young males

5.3.1 Discussion

There is no simple solution to reducing ARI in young males. We suggest three approaches to reducing ARI in young males. These are:

1. Maximise the application of interventions known to be effective against ARI.
2. Apply and test the effectiveness of interventions known to be effective against ARI in one setting in other (related) settings.
3. Apply and test interventions known to be effective against other risk behaviours for the prevention of ARI.

Below we present some general approaches on reducing ARI in young males, which is followed by more specific suggestions. Some gaps and limitations of data on intervention of ARI are also highlighted.

5.3.2 General approaches

Interventions known to be effective against ARI

One approach would be to further investigate what is known about reducing ARI in young males. Useful actions will be to do a systematic review of the effectiveness of interventions against ARI in young males, as no existing systematic review of this topic was discovered in the course of work on this report. Relevant literature on the topic appears in a wide range of publications, reflecting the disparate settings of occurrence and the range of disciplines that may be involved in research. This increases the likelihood that effective measures exist but that they are not widely recognised, or that evidence relevant to an evaluation of measures thought to be effective may have been overlooked.

It is important to assess the outcomes of interventions, especially as some often may have no effect or may sometimes result in negative outcomes. For example, early models of drug education for high school students were based on the philosophy that knowledge of drugs and alcohol would reduce use among this population (Pickens, 1995). However, students frequently increased their quantity and range of drug use after the program because their awareness had been raised.

We suggest that the potential injury reduction and cost-effectiveness of implementing or increasing the use of interventions that successfully reduce ARI in Australia be assessed. When an intervention has been shown to be

capable of reducing ARI, it is desirable to assess the extent of expected benefits if it is implemented (or if its use is increased) and the likely cost of obtaining this benefit.

In the general area of injury control, most work of this type has been undertaken to evaluate road safety countermeasures. For example, efforts have been made to assess the relationship between the intensity and pattern of application of RBT and reduction in crashes or injury. This literature tends to take the form of reports contracted by road safety agencies (Henstridge, Homel et al. 1997). Despite methodological limitations and need for care in its application, the approach is useful. While alcohol-related injury has been touched on in projects of this general type (e.g. (Torpey, Ogden et al. 1991)), we are not aware of any report for which this was the focus and Australia was the setting.

Interventions known to be effective against ARI in one setting

Measures capable of reducing ARI in one setting may be beneficial in other settings (though not necessarily so). Conversely, measures that are found to be ineffective in one setting may be equally impotent in another. Differences in perspective, disciplines and professional media can impede transfer of experience between sectors (e.g. between criminology, road safety and workplace safety).

We recommend that projects be conducted in which measures known to be effective in reducing ARI in at least one setting are assessed systematically for potential application in other settings. Those for which potential benefits appear to be significant should be candidates for formal field-testing and evaluation. One example is to investigate the potential effectiveness of RBT in relation to boating. Alcohol is a risk factor for boating-related injury and drowning more generally. However, traditions of investigation, regulation and enforcement that have become conventional for road safety in Australia do not appear to have spread to the boating sector. The potential benefits and practicalities of doing so warrant investigation.

Interventions known to be effective against other risk behaviours

The risk of physical injury is associated with certain risk behaviour. Some work has been done on understanding the antecedents and consequences of involvement in such risk behaviour among adolescents (Stanton, Fang et al. 1997). These studies provide valuable insights and directions to injury prevention initiatives as some interventions have been shown to be capable of reducing at least some risk factors. It may be that risk of alcohol-related injury can be reduced by means of certain such interventions, even though they may not have been designed to achieve that end.

We suggest a systemic review of such literature and the testing of promising interventions and we support dissemination and evaluation of successful models for investigation and intervention. The Cape York project (Gladman,

Hunter et al. 1997) is an example of where the approach have been disseminated to at least one other area. A review should seek to identify other projects warranting dissemination.

Gaps and limitations

The need for detailed and accurate information to guide prevention programs for young males has still not been fulfilled. One reason for this is that relevant research has been done on a variety of populations, outcome measures, types of intervention, content of intervention, and intervention duration. Therefore, findings are not sufficiently replicated.

There are special issues that need to be considered in regard to young males. They are new to drinking and to certain activities such as driving. Peers seem to have a significant influence. There are certain barriers such as rebelliousness and perceptions of invulnerability that need to be overcome. We should, however, note the opportunities, e.g. it may be possible to affect drinking habits before they are set.

