

The Role of Alcohol in Deaths Presenting to the Coroner's Service in Cork City and County

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Abstract

A retrospective study was conducted in order to determine the prevalence and concentration of alcohol in post-mortem blood samples sent for toxicological analysis in Cork City and County in 2003 and 2004. Post mortem reports of these deaths were reviewed for the presence or absence of alcohol at the time of autopsy, blood alcohol concentration (BAC) at time of death, age and sex of the decedents. Of samples sent for blood alcohol analysis (BAA), 38.4% were positive for alcohol. Significant differences were found between the proportions of alcohol positive cases by cause of death. Alcohol positive cases were significantly younger (44.3 ± 17.8 years) than alcohol negative cases (51.9 ± 19.4 years) and fifty two percent of drivers were positive for alcohol at the time of death. Awareness of the harmful and potentially fatal effects of alcohol should continue to be raised within the community, so as to prevent future fatalities.

Introduction

All sudden, unexplained and unexpected deaths, in Cork City and County are referred to the Coroner's service for post mortem examination. A percentage of these deaths are alcohol related in some way. The Irish continue to be amongst the highest consumers of alcohol in the world, ranking second in 2001 for alcohol consumption within the enlarged EU. In 2003, alcohol consumption per adult was 13.5 litres of pure alcohol, and alcohol related problems cost Irish society in excess of €2.65 billion¹. A study by Ramstedt and Hope² in 2004 showed that adults in Ireland had the highest level of binge drinking in comparison to adults in six other European countries (UK, Germany, Italy, France, Sweden, Finland). The overall finding was that adverse consequences particularly related to single heavy drinking occasions were relatively common in Ireland. The aim of this study is to determine the prevalence and concentration of alcohol in the various types of death presenting to the coroner's service in Cork city and county for the years 2003 and 2004. The reported frequency of cases with alcohol present in post-mortem samples varies from 20-50% in different studies³.

Methods

All medico-legal autopsies in Cork city and county are conducted at the City Morgue on the grounds of Cork University Hospital. This serves a population of 447 829 people⁴. From January 1st 2003 to December 31st 2004, 1028 autopsies were conducted, and of these, 47% were sent for toxicology. Cases that were not sent for blood alcohol analysis were those in which the decedent had a known disease or illness, those involving very small children, infants and badly decomposed bodies. Blood samples were taken in glass bottles (Greiner Bio-One), containing sodium fluoride and potassium oxalate, which inhibit bacterial fermentation of the sample so as not to distort the true blood alcohol concentration (BAC). Samples were analysed for blood ethanol by means of reverse phase gas chromatography (Pencin-Elmer Clarus 500). Blood alcohol concentrations are reported in mg%, where 1.0 mg% is equivalent to 1 mg of alcohol per 100 mL of blood. In Ireland, it is illegal to drive a motor vehicle with a BAC of 80 mg% or higher. Because alcohol is known to impair judgement at levels lower than the legal limit⁵ any presence of alcohol at time of death was considered a positive case.

The data set was analysed according to age, sex, manner of death, and blood alcohol level. Manner of death describes the circumstances of the victim at the time of death (i.e. road traffic accident, drowning, fall, hanging and others) and will be referred to as cause of death for the purpose of this study. The study excludes those aged 12 years and younger.

Complete details for all variables were obtained from post-mortem reports. Age was missing for six cases, which was adjusted for in

statistical analysis. All cases examined in this study were 'closed' as they had completed inquest proceedings. The study focused on those deaths found positive for blood alcohol (BA), which were compared to alcohol negative deaths where possible. Permission to proceed was granted by the four Coroners for Cork. Data was processed with SPSS version 12.1 for windows using standard statistical methods.

Results

Four hundred and eighty two samples were sent to the State Laboratory for the analysis of blood alcohol. Of these, 185 (38.4%) were found positive, with concentrations ranging from trace amounts to 628 mg%, with a mean of $175.3 \text{ mg}\% \pm 112.5 \text{ mg}\%$. Of all deaths involving alcohol, 76% were over the legal limit of 80 mg%. Twenty percent were below the legal limit, and four percent contained only trace amounts of alcohol. The greatest proportion of alcohol related deaths belonged to a BAC category of between 101-200 mg%. Twelve percent of alcohol related deaths had levels $\geq 300 \text{ mg}\%$, which some studies quote as being lethal³.

Blood Alcohol Positive Cases

All cases sent for toxicology were classified according to cause of death (Figure 1), and the percentage of alcohol positive cases within each category was determined. The relationship between categories was found to be significant ($\chi^2 = 65.889$, $Cr = .37$, $P < .001$). The average alcohol concentration by cause of death for positive cases was also determined (Figure 1). A comparison of means using a one-way ANOVA test found a significant relationship between the various causes of death ($F = 13.257$, $df = 11$, $P < .001$).

