

Blood alcohol levels in suicide cases

Linda Hayward, Stephen R Zubrick, Sven Silburn

Abstract

Study objective—The aim was to investigate the relationship between alcohol consumption prior to suicide and the act of suicide.

Design—This was a retrospective total ascertainment survey of a three year cohort of suicides in Western Australia.

Setting—Coroner's records of suicide in Western Australia between 1986 and 1988 inclusive.

Participants—The study involved 515 consecutive suicides: 414 males and 101 females.

Main results—Information on blood alcohol levels at time of death, presence of other drugs at time of death, drug and alcohol abuse history, psychiatric history, life events prior to death and method of suicide were collected. It was found that 35.8% of cases had a positive blood alcohol reading. Those who had been drinking alcohol prior to suicide were younger, more likely to be male, more likely to have chosen carbon monoxide as the method of suicide, more likely to have experienced a break up of a relationship and less likely to have sought professional help than those who had not been drinking.

Conclusions—Data from the present study do not provide evidence for a causal relationship between alcohol consumption and suicide. Differences between those who had consumed alcohol and those who had not are suggestive of a contributory role of alcohol to a decision to commit suicide in a subset of suicide cases.

In the last two decades only a few studies have reported on the presence of alcohol and other drugs in the suicide victim's body. Estimates of the numbers of suicide cases affected by alcohol vary from approximately 20% to 50%, depending on the definition of "alcohol affected". The role that alcohol plays in suicide is not clear: it could be irrelevant; be used after the decision to take one's life has been made; or its use could be part of the set of conditions that lead to the decision to commit suicide.

The first part of this paper reviews the available data on alcohol use and suicide. It also presents data from a study conducted in Western Australia looking at the relationship between alcohol consumption prior to suicide and other possibly relevant variables, for instance, method of suicide used and help seeking behaviour.

THE PROPORTION OF SUICIDES WITH POSITIVE BLOOD ALCOHOL LEVELS

Few studies have documented blood alcohol levels in suicide victims. A study of suicides in Western Australia in the years 1961 to 1982 collected data on postmortem blood and urine alcohol levels.¹ While a total of 293 people committed suicide in those years, blood alcohol levels were available for only 107 cases and urine alcohol levels for only 76 cases.

Of the 107 suicides 40 had blood alcohol of 0.05% or more, with 47.8% of the males and 18.4% of the females in that range. Of the total successful suicides, 8.8% had received psychiatric treatment for alcoholism and a further 8.3% had histories of being alcoholics or heavy drinkers (determined from police, family or friends). Within the 76 subjects where both blood and urine samples were screened for alcohol, 47% had levels of 0.2% or less. The relationship between the blood and urine alcohol content in the remainder (29) showed that (with four exceptions) blood alcohol was lower than urine alcohol content.

The relationship between urine and blood alcohol content was approximately 1.3:1, suggesting "that in the great majority of cases alcohol had been consumed some hours before, and that in only four instances was the alcohol most likely to have been taken just prior to death. In most cases of suicide associated with high blood alcohol levels the records indicated that the act had been committed either during, or in the early hours of the morning following a period of alcohol consumption".¹

James¹ proposed that his evidence suggested that mental changes associated with or following alcohol intoxication may lead to impulsive suicide in individuals who are predisposed to do so, and that it happens more frequently in men between 30 and 60 years of age than in women. Among the data collected by James was information on whether a person had sought psychiatric treatment prior to the suicide. He found that 37% of the cases had at some time in the past received such treatment, and 15% were under medical care just prior to the suicide. However, these conclusions must be regarded as tentative because of the incomplete ascertainment of blood alcohol levels in this study.