We also need to investigate whether interventions can affect which drinking patterns are adopted, and once adopted whether they can be changed. We do not know why some people only experiment, why some behaviours are more enduring and why some people are more vulnerable. More understanding about cultural differences is also needed. Very little research has addressed risk behaviour as a syndrome in that most studies have focussed on specific outcomes.

5.3.2 Specific approaches

For some specific problems it seems that strategies that incorporate a number of different effective approaches are the way to go. Many of these involve community level interventions over many years. Another possible avenue is to focus on a syndrome of risk behaviour (which includes those that put young males at risk for injury, e.g. drinking and driving).

Measures to reduce alcohol-related transport injury

Evidence shows that there has been a decline in alcohol-related motor vehicle crashes. The key to this was a comprehensive strategy, which employed three main elements, i.e. legislation, RBT, and ongoing reinforcement of media messages and community responses. Although expensive, the strategy has shown to be cost-effective overall.

In regard to road ARI, there are indications that current intervention strategies, which addressed the whole population, may have been less effective in young males. For example, it is unknown whether current RBT operations include a large enough proportion of young men to establish and reinforce a high enough perception of 'being caught when you drink and drive'. It may be that young men need a higher proportion of apprehension.

There are also some questions about the sustainability of current effective strategies in the future and questions remain about whether current media messages are effective on young men.

There are a number of laws to protect young drivers, such as very low BAC limits for young or novice drivers and graduated license strategies and there is a growing body of knowledge in both Australia and other countries that low BAC laws are effective. For young males the combination of graduated licenses and low BAC laws may be the most appropriate strategy as it limits the exposure of inexperienced drivers, as well as another important risk factor, namely alcohol.

Other factors may also contribute to decreasing the problem further. There seems to be a sub-group of recidivist drink-drivers, but a clearer profile of these young drivers are needed. It is still unclear whether the numbers of these drivers warrant special attention. If they do, more work is needed to identify them and to develop specific programs for them. Several methods currently being employed to address recidivist drink-drive offenders in general, such as administrative per se laws (although evidence on its effectiveness is still equivocal) and installing ignition interlock devices (which seems to be effective for convicted drink-drivers) may be useful.

There are no specific strategies aimed at reducing alcohol-related motorcycle crashes, but some strategies may be useful. These include a process of increasing the proportion of licensed motorcycle drivers. More education about the necessity to obtain a license may be useful, but better detection of unlicensed motorcycle riders may be more beneficial. Education during licensing can be revised, but the key may be to find ways of repeating an anti-drink drive message for motorcyclists. Maybe another more effective way may be to lower the BAC level for all motorcyclists and not just novice drivers. Also, investigation into the use of ignition key locks may prove worthwhile, as may an exploration into whether a subgroup of 'problem' motorcyclists exist, and if so, who they are and what proportion they make up of all motorcyclists. Acceptance of such strategies by the public is unclear.

In regard to bicyclists, it may be useful to include them in RBT operations and to enforce legislation about the wearing of helmets more rigorously.

There are few existing strategies for addressing alcohol-related collisions involving pedestrians. Most reductions seen in this regard were due to strategies that addressed drink-driving and speeding. Promising strategies are those that will increase visibility of pedestrians and those that enhance safe negotiation between pedestrian and motorist as many ARPC occur at night, in dark conditions and in proximity of bars, hotels, etc. Improving lighting in areas around such places will be useful as will increased visibility of pedestrians. This can be achieved by incorporating reflective strips/strands in fashion wear (clothes and footwear) for youth.

Other approaches

The availability of alcohol appears to play a role in ARI. Therefore, a number of strategies can be employed to reduce availability. One is to decrease the density of liquor outlets. Although data are still equivocal about the effectiveness of this strategy, it may be useful to follow this approach. Another strategy that seems to work well in geographically isolated communities is to ban alcohol completely, or to at least limit alcohol availability during particular times of the week or day. This strategy should be used with caution and only if there is relevant community support. In less isolated communities, the approach should be implemented with care because it can have unintended consequences such as to shift the problem to another community or to increase drink-driving rates. However, it is unclear whether such strategies are likely to be implemented on a wide scale. In a society where a free marketplace is the norm, controlling alcohol availability may be unpopular and may face community, industry and political opposition. The way such an approach is employed in a community is important. On the other hand, availability should be considered against public health implications and other specific strategies should be embraced (e.g. RBT for drink driving, etc.).

