Survival of patients with alcohol diagnosis discharged from an emergency department:

A population-based cohort study

Anna Steinunn Gunnarsdóttir

Ritgerð til meistaragráðu
Háskóli Íslands
Læknadeild
Námsbraut í lýðheilsuvísindum
Heilbrigðisvísindasvið

HÁSKÓLI ÍSLANDS

Lifun sjúklinga með áfengisgreiningu útskrifaðir heim af bráðamóttöku: Lýðgrunduð hóprannsókn

Anna Steinunn Gunnarsdóttir

Ritgerð til meistaragráðu í lýðheilsuvísindum

Umsjónarkennari: Vilhjálmur Rafnsson

Meistaranámsnefnd: Aðalbjörg Kristbjörnsdóttir, Ragnhildur Guðmundsdóttir

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Anna Steinunn Gunnarsdóttir

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Supervisor: Vilhjálmur Rafnsson

Masters committee: Aðalbjörg Kristbjörnsdóttir, Ragnhildur Guðmundsdóttir

Faculty of Medicine

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Abstract

Objectives: The aim was to study the cause specific mortality of users of emergency department (ED) who received a diagnosis of alcohol use disorder in comparison with mortality of all other users of the department, while taking into consideration other mental diseases and the frequency of visits.

Methods: The study was a prospective cohort study of all individuals attending, and who were subsequently discharged home from the ED at Landspitali - the National University Hospital of Iceland (LUH) during the years 2002 to 2008. We followed-up 107 237 patients by record linkage to a nation-wide cause of death registry. Altogether 1 210 patients were ever with alcohol use disorders (ICD-10 codes F10) as the main diagnosis and 106 027 were never with that diagnosis. Every visit (n=257 955) was filed with unique registration number, patients identification number, birth date, gender, date of visit, and discharge diagnosis. Death rates among patients who had received an alcohol diagnosis were compared with death rates among patients who had never received such a diagnosis, with hazard ratio (HR) and 95% confidence intervals (CI) in Cox model, adjusted for age, gender, mental and behavioural disorders, year of entrance, and number of visits to the ED.

Results: The adjusted HR for all causes of death for those who had received an alcohol diagnosis at the ED compared to those who had never received such a diagnosis was 1.91 (95%CI 1.51-2.42). The HR for alcohol use disorders was 47.68 (95%CI 11.56-196.59), and for alcohol liver disease the HR was 19.06 (95%CI 6.07-59.87). The HR was also elevated for diseases of the circulatory system 2.52 (95%CI 1.73-3.68), and external causes of injury and poisoning 4.02 (95%CI 2.48-6.53) mainly due to accidental poisoning (HR=13.64, (95%CI 3.98-46.73)), suicide (HR=2.72 (95%CI 1.08-6.83)), and event of undetermined intent (HR=10.89 (95%CI 4.53-26.16)). The HR for all causes of death was significantly associated with gender, age, year of entry, mental diseases, and frequency of visits to the ED.

Conclusion: Alcohol use disorders as the discharge diagnosis at the ED among patients, who were not admitted to a hospital ward, but discharged to home after diagnostic work up and treatment, seems to predict high mortality. However this increased mortality is not exclusively a direct result of alcohol related causes of death. The ED in the present study was intended to treat somatic diseases and injuries; there is a separate psychiatric ED at the hospital. Thus, somatic diagnosis would usually have priority over alcohol diagnosis. As the results conclusively show the vulnerability of these patients one can question whether their needs are adequately met at the emergency department.

Keywords: alcohol use, emergency department, mortality, alcohol related diseases, suicide

Ágrip

Inngangur: Sýnt hefur verið fram á að misnotkun áfengis hefur sterk tengsl við aukna heildar dánartíðni. Fyrri rannsóknir gefa til kynna að hegðunar- og geðræn vandamál, önnur en misnotkun áfengis, tengjast aukinni dánartíðni og að þessi vandamál tengist einnig áfengisneyslu. Á bráðamóttökum er umfang áfengistengdra vandamála töluvert. Sérstakar deildir eru ætlaðar fyrir þá sem eiga við geðræn vandamál að stríða. Það er mikil þörf á því að skoða ástand þessara sjúklinga og meta það hvernig er hægt að veita þeim stuðning og aðstoð í heilbrigðiskerfinu.

Markmið: Markmið var að rannsaka tengsl dánartíðni þeirra sem hafa leitað til bráðamóttökunnar og fá áfengisgreiningu samanborið við alla aðra notendur bráðamóttöku þegar tekið er tillit til annara geðrænna vandamála sjúklinga og fjölda koma á bráðamóttöku.