Studies in the USA and Canada have also found relatively high proportions of suicide cases positive for blood alcohol. Kraft and Babigian² found that 26% of their New York sample of 179 suicides had blood alcohol of 0.05% or greater. Their sample was divided into those with a definite psychiatric history versus those without; those with a psychiatric history were more likely

Health Department of
Western Australia,
PO Box 8172, Stirling
Street, Perth, Western
Australia 6000:
Epidemiology Branch
L Hayward
Neurosciences Unit
S R Zubrick
Selby Child and
Adolescence Clinic
S Silburn

Correspondence to:
Dr Hayward, at Neuro-
sciences Unit, Selby Centre,
2 Selby St, Shenton Park
6008, Western Australia

Accepted for publication
June 1991

to have blood alcohol of 0.05% or more (32%) than those without (19%). Furthermore, males were approximately twice as likely to have a blood alcohol level over 0.05% than females. Varadaraj and Mendonca,³ in a study of 58 cases of overdose admitted to accident and emergency departments in Ontario, found that 41% had consumed alcohol and 29% had a blood alcohol greater than 0.08%. The alcohol impaired patients, both males and females, were older than the non-impaired patients. Furthermore there was a significant positive correlation between age and blood alcohol level.

ALCOHOL CONSUMPTION AND YOUTH SUICIDE

Some studies have focused on the relationship between alcohol consumption and youth suicide. Friedman⁴ studied the relationship between alcohol consumption and 57 sudden deaths in San Francisco youths aged 12 to 24 years. Of the suicide victims in their sample, 25% had been drinking prior to the event. Fifty percent of accident victims and 21.4% of homicide victims were intoxicated at time of death. Misuse of other drugs played a role in 10.5% of the 57 deaths.

Brent *et al.*,⁵ in a study of youth suicide in the USA, found increases in the suicide rates for white youths (15 to 19 years old) from 6.47 per 100 000 in 1960 to 14.37 per 100 000 in 1983. This increase was paralleled by an increase in the number of positive blood alcohol readings from 12.9% in 1968 to 46% in 1983. They also found an association between blood alcohol and use of firearms to commit suicide. Those positive for blood alcohol were 4.9 times more likely to use firearms than those with no alcohol in their blood. Those under the influence of other drugs were less likely to use firearms; 67% of them overdosed instead.

DOES EXCESS ALCOHOL CONSUMPTION HAVE A CAUSAL ROLE TO PLAY IN SUICIDE?

It is not at all clear what role alcohol plays in suicides. It is possible that alcohol consumption prior to suicide occurs after the decision has already been made to take one's life, a form of "Dutch courage". Alternatively, alcohol may be more directly related to the suicide by its depressant and disinhibiting effects combining with an already depressed state in the person and leading to an impulsive decision to commit suicide. The work of James¹ has already been discussed; his findings that urine alcohol concentrations were higher than blood alcohol concentrations and that suicide occurred hours after alcohol consumption seem more supportive of the latter view, which is how James himself construed his findings.

Clifford⁶ looked at the relationship between alcohol consumption rate, suicides, and road deaths in Australian states and territories and came to the conclusion that alcohol was probably directly related to suicide in some cases. He reported that the annual average road death for Western Australia (30.7 per 100 000) was the second highest of all states during 1968 to 1977 and the average suicide rate for Western Australia was 11.5 per 100 000, the third highest rate of the states. The average ratio of road deaths to suicides in Western Australia for the period 1963 to 1977 was 2.5:1. Clifford noted that the results were

suggestive of a relationship between alcohol and suicide: "... in comparison to other states, the limited data available shows Western Australia to have the second highest road death rate, the second highest alcohol consumption and expenditure rates—and the third highest suicide rate. This could be more coincidental, the relationship between drunken driving and deaths on the road being well established."

The present study was designed to collect data on three years of consecutive suicides in Western Australia in order to investigate the relationship between alcohol use prior to the suicide, and the act of suicide. A major question of interest was whether those people who consumed alcohol prior to the suicide differed from other suicide cases, and whether any resultant pattern of differences suggested an explanation for the role of alcohol in suicide.

Methods

SUBJECTS

Five hundred and fifteen consecutive suicides in Western Australia between 1 January 1986 and 31 December 1988 were studied. The Perth Metropolitan Coroner's Court dealt with 421 of these cases, the remaining 94 were dealt with in country districts of Western Australia. The ratio of males to females was 4.5:1, with 414 male suicides and 101 female suicides being studied. The average age of the suicide cases was 41.3 years (SD = 17.5), with no significant difference in age between males (41.2 years) and females (41.7 years). Two hundred and ten subjects were married or living in defacto relationships, 181 were single, and the remaining 124 were divorced, separated, or widowed. Of the sample, 69.1% were Australian born (with 2.1% of the sample being aboriginal), 15.1% were born in England, Scotland, Wales, and Ireland, and the remaining 15.8% came from a number of other countries. It would appear that the suicide sample is similar to the Western Australian population in terms of country of birth. The 1986 Australian census showed that 72.5% of Western Australians were born in Australia (2.7% of the population being aboriginal), and that the remaining 27.5% were born overseas (including the United Kingdom). Apart from those born in England, Scotland, Wales, and Ireland (who comprise 13.5% of the Western Australian population) the numbers from other countries are too small to compare.

