Injuries

Gender differences in role of alcohol in fatal injury events

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Background: The aim was to investigate the differences in alcohol involvement in fatal injury events between females and males. Methods: Information was obtained from the Forensic Medicine Database and the Forensic Toxicology Database of the National Board of Forensic Medicine, and from the inpatient register of the National Board of Health and Welfare. Alcohol was regarded to be involved in the injury event: if there was any indication that the deceased was a ‘known alcoholic’; if the underlying or contributing causes of death were alcohol-related; if the deceased had alcohol-related inpatient diagnosis during a 3-year period prior to death; or if the deceased tested positive for blood alcohol at autopsy. All injured cases who underwent medico-legal autopsies (1992–1996) in Sweden were analysed (4471 females and 11 156 males). Results: Compared to males, females died more often (P < 0.05) in intentional injury events (48.0% females, 44.2% males), were less often (P < 0.001) blood alcohol-positive (29% females, 43% males), had lower (P < 0.05) blood alcohol concentrations (0.17% in females, 0.18% in males), and were less likely (P < 0.001) to have an alcohol-related death history (18.4% females, 24.4% males). For females, intentional deaths (31.4%) were significantly (P < 0.001) more often alcohol-related than unintentional deaths (22.9%). A significantly (P < 0.001) higher proportion of deaths in males (48.4%) were alcohol-related compared to females (32.9%). Conclusions: Almost every third injury event in females and in almost every other event in males is alcohol-related, showing that alcohol plays an important part in fatal injuries in females even though it is mostly a male problem.

Keywords: alcohol, deaths, gender, injuries
and Welfare for a period of 3 years prior to death (for details of methods see Sjögren et al.\textsuperscript{30}).

Cases with alcohol-related underlying and contributing causes of death, and/or with alcohol-related inpatient diagnoses were identified as described previously.\textsuperscript{30} Cases were regarded to have an alcohol-related history if they had alcohol-related underlying and contributing causes of death, alcohol-related inpatient diagnoses, or other indication of alcoholism. Deaths were regarded to be alcohol-related if there was any indication in the information from Forensic Medicine Database that the deceased was a ‘known alcoholic’ or ever had any health or other problem associated with drinking; if the deceased had alcohol-related underlying and contributing causes of death; if he/she had alcohol-related inpatient diagnoses during a period of 3 years prior to death; and if he/she tested positive for blood alcohol at autopsy.

Based on ICD-9 E-codes,\textsuperscript{29} injuries were grouped into nine groups as follows: traffic injuries (E800–E849), intoxication (E850–E869), falls (E880–E888), fire (E890–E899), asphyxia (E910–E915), suicide (E950–E959), homicide (E960–E969), other (E870–E879, E900–E909, E916–E949, E970–E978, E990–E999), and undetermined manner of death (E980–E989).

Terms such as ‘alcohol-related deaths’ and ‘role of alcohol’ are used in the present report, and imply that alcohol is a component present in the events that lead to death. Most ‘causes’ are components of a cluster of causes, which together are sufficient to produce a condition.\textsuperscript{31} Since research has shown that alcohol increases the risk of death from a given physical insult,\textsuperscript{32} it is reasonable to assume that alcohol is a component ‘cause’ of certain types of death.

Biochemical analysis

The concentrations of ethanol were determined by headspace gas chromatography as reported in detail elsewhere.\textsuperscript{33}

Statistics

Significance in mean values of blood alcohol concentrations (BACs) between two groups was tested using the independent sample t-test (SPSS 9.0, 1998). Comparisons between proportions expressed as percentages were done using χ²-test (SPSS 9.0, 1998). The risk of having an alcohol-related history when testing positive for blood alcohol was estimated as odds ratios (SPSS 9.0, 1998).

Results

Age and external cause of death

Of the total investigated (n = 15 627), 28.6% were females and 71.4% males (table 1). Females (mean age 52.0 years, SD 21.2) were significantly (P < 0.05) older than males (mean age 48.5 years, SD 19.5), and were also significantly (P < 0.05) older than males in all subgroups of external causes of death, except for the homicide group where there was no significant age difference. A significantly (P < 0.05) higher proportion of females (48%) than males (44.3%) died due to intentional causes (table 1). The largest group of both males and females died due to suicide, followed by traffic events, asphyxia, falls, homicide, intoxication, and fire (table 1).