RTA = road traffic accident. D&AOD = drug and alcohol overdose, AAINTOX = acute alcohol intoxication, GSW=gun shot wound,

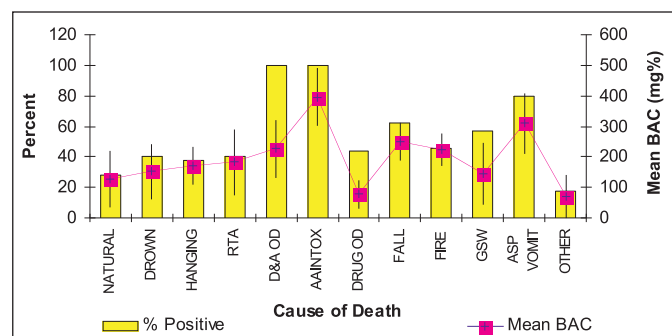


Figure 1 Percentage of cases found positive for blood alcohol classified by cause of death, and mean BAC by cause of death.

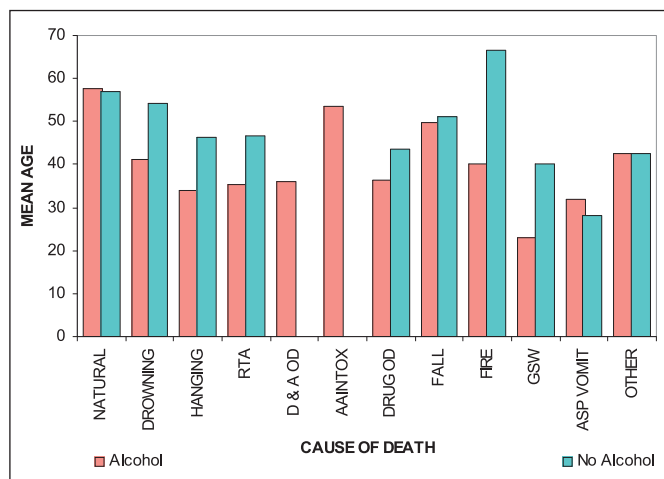


Figure 2 Mean age by cause of death for alcohol positive and alcohol negative deaths.

ASPVOMIT=aspiration of vomitus, OTHER= car exhaust carbon monoxide poisoning, crush injury, undetermined/sudden unexpected death, hypothermia, choking, industrial accident, poisoning, suffocation, stabbing.

Age

A statistically significant difference was found between the mean age of the BA positive decedents (44.3 years \pm 17.8 years) and those negative for BA at the time of death (51.9 years \pm 19.4 years) ($t = 4.292$, $P < .001$). Furthermore, when comparing mean ages between causes of death for the positive and negative groups, victims of deaths involving alcohol were younger for most causes of death (Figure 2). A one-way ANOVA for the comparison of means found a significant relationship between the mean age and cause of death ($F = 1.451$, $P < .05$) in BA positive deaths.

Alcohol positive and negative deaths were compared by age groupings. A significant relationship was found to exist between the presence or absence of BA at the time of death and age category ($\chi^2 = 23.969$ $P < .001$). Those younger than 25 were more often intoxicated than not and comprised the largest proportion of alcohol positive deaths by age group. The 46-55 group had the highest average BAC (Table 1).

Gender

Males comprised 79.5% of the alcohol positive sample. The mean BAC in positive cases for females was 193.21 mg% \pm 128.6 mg% and 170.67 mg% \pm 107.9 mg% for males. Women were on average five years older than men in alcohol positive cases (48.84 \pm 17.5 years versus 43.12 \pm 17.7 years respectively).

Road Traffic Accidents (RTAs)

Decedents involved in RTAs are listed in table 2. Forty percent of all RTAs in this study involved alcohol (Fig. 1). All drivers positive for alcohol were male with a mean age of 32.9 years (\pm 12 years), compared to BA negative cases, with an average age 45.2 (\pm 24.5 years). Although not significant, this 12-year age difference is substantial. Pedestrians were found to have the highest BAC (Table 2).

Discussion

The presence of drugs at time of death is a possible confounding variable in this study. Previous studies vary on their inclusion of these cases. Because the main aim here was to study the prevalence of alcohol in all deaths presenting to the coroner's service, all alcohol positive deaths were included regardless of drug status.

There is clear evidence that driving skills deteriorate and the risk of becoming involved in a crash increases from a blood alcohol concentration of 20mg per 100 ml⁶. A study looking at blood alcohol levels of those dying in RTAs in Cavan, Monaghan and Louth in 2001 and 2002 found that 40% of those killed on the road had alcohol present in their blood and that all drivers detected with alcohol in their blood were male⁷. These figures closely match the present material. Of all RTA victims, pedestrians in this study and in others have been found to have the highest BAC compared to drivers and passengers⁸. One of the recommendations set out by the Strategic Task Force on Alcohol in their second report in 2004 was to lower the Irish legal limit of BAC to 50 mg%. Several EU countries have lowered their limits from 80mg% to 50mg% in recent years with Sweden at the lowest limit of 20mg%, where only 22% of RTA deaths were found positive for BA⁹.