PROCEDURE

All files on sudden death in this state are held in the Perth Coroner's Office. Cases were examined where the Coroner's ruling had been death by suicide. Coronial files contain detailed documentation, including: forensic pathology reports, police records of interviews with family and friends, documentation from the person's medical practitioner and/or psychiatrist and hospitals (where relevant), details of the circumstances of death, and the suicide note, if any. The following data were extracted from the files: demographic details; cause of death; presence of drugs in the body at time of death (including alcohol); the relationship between the presence of the drug and cause of death; history of

drug misuse and type of drug misused; psychiatric history and type of psychiatric illness; number of admissions to psychiatric hospitals; whether the person was currently being treated for a psychiatric problem and type of treatment received; whether the person had approached any professional for help prior to the suicide and type of help received; whether friends or relatives thought the person was depressed and the reasons they gave for it; and whether the person left a suicide note and the reasons in it for the suicide.

This paper is concerned primarily with the relationship between alcohol, drugs, and suicide. Details regarding the person's history of drug misuse and type of drug were recorded from a variety of sources and vary in terms of reliability. In some cases the police would note the person as a known drug offender, in others the person's physician would provide the detail, and in others the information would be obtained from interviews by police with family and friends. It is in the latter category that judgments about drug abuse may be inaccurate, although the most likely source of error would probably be that of underreporting rather than overreporting. Details regarding drugs present in the body at time of death and relationship between the drug and cause of death are likely to be reasonably accurate since this information was obtained from forensic pathology reports. The largest source of error in the latter data is the variations between cases in the time elapsing between collection of specimens and time of death.

Results

BLOOD ALCOHOL LEVELS AT TIME OF DEATH

Blood alcohol levels at time of death were taken in all but six cases, where the condition of the body did not enable a measurement to be taken. At the time of death 327 cases had no alcohol in their blood, in 56 cases the blood alcohol was between 0.001 and 0.049%, in 23 between 0.05 and 0.079% (moderate impairment), and in 103 it was 0.08% or greater (significant impairment). In other words, 35.8% of all suicides had some alcohol in their blood, and 24.5% were moderately to significantly impaired by alcohol at the time of death. Males were more likely to have consumed any alcohol than females (39.7% versus 19.8%). Overall, there was a small but significant negative correlation between blood alcohol and age for the entire group ($r = -0.14$, $p < 0.001$) and for males ($r = -0.16$, $p < 0.001$); females, however, had no correlation between alcohol consumption and age ($r = 0.00$).

Table 1 Blood alcohol levels (BAL) by method of suicide, 1986-1988

Type of suicide	Blood alcohol levels (%)				% BAL positive*
	0.0	0.001-0.049	0.05-0.079	0.08+	
Carbon monoxide poisoning	92	31	11	47	49.2
Firearms	53	7	1	25	38.4
Drug overdose	49	8	2	8	26.9
Hanging	74	3	5	16	24.5
Jumping	11	0	0	1	8.3
Other poison	5	2	0	1	37.5
Moving object	5	1	0	0	16.7
Drowning	9	1	2	1	30.8
Stabbing/cutting	4	1	0	1	33.3
Other	25	2	2	3	21.9
Totals	327	56	23	103	

*BALs not available for six cases

When cases with positive blood alcohol tests were broken down into age groups, a high percentage of 15 to 19 year olds (44.8%) were represented. The 20 to 24 year age group had a smaller proportion of cases with positive blood alcohol tests (35.1%), the 25 to 44 year olds had the lowest proportion with positive blood alcohol tests in 25.9%.