Prevalence of alcohol and alcohol-related history

Eighty-one per cent of females and 85% of males were tested for blood alcohol (table 1). Of those tested, 29.3% of the females and 42.7% of the males tested positive (table 2). Data for different causes of death are presented in table 2. For unintentional deaths, fewer females (20.3%) were blood alcohol-positive than males (40.2%). Females who died due to intentional causes (28.7%) tested positive significantly (P < 0.05) more often than those dying due to unintentional causes (20.3%) whilst for males there was no significant difference (intentional causes, 38.7%; unintentional causes, 40.2%).

Females (0.17%, SD 0.12) had significantly (P < 0.05) lower mean BACs than males (0.18%, SD 0.11). For intentional deaths, females (0.13%, SD 0.09) had significantly (P < 0.001) lower mean BACs than males (0.15%, SD 0.09) but for unintentional deaths there was no significant difference between the sexes (females 0.21%, SD 0.13; males 0.20%, SD 0.11).

Data for differences in alcohol-related history between females and males for different causes of death are presented

<table>
<thead>
<tr>
<th>Table 1 Different groups of external causes of death and blood alcohol tested in each group for females and males</th>
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<tbody>
<tr>
<td><strong>Population investigated</strong></td>
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<tr>
<td><strong>Female</strong></td>
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<tr>
<td><strong>Unintentional death</strong></td>
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<tr>
<td>Traffic</td>
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<td>Intoxication</td>
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<td>Falls</td>
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<td>Other</td>
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<td><strong>Intentional death</strong></td>
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<td>Suicide</td>
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<td>Homicide</td>
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<td>Undetermined</td>
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<td><strong>Total</strong></td>
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</table>

<sup>a</sup> Percentage of all females and males, respectively

<sup>b</sup> Percentage tested for blood alcohol in each group of external cause of death
Strengths and limitations

In table 2. Alcohol-related history was significantly (P < 0.001) less common in females than in males. For unintentional deaths alcohol-related history was significantly (P < 0.05) less common in females (11.5%) than in males (22.7%). For suicides there was no significant difference between females (15.9%) and males (15.0%). Among homicide victims the proportion of a positive alcohol-related history was higher (P < 0.001) in males (20.6%) than in females (5.9%). Females were about three times more likely than males to have an alcohol-related history if they tested positive for blood alcohol at autopsy (table 2).

**Alcohol-associated deaths**

Data for differences in alcohol-related deaths between females and males for different causes of death are presented in table 3. A significantly lower proportion (P < 0.001) of deaths in females than in males were alcohol-related: 28.8% of females and 44.3% of males (table 3). If only blood alcohol tested cases were included in the analysis, alcohol-related deaths increased for both females and males (table 3). For females, intentional deaths (31.4%) were significantly (P < 0.001) more often alcohol-related than unintentional deaths (22.9%) whilst for males (intentional, 45%; unintentional, 43.2%) there was no significant difference. Both female and male alcohol-related death victims were significantly (P < 0.001) younger (female 47.9, SD 15.6; male 45.6 years, SD 15.5) than those where death was not alcohol-related (female 53.7 years, SD 22.9; male 50.5 years, SD 22.0). For those aged <59 years, 41.5% of deaths in females and 55.5% of deaths in males were alcohol-related (table 3).

**Discussion**

**Strengths and limitations**

The present study is unique in that there is no published study in the scientific literature investigating gender differences in alcohol-related mortality due to all types of injuries, based on a large autopsy series. Use of medico-legal autopsy data on males and females in the present study offered distinct advantages in investigating the relationship between alcohol and fatal injuries, in that a high proportion of both females and males were tested for alcohol and also information on alcohol abuse was available. In comparison to other studies on alcohol involvement in injuries (30–62% females, 51–69% males; 17,39), a much higher proportion of both male and female victims were tested for alcohol in the present study (81% females, 85% males), increasing the reliability of the present findings. The present results are based on 53% and 76% of all fatal injuries in Sweden in females and males, respectively (Sjögren and Ericksson, unpublished data). Since the medico-legal autopsy rate is higher in age group 0–59 years (84% females, 90% males) than among older victims, the present results are more reliable for premature unnatural mortality. Totally, approximately one-third of all cases with unnatural death were issued a death certificate without medico-legal autopsy. In that study most of these were older persons (mean age 78 years) who were injured in falls (56%) or other persons who had had prolonged hospital care before death (87%).

