



High mortality among people suspected of drunk-driving. An 18-year register-based follow-up

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ABSTRACT

Objectives: The aim of this study was to examine the overall and cause-specific mortality of DUI arrestees compared to a reference population with no history of DUI and to recognize the risk factors of premature death.

Methods: The data used were a register of all DUI arrestees between April 1988 and December 2006. All drivers with drug-positive samples were excluded. DUI arrestees were compared to a reference population with no previous history of DUI. Overall and cause-specific hazard ratios were calculated and risk factors were estimated.

Results: Alcohol causes, diseases of the circulatory system and accidents constituted the most common causes of death among DUI arrestees. Suspected DUI was linked with higher mortality in every observed cause of death. The risk of death by alcohol-related or external cause was especially high. Among women DUI arrests caused sharper increase to the risk of death than increase found among male arrestees. Within the group of DUI arrestees the risk of death was affected by age, sex, marital status, education, multiple arrests as well as time and observed blood alcohol level of the arrest. Half of the suspected DUI cases and one in five of the references had alcohol as a contributing factor to death.

Conclusions: Arrest on suspicion of drunk-driving is an indicator for elevated risk of death. Alcohol is often related to deaths of DUI arrestees. Drunk-drivers should be efficiently guided with respect to evaluations and treatments for harmful drinking.

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1. Introduction

It is well established that alcohol impairs the driving ability and that the intoxicated driver is more likely to cause fatal road traffic accidents (Hingson and Winter, 2003; Ogden and Moskowitz, 2004; WHO, 2007). People who drive under the influence (DUI) also have a high risk of alcohol dependence (Brinkmann et al., 2002) and psychiatric disorders (LaPlante et al., 2008; Shaffer et al., 2007). Existing studies show that drunk-drivers are more likely to face premature death. Most excess mortality is caused by accidents, suicides and alcohol causes (Hausken et al., 2005; Penttila et al., 1995; Skurtveit et al., 2002). The excess mortality is described as similar to mortality among alcoholics, with liver cirrhosis, alcohol dependence syndrome and external causes being the main causes of excess mortality in both groups (Mann et al., 1993). However,

there are only a few larger studies dealing with the overall and especially cause-specific excess mortality of DUI offenders.

The links between alcohol drinking and higher rates of mortality are well known at both the population and individual level (Breslow and Graubard, 2008; Mäkelä, 1998; Rehm et al., 2006; Room et al., 2005). DUI offenders may often be considered as alcohol-dependent, with similar patterns of mortality to alcoholics. DUI arrest can also be considered an indicator of an individual's health behaviour as it is linked with, for example, smoking (Eensoo et al., 2005; Riala et al., 2004) and low educational performance (Riala et al., 2003). We could assume DUI offenders to be a partial subset of alcoholics, with similar health problems. Yet the whole group of DUI offenders is large and heterogeneous (Nochajski and Stasiewicz, 2006). More precise knowledge is needed about the risk factors and excess mortality within the group to create targeted interventions.

The study has two main aims. The first is to examine overall and cause-specific mortality of DUI offenders compared to reference population with no history of DUI from 1988 to 2006 in Finland.

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Secondly, the factors predicting the level of risk are analyzed so as to recognize those groups with elevated mortality levels.

2. Material and methods

The Finnish legislation prohibits the operation of a motorized vehicle if the driver's blood alcohol concentration (BAC) exceeds 0.05% (=0.5 mg/g). If the BAC is above 0.12% (0.15% up to September 1994) the offence becomes one of the aggravated DUI. The police perform preliminary breathalyzer tests for drivers. If preliminary tests suggest DUI, an arrest on suspicion of DUI is made and further precision breath testing or a blood sample is required. In suspected cases of driving under the influence of drugs, a blood sample is taken. Blood sample analysis is carried out centrally at the National Institute for Health and Welfare (THL, formerly the National Public Health Institute KTL). The individual case data are recorded in the database maintained by THL. Case data include information about an arrest event, the driver, and laboratory results.

The data utilized in this study were derived from the register of all DUI arrestees, the cause of death statistics and employment statistics. Suspected DUI cases and deaths occurring between April 1988 and December 2006 were studied. Drivers with any history of driving under the influence of drugs were excluded ($N=6345$, 5%) as it can be assumed that drugged and drunk-drivers might have very different mortality profiles (Skurtveit et al., 2002). Only drivers arrested within motorized road traffic (e.g. no water traffic) were studied.

The cause of death statistics compiled at Statistics Finland cover all deaths for persons with a permanent residence in Finland. It uses the International Classification of Diseases version 9 (ICD-9) between 1986 and 1995 and version 10 (ICD-10) since 1996. It also includes a variable with time-series applicable cause-of-death classification that is consistent with different ICD versions. As the rate of medico-legal autopsies and autopsies overall is very high (24%) compared to other high-income countries the cause of death statistics can be considered very reliable. Unintentional injuries, homicides and suicides have an especially high rate of medico-legal autopsies (>97% up to 64 years) (Lunetta et al., 2007).