Efniviður og aðferðir: Rannsóknin er framsýn ferilrannsókn sem heldur utan alla einstaklinga sem komu á bráðamóttöku Landsspítalans á árunum 2002 til 2008 og voru í framhaldinu útskrifaðir heim. Við fylgdum eftir 107 237 sjúklingum, af þeim voru 1 210 sem höfðu fengið áfengisgreiningu (ICD-10 kóðar F10) sem aðalgreiningu en 106 027 höfðu aldrei fengið áfengisgreiningu. Gögnin voru samkeyrð við dánarmeinaskrá til að finna dánardag og dánarmein þeirra sem látist höfðu. Hver koma (n=257 955) var skráð með sérstöku skráningarnúmeri, kennitölu viðkomandi, kyni, dagsetningu komu og greiningu við útskrift. Dánartíðni meðal sjúklinga með áfengisgreiningu var borin saman við dánartíðni meðal sjúklinga sem ekki höfðu fengið áfengisgreiningu. Reiknað var áhættuhlutfall (Hazard ratio, HR) og 95% öryggisbil (CI) í Cox aðhvarfsgreiningu, leiðrétt var fyrir aldri, kyni, geðrænum vandamálum, komuári og fjölda koma.

Niðurstöður: Leiðrétt áhættuhlutfall (HR) vegna allra dánarmeina fyrir þá sem höfðu fengið áfengisgreiningu á bráðamóttökunni samanborið við þá sem ekki höfðu fengið áfengisgreiningu var 1.91 (95% CI 1.51-2.42). HR fyrir ofnotkun áfengis var 47.68 (95 % CI 11.56-196.59), fyrir lifrarsjúkdóma vegna áfengisneyslu var HR 19.06 (95% CI 6.07-59.87). Áhættuhlutfallið var einnig hækkað fyrir hjartasjúkdóma eða 2.52 (95% CI 1.73-3.68) og vegna áverka og eitrana eða 4.02 (95% CI 2.48-6.53) einkum vegna slysa eitrana (HR=13.64 (95% CI 3.98-46.73)), sjálfsvíga (HR=2.72 (95%CI 1.08-6.83)) og atburða með óvissan ásetning (HR=10.89 (95% CI 4.53-26.16)). Áhættuhlutfallið fyrir heildar dánartíðni var tölfræðilega marktækt tengt kyni, aldir, komu ári, geðsjúkdómum og fjölda koma á bráðamóttökuna.

Ályktanir: Áfengisgreining sem aðal greining á bráðamóttöku meðal sjúklinga sem voru ekki innlagðir heldur útskrifaðir heim virðist spá fyrir um háa dánartíðni, er þó ekki átt eingöngu við bein tengsl til áfengistengdra dánarorsaka. Bráðamóttakan í þessari rannsókn er umfram allt ætluð til að þjónusta þá sem hafa líkamlega áverka, það er önnur bráðamóttaka fyrir þá sem þjást andlega. Þar af leiðandi hafa sjúkdómsgreiningar sem varða líkamlega áverka eða sjúkdóma en ekki áfengisgreiningar forgang fram yfir áfengisgreiningu. Þessi rannsókn sýnir vel hversu berskjaldaðir þessir sjúklinga eru, og hægt er að velta fyrir sér hvort hin aukna dánartíðni þeirra sé rétt áskynjuð á bráðamóttökunni.

Lykilorð: Áfengi, bráðamóttaka, dánartíðni, áfengistengdir sjúkdómar, sjálfsvíg

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Abbrevations

ED: Emergency department

HR: Hazard ratio

ICD: International Classification of Diseases

OR: Odds ratio

CI: Confidence interval

RR: Relative risk

LUH: Landspitali - the National University Hospital of Iceland

1 .0 Background

1.1 Alcohol use

Alcohol is a legal substance that is marketed and provides high social status, it can be purchased easily, however there are age limits. Alcohol is often used in social gatherings and tends to provide the drinker more pleasure, relaxation and enjoyment [1] [2]. Alcohol makes the drinker more relaxed, sociable, lively, easily amused, talkative, self-accepting and self-assured. At the same time alcohol is a central nervous system depressant whereas it seems to have stimulant effects to the drinker [1].

It is not known for certain when humans started to drink alcohol although it's presence has been felt throughout history. It was drunk for enjoyment in Mesopotamia some 5 thousand years ago. Alcohol is mentioned over 200 times in the Old Testament. It is also known to have been an integral part of most of Romans activities, where feasting and drinking always played a major part [1] [2]. Despite that, people were aware of the harmfulness of alcohol and words of precaution were widely written [2].