BLOOD ALCOHOL LEVELS AND METHOD OF SUICIDE

The most common methods of suicide were carbon monoxide poisoning ($n = 181$), hanging ($n = 98$), firearms ($n = 86$), and drug overdose ($n = 67$). Details of method of suicide and blood alcohol levels are given in table I. More cases positive for blood alcohol were found in suicide due to carbon monoxide poisoning (49.2%) than to any other method.

Of the other more common methods of suicide, 38.4% of cases of suicide by firearms were positive for alcohol, 26.9% of drug overdose, and 24.5% of hangings. Of the less common methods, people who jumped off buildings or other structures or who placed themselves in front of moving objects were less likely than people who used other methods to have consumed alcohol prior to the suicide.

BLOOD ALCOHOL LEVELS AND URINE ALCOHOL LEVELS

Urine and blood alcohol levels were available for 458 of the 515 subjects. Urine alcohol levels were higher (0.045%) than blood alcohol levels (0.040%) for the entire sample ($t = -3.24$, $df = 457$, $p < 0.001$). Males had higher urine alcohol (0.053%) and blood alcohol (0.046%) than females (0.016% and 0.16% respectively) on average ($t = 3.25$, $df = 298$, $p < 0.001$ for urine alcohol, and $t = 2.85$, $df = 336$, $p < 0.005$ for blood alcohol).

Overall, 49 subjects had higher blood alcohol than urine alcohol, that is, they had been drinking over a relatively short period of time, and 101 had higher urine alcohol than blood alcohol, indicating drinking over a longer period of time.

The pattern of males having higher blood alcohol than females in the whole sample remained the same when mean blood and urine alcohol values were calculated for only those people who had consumed any alcohol. Males who had consumed alcohol had an average blood alcohol of 0.12% and a urine alcohol of 0.13%; in females the average blood and urine alcohol values were 0.08% and 0.07% respectively.

BLOOD ALCOHOL LEVELS AND DRUG MISUSE HISTORY

Of all suicide cases 26.2% (135) had a history of drug or alcohol misuse, with alcohol being identified as a drug of misuse in 108 cases.

On average, those with a history of drug or alcohol misuse had a higher blood alcohol (0.062%) than those without (0.032%) at the time of suicide ($t = 4.10$, $p < 0.001$). Of those cases with a history of abuse, 44.4% were positive for blood alcohol versus 32.7% of those with no such history. The differences were at the extremes of alcohol consumption; those people with no alcohol in their blood were less likely to have an alcohol or drug misuse history (67.3%) than those with such a history (55.6%). People with a drug

misuse history were more likely to have a blood alcohol level of 0.08% or more (31.1%) than those without (16.4%). However, there were no differences between those with or without a drug misuse history for blood alcohol levels between 0.01% and 0.79% (13.3% and 16.3% respectively).

RELATIONSHIP BETWEEN ALCOHOL CONSUMPTION PRIOR TO SUICIDE AND PSYCHIATRIC HISTORY AND PSYCHOLOGICAL STATE

Eight percent of people with a previous history of psychiatric illness (ie, prior to the episode immediately preceding the suicide) had no alcohol in their blood, compared to 59.7% of those with no psychiatric history.

People negative for blood alcohol were more likely to have sought help from a professional (50.0%) than those positive for alcohol (33.3%) ($\chi^2 = 12.4$, $p < 0.001$). Those members of the alcohol negative group who sought help were more likely to have gone to a psychiatrist (70.4%) than a general practitioner (27.7%), whereas alcohol positive people were equally likely to have gone to a psychiatrist (55.7%) or a general practitioner (41.0%) if they sought help.

As might be expected, help seeking and treatment were related, so that people who were negative for blood alcohol were also more likely to be receiving treatment (45.3%) than those who were positive for alcohol (27.0%) ($\chi^2 15.5$, $p < 0.0001$).

Regardless of a person's alcohol consumption prior to suicide, friends and relatives were equally likely to describe them as depressed immediately prior to the suicide (73.4% and 69.1% of those negative and positive for alcohol respectively).