Responsible beverage service strategies are useful, but seem to be most effective when combined with other strategies. This also applies to environmental strategies, as these on their own are not enough to sustain long-term changes.

There is an increasing amount of evidence from community trials aimed specifically at reducing ARI, but not enough of these studies that have been evaluated thoroughly, and so far the results are mixed. Some studies show little or no improvement, while others show large reductions in fatal crashes involving alcohol. Most of the community trials approach the problem of ARI from various fronts and seem to incorporate at least two or more of the components. Strategies that have a multi-pronged approach seem to be most effective in addressing alcohol-related problems.

Brief interventions appear to be effective in reducing alcohol consumption.

Other risk behaviour

The risk of injury is often associated with other health risks (such as smoking tobacco, using drugs other than alcohol and engaging in unprotected sexual intercourse). In turn, such risk behaviour has been linked with alcohol.

Some work has been done on understanding the antecedents and consequences of involvement in such risk behaviour among adolescents. These studies provide valuable insight and directions to injury prevention initiatives as some interventions have been shown to be capable of reducing at least some risk factors, even though the effects are often complex. It seems

that the risk of ARI can be reduced by such interventions, even though they may not have been designed to achieve that end.

It has been stated that perceptions of health risks tend to be optimistically biased (Peersman, Sogolow et al. 1998). It seems as if people generally perceive others as more vulnerable than themselves. However, the minimisation of the risk for adverse health outcomes requires adequate knowledge of what the risks are and how to avoid them. Young people are increasingly knowledgeable about the outcomes of risk behaviour, e.g. HIV/AIDS, but ignorance of basic facts (e.g. about sexuality, reproduction, and contraception) still exists, as do considerable misinformation (e.g. about the transmission of HIV and other sexually transmitted diseases). Also, though knowledge is necessary, it is not sufficient to ensure appropriate behaviour or changes in inappropriate behaviour. A large body of literature documents the extent to which health education increases young people's knowledge but is unassociated with behavioural change. This has important implications for the development of prevention strategies.

A number of characteristics that predispose young persons to risk behaviour has been identified. These include rebelliousness, low self-esteem, low self-efficacy, etc. Another important factor seems to be an individuals' perception that they are 'out of sync' with their peers. Protective factors have also been identified. The most important seems to be 'connectedness' to family or a responsible adult and school, and to a lesser degree to religion. Individual factors such as high self esteem and high grade point average also play a protective role. Therefore, strategies to enhance young people's connectedness to adults and schools may be useful and implementation of such interventions should be investigated.

There are a number of theories available that assist in understanding risk behaviour in young persons. The one that seems most useful is the Problem Behaviour Theory that postulates that, for young people, risk behaviours are a means to an end and that involvement in one risk behaviour is likely to increase involvement in other such behaviours. It still does not explain why some adolescents engage in risk behaviours (often to a high degree), while others do not or do so to a lesser degree.

The inter-relatedness of risk behaviour has important implications for intervention. Prevention strategies should address risk behaviour as a complex of health compromising behaviours and should seek to address the psychosocial functions that underlie these behaviours (Hewitt, Elliott et al. 1995). Available research shows that there are promising (though not conclusive) evidence that theory-based prevention programs can reduce risk behaviour. It also seems as if a combination of methods, such as a combination of school-based programs, together with community wide cessation campaigns for adults and a strong mass media component may be most successful. Those that involve pre-adolescents seem to have particular value in preventing children from initiating risk behaviour.

There is no easy answer. Programs that have been successful were ones where a combined approach over many years was used. This involves dedicated participants, sufficient funds and long-term commitment.

Populations at special risk

Indigenous young males are at increased risk for experiencing alcohol-related problems. A number of approaches have been employed to reduce ARI in Indigenous people. However, the impact that this has had on young males is unknown. Little research has been done where reducing ARI in young Indigenous males was the aim. Clearly, more research on this is needed.

Public health approaches to injury control offer potential benefits, but these are difficult to realise unless there is a collaborative relationship with Indigenous communities and organisations. This can be achieved and there is potential to disseminate successful models (Gladman, Hunter et al. 1997).

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