1.2 Social effects of alcohol use

Alcohol and or drug misuse is a problem in many societies. The use of alcohol and or drugs is a social behaviour that affects the whole society [3]. Use of alcohol and the rising consumptions levels of it [4] can have various effect on people [3]. Normal drinking has cardio protective effects on both men and women [5], light to moderate drinking results in lower total mortality rates among both men and women compared to non drinkers or heavy drinkers [6] [7]. Binge drinking has however increased the risk of coronary heart disease in both men and women [5].

Negative effects of alcohol use are however more generic in the society. According to the World Health Organisation alcohol use results in 2.5 million deaths each year [8]. It is widely known that alcohol is a risk factor for loss of health, disability and premature mortality, the World Health Organisation claims it to be the world´s third largest risk factor for these outcomes [8]. Considering different venues of the world, alcohol is the leading risk factor for previously mentioned outcomes in the Western Pacific and the Americas. In Europe it is the second largest [8].

Alcohol is associated with many serious social issues, violence in particular [4]. It is also associated with child neglect and abuse [8]. The worlds industry is affected by alcohol use, which is sickness absence, reduced productivity, unemployment and premature death. Alcohol also produces other costs via road traffic accidents for example [4] [1].

Compared to other substances such as cocaine and methamphetamine epidemic, alcohol use disorder are by far the most prevalent and costly substance abuse problems in the United States [9].

2.0 Physical effects of alcohol use

In the United States alcohol is the preeminent drug of choice and the leading cause of mortality and morbidity [10]. Alcohol misuse weakens the immune system, which puts alcohol misusers at increased risk to get infected by diseases like HIV/AIDS, tuberculosis and sexually transmitted infections. Alcohol is also a major determinant for non-communicable diseases such as cardiovascular diseases, cirrhosis of the liver, [8] hypertension, stroke, diabetes, liver diseases, breast cancer and oesophageal cancer [10].

Alcohol is a determinant factor ranging between 40-70% in homicides, suicides, fatal motorcycle crashes, fatal burn injuries, drownings and falls. Almost 50 percent of severely injured trauma patients and 22% of minor trauma patients are injured while at the same time under the influence of alcohol [10].

2.1 Mortality

Excessive drinking being attributable to premature death is not a new finding. In 1984 Clive Eastman explained that there is a definite and significant association between excessive drinking and an increased risk of death [1]. In an Icelandic study from 1979 on alcoholic males the mortality ratio was 2,24 when compared to the general population [11]. Thorarinsson concluded in her study that the consequences of alcoholism were reflected in the excess deaths, such as accidents and suicides, while the consequences of cigarette smoking were possibly contributing to the excess deaths due to lung cancer and arteriosclerotic heart diseases. This leads her to ascribe alcoholic´s excess mortality solely to the harmful effects of excessive drinking. Further noting the difficulty of concurrently evaluating the importance of the many factors associated with alcoholism [11]. More recent studies show the same findings that is; a high death rate among alcohol dependent individuals [12, 13].

A study on the incidence rate of hepatocellular carcinoma in 1984-1998 showed that in Iceland and the other Scandinavian countries the most prevalent risk factor was alcohol misuse, 15.5% [14]. An Icelandic study from 2004 about acute pancreatitis found that the incidence was decreasing through the last 10 years and the most common cause of an attack of an acute pancreatitis was gallstones but in the second place or claiming 32% of the incidence long-term, alcohol use was the cause of an attack [15].

Dischinger et al. claims that men who misuse alcohol regularly but are not admitted alcoholics have about a 200% higher unexpected death rate compared to men who do not drink [16]. Roerecke and Rehm studied alcohol use disorder and mortality in a meta-analysis in 2013. Their results show that those with alcohol use disorders have markedly higher mortality than previously was thought, since the most recent meta analysis which was conducted in 1998 [18]. The risk ratios were twice as high for alcohol use disorders compared with the general population. Furthermore women have demonstrably higher risk ratios than men. There is also higher risk for young people than for the older ones [18]. Other studies show the same results that is; a definite relationship between alcohol abuse and higher mortality rates, primarily due to cardiovascular disease [19].

2.2 Gender differences

The effects of alcohol use affects the genders differently, this is because of different anatomy and different proportions of water and fat in the body. Due to this women´s organs will be much more intoxicated despite the fact that both genders have had same amount of alcohol. Therefore it takes women much less time to evolve physical diseases due to alcohol use [20] [21].

Heavy drinking in women was associated with increased mortality due largely to an increased risk of death from non-cardiovascular diseases, including breast cancer [6]. For women 34-39 years of age there was an elevated risk of death for all levels of alcohol consumption [6].