Alcohol related death, illness and injury is one of the largest public health issues facing Ireland today. Alcohol substantially increases the risk of an individual to die an unnatural and violent death¹⁰ as

Table 1 Prevalence of BA positive and negative deaths, main cause of death, by age category for Cork City and County 2003-2004.

Age group	≤ 25	26-35	36-45	46-55	56-65	>65
Alcohol ^a Positive % (N)	52.7% (39)	44.4% (28)	52.2% (35)	30.8% (28)	37.8% (28)	24.3% (26)
% of total Positive Deaths	21.2 %	15.2%	19.0%	15.2%	15.2%	14.1%
Average BAC mg% Positive cases	150 % \pm 80.8 %	186 % \pm 123.1 %	186 % \pm 116.9 %	223 % \pm 121.8 %	155 % \pm 115.5 %	159 % \pm 114.1 %
Main COD in positive cases	Hanging	Hanging	Natural	Natural	Natural	Natural
Alcohol ^a negative % (N)	47.3% (35)	55.6% (35)	47.8% (32)	62.9% (63)	62.2% (46)	75.5% (81)
% of total Negative Deaths	11.8%	11.8%	10.8%	21.2%	15.5%	27.3%
Main COD in negative cases	RTA	Natural	Natural	Natural	Natural	Natural

^a $\chi^2 = 23.969$ $P < .001$

Table 2 Mean blood alcohol concentration according to decedent situation in road traffic accidents for Cork City and County 2003-2004.

RTA Victim	Alcohol Positive N	Alcohol Negative N	% Positive for alcohol	Mean BAC mg%
DRIVER/ MOTORCYCLIST	14	13	52%	172.2 ± 120.9
PASSENGER	1	8	12.5%	192.0
PEDESTRIAN	4	6	40%	217.5 ± 54.7
BICYCLIST	0	1	0%	–

it blurs rational thinking and increases self-destructive behaviour and aggressiveness towards others¹¹. It is debatable what BAC is necessary before acute alcohol influence should be regarded as a contributory cause of death³. Factors such as size, time of last meal, and alcohol tolerance all play a role in how alcohol impairs a person's coordination, vision and thinking. It is important to recognize the relationship between alcohol and unexpected deaths, as these deaths are potentially preventable. Studies to determine how the BAC of Irish deaths reflects on alcohol consumption in the overall population compared to other EU countries would create greater awareness of the problem of alcohol related deaths on a national and European level.

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References

1. Strategic Task Force on Alcohol. Second Report. Ireland: Health Promotion Unit, Department of Health and Children; September 2004.
2. Ramstedt M, Hope A. The Irish drinking culture – drinking and drinking-related harm, a European comparison. [Online]. 2004. [cited 2006 Jan 8]; [10 pages]. Available from: URL:http://www.healthpromotion.ie/uploaded_docs/Irish-Drinking-Culture.pdf.
3. Nordrum I, Eide TJ, Jorgensen L. Alcohol in a series of medico-legally autopsied deaths in northern Norway 1973-1992. *Forensic Sci Int* 2000 May 15;110:127-137.
4. Central Statistics Office Ireland. [Online]. 2002 [cited 2005 Dec 22]; Available from: URL:<http://www.cso.ie/census/>.
5. National Safety Council. Never ever drink and drive. [Online]. 2005. [cited 2005 Dec 22]; Available from: URL:<http://www.nsc.ie/RoadSafety/RoadSafetyIssues/DrinkDrivingLeaflet/>.
6. BBC News. Alcohol limits should be lower. [Online]. 2004 Apr 8 [cited 22 Dec 2005]; Available from: URL:<http://news.bbc.co.uk/1/hi/health/3611173.stm>.
7. Condon D. Young men risk driving drunk. [Online]. 2004 Nov 11 [cited 22 Dec 2005]; Available from: URL:<http://www.irishhealth.com/?level=4&id=6624>.
8. Hain JR, Ryan DM Spitz WU. Fatal accidents and blood ethanol levels in adolescents and adults. *Am J Forensic Med Pathol* 1989 Sep;10:187-192.
9. Sjogren H, Eriksson A, Ahlm K. Alcohol and unnatural deaths in Sweden: a medico-legal autopsy study. *Alcohol Clin Exp Res* 2000 Jul;24:1050-1056.
10. Loftus IA, Dada MA. A retrospective analysis of alcohol in medicolegal post-mortems over a period of five years. *Am J Forensic Med Pathol* 1992 Sep;12:248-252.
11. Skibin L, Bilban M, Balazic J. Harmful alcohol use of those who died a violent death (the extended region of Ljubljana 1995-1999). *Forensic Sci Int* 2005 Jan 17;147:S49-52.