In the majority of suicide cases (509) an event occurring prior to the suicide was nominated as a contributing factor to the suicide by friends or relatives. The frequency of nomination of such an event did not differ between the negative (87.8%) and positive (89.0%) alcohol groups. The following types of events were identified: financial problems, break up of a significant relationship, death of a close friend or family member, family problems, trouble with the law, physical illness, old age, loss of job, loneliness, or psychiatric illness (see table II). The alcohol positive group was significantly more likely than the alcohol negative group to have experienced break up of a relationship (59.3 versus 37.4%), or loss of job (17.0 versus 5.8%). The only event that was mentioned more often for the alcohol negative group was psychiatric illness (20.9 versus 6.0%).

The two groups did not differ on either threatening to commit suicide (39.1% and 35.4%,

alcohol negative and positive groups respectively) or having made previous attempts (32.0% versus 28.0%).

ALCOHOL IMPAIRMENT

People who were alcohol impaired (a blood alcohol of 0.05% or more) at time of death were compared to the rest of the suicide cases. Alcohol impaired cases were younger (mean age 37.0 years) than those who were not (mean age 42.8 years, $t = 3.28$, $p < 0.001$). Proportionally more males (27.9%) than females (11.9%) were impaired by alcohol. Of those in the alcohol impaired group, 46.0% used carbon monoxide, 20.6% used firearms, and 16.7% hanged themselves.

There were no differences between the two groups in threatening (37.5% and 38.4%) or attempting (31.2% and 28.6%) to commit suicide. The alcohol impaired group, however, were more likely to have experienced a break up of a relationship (61.9%) than the rest of the sample (39.8%), more likely to have lost their job (20.6% versus 6.3%), and less likely to have a physical illness (12.7% versus 23.8%).

Discussion

Generally, results from this study have produced similar findings to those from earlier studies. The number of people with a history of alcohol abuse in this study (26.6%) is similar to the findings of studies from overseas⁷ and Australia.⁸

A substantial number of suicides had positive blood alcohol at time of death (35.8%), with 24.8% of all suicides being moderately or significantly impaired by alcohol (ie, an alcohol level of 0.05% or more) at the time of the suicide, results strikingly similar to those reported by Kraft and Babigian.² Males were more likely to have consumed any alcohol (39.7%) than females (19.8%), a finding similar to that of Varadaraj and Mendonca.³ Overall, there was a small negative correlation between blood alcohol and age, with 44.8% of teenagers, and 35.1% of 20–24 year olds being positive for blood alcohol; positive blood alcohols were found less frequently in people over 45 years of age (25.9%). This trend for those who have been drinking to be younger is opposite to that reported by Varadaraj and Mendonca.³ Brent *et al.*,⁵ however, also found that 46% of youth suicides were positive for blood alcohol and related their findings to increases in alcohol consumption among young people.

Urine alcohol levels were higher on average than blood alcohol levels. The finding of more cases with higher urine than blood alcohol replicates those of James¹ and suggests that many suicide cases had been drinking for some time prior to their death. The present study, however, does seem to contain more subjects who had been drinking over a shorter period of time, although it should be noted that the data for blood and urine alcohol levels in this study were far more complete than in the earlier one.¹

The most common method of suicide in the present study was carbon monoxide poisoning, followed by hanging, firearms, and drug overdose. More positive blood alcohol values were found in suicides by carbon monoxide poisoning than by any other method.

Table II Type of event described as precipitating suicide in blood alcohol positive and negative cases

Event	Blood alcohol	
	Negative	Positive
Financial problems	12.9	19.2*
Relationship break up	37.4	59.3†
Death of spouse/friend	12.0	9.3
Family problems	6.7	6.0
Problems with law	9.2	8.8
Illness	23.9	15.9
Old age	2.8	1.6
Job loss	5.8	17.0†
Loneliness	4.0	1.6
Psychiatric illness	20.9	6.0†
Other	3.1	2.2

Note: More than one event per person could be nominated
* $p < 0.05$; † $p < 0.001$ v negative group

Cases positive or negative for blood alcohol were compared for a number of psychological variables and psychiatric history. People who were alcohol positive were less likely to have sought help from a professional than those who were alcohol negative. Where professional help had been sought, alcohol negative people were more likely to have gone to a psychiatrist than to a general practitioner, whereas alcohol positive people were equally likely to have gone to either.