Data about the socioeconomic background of study subjects were obtained from employment statistics, which are also maintained by Statistics Finland. They are annual statistics that cover the population's economic activity and employment. Information about marital status and level of education was used. Education was classified as high (tertiary), medium (upper secondary/post-secondary non-tertiary) or low (less than previous) education.

To protect the privacy of the people involved, a 50% random sample was drawn from all DUI arrestees. The data on DUI and mortality were linked by Statistics Finland using unique personal identification numbers. Another sample was also drawn from the general population as a reference group. For every case of suspected DUI a reference case was matched for sex and age (± 1 years). Subjects in the population register were eligible for the reference sample if they had no entry for a DUI arrest previous to their matched DUI case. Thus the age and sex structure among the reference population is similar to the cases.

Mortality rates were calculated per 100 000 person years. Statistical survival analysis methods were used to analyze mortality. Kaplan–Meier estimates (Clayton and Hills, 1993) of survival were computed and Cox-regression model (Cox, 1972) fitted to the data. Statistical analysis was performed with SAS software version 9.1.3 (SAS Institute, Cary, NC, USA). Exact dates of deaths could not be obtained while some arrest dates were missing; in such cases, the date of death was set at 1st July and missing arrest dates were set at 30th June. Thus the follow-up times are not exact but rather given to within 1-year accuracy. Only deaths prior to December 31st 2006 were observed. People with a single arrest were followed from the first

arrest. Re-arrested drivers were followed from the second arrest, as by definition they are not deceased before that. Mean follow-up times were 8.6 years for cases and 9.9 years for references.

3. Results

3.1. Mortality and hazard ratios

The DUI data included 112 398 people with an arrest on suspicion of drunk-driving, 88% of them being men. The reference population included 115 019 people. The mean age of those with a first-recorded arrest was 35 years for men and 34 for women. Arrested drivers had a mean blood alcohol concentration (BAC) of 0.14%, with 59% of drivers exceeded the limit of aggravated DUI of 0.12%. One in three drivers were arrested twice or more during the study period. DUI took place on the weekend (between Friday 4 pm and Sunday 12 pm) in 59% of cases.

During the follow-up time, 19 490 deaths were registered in the complete data on suspected DUI cases and the reference population together; 14 636 deaths (13%) were found among DUI arrestees, while 4854 deaths (4%) occurred among age- and sex-matched references. Among cases 6% and among references 4% of deaths were of women. Among people who died during the follow-up, the observed mean age of deaths was lower among DUI arrestees than among references.

The most common causes of death among DUI offenders were alcohol causes (alcohol-related diseases and accidental poisonings by alcohol), diseases of the circulatory system, accidents (including traffic accidents and other accidents), suicides, and neoplasms respectively (Table 1). In women alcohol causes constituted one-third (32%) and in men one-fifth (22%) of all deaths. Diseases of the circulatory system were twice as common among men (22% of all deaths) than among women (12% of all deaths). Within the reference population the most common causes of death were diseases of the circulatory system, neoplasms, other diseases, accidents and alcohol causes, respectively. The mortality of DUI arrestees was higher within every main group of causes of death.

Hazard ratios (HR) were computed between the DUI and reference populations to compare the risks of different causes of death. DUI arrest was linked to higher mortality and hazard rates in all main groups for causes of death examined (Table 1). Particularly elevated was the risk of death due to alcohol causes and/or external causes. All the differences were statistically significant. Women's mortality rates were overall lower than men's. However among women, DUI arrest elevated the risk of death more than it did among men.

Table 1
Mortality by cause of death for case and reference population (per 100 000 person years) and hazard ratios (HR).

	Mortality				Hazard ratios ^a					
	Men		Women		Men			Women		
	Case	Reference	Case	Reference	HR	95% CI		HR	95% CI	
Neoplasms	176	111	79	66	1.5	1.4	1.7	1.2	0.9	1.7
Diseases of the circulatory system	353	163	109	36	1.8	1.7	1.9	2.8	2.0	4.0
Alcohol-related causes ^b	351	36	273	16	8.0	7.1	8.9	16.8	10.5	26.9
Other diseases	153	64	92	33	2.0	1.8	2.3	2.7	1.8	3.9
Traffic accidents	61	9	37	5	3.8	3.0	4.8	2.5	1.0	6.5
Other accidents	224	33	122	3 ^c	5.5	4.9	6.2	33.2	12.2	90.3
Suicides	205	34	113	10	4.6	4.1	5.2	8.8	4.8	16.1
Violence	36	4	24	1 ^c	6.8	4.9	9.7	22.2	2.9	168.0
Other causes	26	4	18	1 ^c	5.1	3.6	7.3	15.9	2.1	122.6
All causes	1584	458	865	172	2.8	2.7	2.9	4.5	3.9	5.3
All causes, N	13 750	4650	915	204						

^a Adjusted for age, marital status and education.

^b Including alcohol-related diseases and accidental alcohol poisoning.

^c 5 deaths or less.

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