By using various sources of information such as the underlying and contributing cause of death based on autopsy, information on evidence of alcohol abuse from autopsy reports, toxicology data, police records, and hospital discharge data, chances of detecting alcohol abuse in our study population were optimized. All these sources have limitations but taken together, underestimation of alcohol-related mortality is minimized in the present study.

In cases testing positive for blood alcohol, it was assumed that alcohol played a role in the death. It can be argued that very low levels of alcohol do not cause impairment and thereby do not play a role in the initiation of an injury event. However, in the present study 92% of females and 94% of males testing positive for blood alcohol had alcohol levels above 0.2%, which is the legal driving limit in Sweden. Previous studies have shown that
alcohol influence and chronic alcohol abuse can affect also the outcome of trauma.

**Gender differences**

Almost one-third of injury events in females and almost half of those in males were alcohol-related. This shows that alcohol as a risk factor in injury events differs between the sexes and that alcohol is also an important factor even in female deaths. In those aged ≤59 years, 42% of deaths in females and 56% of those in males were alcohol-related.

In general, comparison of our results with those from other studies on injuries is difficult. This is due to lack of separate gender data, and due to differences in the categorization of deaths, in criteria used to define alcohol involvement, in survey periods, in selection of study populations, in the extent of blood alcohol testing, in autopsy rates, and geographical differences. Most studies on autopsy data have focused on a combination of natural and unnatural deaths or sudden deaths. Only a few investigations have studied all unnatural deaths, or one of the major categories of external cause of death such as suicides. Other studies on alcohol involvement in drowning, accidental falls, and fires/burns have not focused on gender differences and not provided separate data for males and females. One reason that studies do not focus on gender differences is small study samples and lower female alcohol involvement in injuries. In the present study, however, an analysis of gender differences in the different types of injuries was made possible by the large autopsy sample.

Romelsjö et al. in their study on fatally-injured persons aged 15–54 years (66 females, 166 males; 30% females and 51% males blood alcohol tested) in Stockholm found alcohol involvement in 34.9% of female and 60.2% of male deaths. Comparable results in the present study show that alcohol involvement in injuries for the **whole of Sweden** was slightly higher for females (43%) but lower for males (56%). Another Swedish study on middle-aged men in Malmö showed that about half of all types of death were alcohol-related.

In line with the present findings, a study on autopsied injured victims from the United States also showed that, in general, alcohol was detected more often among males than females. A Finnish study on medico-legal autopsied cases (natural and unnatural deaths) showed higher alcohol-related deaths in both males and females (30% females and 48.5% males) for blood alcohol; 32.3% females and 48.5% males had alcohol-related diseases diagnosed at autopsy than the present findings on injuries (corresponding data: 29% females and 43% males; 18% females and 24% males, respectively). However, a study based on the Finnish death register showed that a lower share of unnatural deaths were alcohol-related (12% females, 39% males) than found in the present study for Sweden (33% females, 48% males). The variability in gender differences in alcohol-related deaths presumably reflects the different approaches and diversity of the study groups.

The present study shows that there are significant differences between females and males in alcohol-related fatalities due to external causes. Intentional deaths were more common than unintentional ones in both sexes but a higher proportion of females than males died due to intentional causes. Intentional deaths in females were more often alcohol-related than unintentional ones and relative to males, females dying due to intentional actions had higher mean BACs suggesting that alcohol plays an important role in female intentional deaths. As for males similar significant differences between intentional and unintentional deaths were not found.

The observed differences between females and males can in some part be explained by the gender difference observed in a Swedish population in the prevalence of alcohol abuse, alcohol dependence, and risk consumption of alcohol. Similar gender differences in alcohol drinking patterns and adverse drinking consequences were observed in other countries. Almost every third injury event in females and every other event in males was alcohol-related suggesting that alcohol plays a major role in injury events in both sexes with a dominance in males. Injury prevention strategies directed at reducing alcohol involvement in injuries can be optimized if the differences between sexes are taken into consideration.
Key points

- The differences between females and males in alcohol involvement in fatal injury events were investigated.
- All injured cases who underwent medico-legal autopsies (1992–1996) in Sweden were analysed.
- Almost every third injury event in females and in almost every other event in males is alcohol-related.
- In optimizing injury prevention strategies against alcohol involvement in injuries the differences between sexes should be taken into consideration.

References


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