Alcohol negative people were also more likely to have a history of psychiatric illness than the alcohol positive group. Both groups, however, were equally likely to have been described by family or friends as being depressed immediately prior to the suicide; furthermore there was no difference in the identification rate of a possible precipitating event prior to the suicide. The negative and positive alcohol groups did differ, however, in the type of precipitating event identified. Those positive for alcohol were more likely to have experienced the break up of a relationship and loss of job. The only event that was mentioned more for the alcohol negative group was previous psychiatric illness. Interestingly, there were no differences in the number of people who threatened and had previously attempted suicide, with approximately 37% of the suicide cases having threatened suicide, and approximately 30% having made a previous attempt.

When those cases with blood alcohol levels greater than 0.05% (alcohol impaired) were compared to the other suicide cases, the alcohol impaired group were younger, and more likely to be male and to have used carbon monoxide, firearms, and hanging as methods of suicide. Alcohol impaired suicides were also more likely to have experienced a relationship break up or loss of job and less likely to have a physical illness than other suicide cases.

Many of these people had been drinking for some time prior to their death, and it is possible that in such cases the depressant and disinhibiting effects of alcohol, combined with depression arising from a recent loss of a relationship and lack of attempt to seek professional help, created an emotional state where they sought to take their lives.

It has been suggested that impulsive suicides, which, it could be argued, are likely to include those committed under the influence of alcohol, are most likely to use easily accessible or convenient methods.⁹ The choice of carbon monoxide poisoning from a motor vehicle could fall into this category as it is a method which is

convenient and accessible (most people in Western Australia have access to motor cars). In the present study it was also the method most commonly used by those who were positive for alcohol. In the USA, studies have linked suicide using firearms to increases in alcohol consumption.⁹ Firearms are more widely available in the USA than in Australia, and it is possible that a similar effect due to availability is being seen in Western Australia, with the use of carbon monoxide as a method of suicide.

It is of interest that 30% of alcohol positive suicides were receiving treatment from a professional prior to their suicide. Perhaps some impact could be made on suicide rates if professionals were alerted to the danger of alcohol consumption during depression, and stressed to their patients the need to avoid consuming alcohol during such times.

The data from the present study do not provide evidence for a direct causal relationship between excess alcohol consumption and suicide. On the other hand, the data we present here suggest that alcohol consumption may function as an important effect modifier to the act of suicide. The differences between alcohol impaired cases and the other cases of suicide in age, lack of previous psychiatric history, differences in prior psychological stressors, and in particular the high rate of relationship break up and lack of help seeking behaviour, suggest that alcohol may be an important factor in the final act of suicide. As such, alcohol consumption is best understood as in the first place a response to (or symptom of) mental health and psychosocial morbidity, and then, for some, as a potential modifier in the chain of decisions leading to the act of suicide.

We would like to thank Doreen Hayward and Colleen Lang for coding and entering the suicide data and Maria Kent and Shelley Frowen for typing the manuscript.

- 1 James P. Blood alcohol levels following successful suicide. *Q J Stud Alcohol* 1966; 27: 23-9.
- 2 Kraft DP, Babigian HM. Suicide by persons with and without psychiatric contacts. *Arch Gen Psychiatry* 1976; 33: 209-15.
- 3 Varadaraj R, Mendonca J. A survey of blood alcohol levels in self-poisoning cases. *Adv Alcohol Subst Abuse* 1987; 7: 63-9.
- 4 Friedman IM. Alcohol and unnatural deaths in San Francisco youths. *Pediatrics* 1985; 76: 191-3.
- 5 Brent DA, Perper JA, Allman CJ. Alcohol, firearms, and suicide among young. *JAMA* 1987; 257: 3369-72.
- 6 Clifford W. *Suicide in Western Australia*. Canberra: Australian Institute of Criminology, 1979.
- 7 Berglund M. Suicide in alcoholism: a prospective study of 88 suicides: 1. The multidimensional diagnosis at first admission. *Arch Gen Psychiatry* 1984; 41: 888-91.
- 8 Chynoweth R, Tonge JI, Armstrong J. Suicide in Brisbane: a retrospective psychosocial study. *Aust NZ J Psychiatry* 1980; 14: 37-45.
- 9 Farmer RDT. Assessing the epidemiology of suicide and parasuicide. *Br J Psychiatry* 1988; 153: 16-20.