3.0 Psychological effects of alcohol use.

As previously demonstrated misuse of alcohol has negative association with physical health and increase in mortality. Alcohol produces disinhibition to the brain, but it does not however determine the type of behaviour that it results. Behaviour is a function of mixture between the individual´s culture, immediate environment, experiences, expectations and so forth [1]. Various neuropsychiatric disorders, such as alcohol use disorders and epilepsy are an obtainable effect of harmful drinking [8]. Alcohol use can however lead to many different psychological problems, it has quite commonly been linked with depression and other mood disorders [22].

3.1 Mental disorders

Not only has alcohol use relation to mood disorders it is also associated with different mental disorders, suicides, heavy consumption of alcohol, disability, impairment and family history of drug or alcohol problems [23], as well as with avoidant, dependent, obsessive-compulsive, paranoid, schizoid and histrionic disorders. With increasing age, these health problems may become more severe, posing an independent risk for mood, anxiety and personality disorders [24]. These studies have demonstrated that alcohol use disorder appears to be associated with psychopathology [23, 24].

There is an observed link between panic disorder and alcohol use disorder but the reason for this is unknown. Alcohol use disorder can lead to the onset of panic disorder and inversely panic disorder can lead to the onset of alcohol use disorder. There is also the possibility that the comorbidity of panic disorder and alcohol use problems results from a shared familial vulnerability to both panic disorder and alcohol use problems, whereas Goodwin and co-workers found a definite relationship between panic disorder, alcohol use disorder and family history [22].

In a large study on major depressive disorder Hasin et al. realised that major depressive disorder has increased a lot in the United States since the 1990s. Their results indicate a strong association of major depressive disorder with the use of alcohol, drugs and nicotine. There was though a stronger relationship between drug dependence and depression than between alcohol use or nicotine use and depression [25].

This field has been studied in Scandinavia more specifically in Finland. Results from a Finnish research on heavy drinkers attending the ED shows that heavy drinking was most often connected with psychiatric disorders [26]. Hasin and co-workers found significant associations between mood, anxiety, personality disorders and alcohol dependence. Alcohol dependence showed strong, significant associations with all other substance and psychiatric disorders [27]. In a study on alcohol-related ED visits it came clear that alcohol-related ED visits are closely correlated with smoking and depression. The proportion of alcohol-related ED visits was nearly 6 times that for patients with depression than for patients without depression. Depression was more common among smokers or 9% compared to non-smokers 1%. Therefore an interaction effect appeared between smokers, depression and alcohol related ED visits. The proportion of alcohol-related ED visits increased of 23% for smokers with depression [28].

Monrás and Ortega found that alcoholic patients who also have a psychiatric profile, showed symptoms that increased the likelihood of premature mortality, e.g. they take more antidepressants, have less family support, show poor physical care, have traumatic mental situations and are more likely to have relapsed into alcohol use [29].

All mental disorders, including dependency syndromes, are associated with increased overall mortality in the important meta-analysis of Harris and Barraclough [17] and alcohol use is related to mental disorders as discussed above [27], thus the mortality of alcohol users cannot be investigated in an unbiased manner without taking that association into consideration.

3.2 Suicide

Suicide is the result of complex interactions between biological, psychological, social and environmental factors, which impact on one another. Suicide is particularly likely to occur during periods of personal crisis such as loss of a loved one or unemployment [30].

There has been a demonstrable existence of a link between alcohol use and suicide since 1899 [30], this link has been developed more convincingly since the mid-1960s and confirmed by Bernal and co-workers and others in the recent years [31, 32]

Mental disorders, mostly depression and substance abuse, are often associated with suicide. Depression is repeatedly a precursor of alcohol abuse but it can be reversed, whereas alcoholism may exacerbate depression. Suicidal behavior generally occurs early in the course of mood disorders and only in the final phase of alcohol abuse [30]. Alcohol abuse is generally caused by people needing to ease their psychological stress but at the same time it impacts on other factors, rendering suicide more likely [30]. A study on suicides among adolescents, found alcohol and drug abuse to be one of the major risk factors for suicide for those adolescents who have a psychiatric profile. There was a higher proportion among suicidal victims who were diagnosable for alcohol misuse and were under the influence of alcohol and also heavily intoxicated [33].

In a recent study by Ferrari and co-workers it was demonstrated that depression was responsible for the largest proportion of suicide [32].

4.0 Stressful life events and childhood

Exposure to stress is an important factor in every individuals risk for alcohol use disorder and alcohol consumption. Individuals with a history of alcohol use disorders are more likely to resort to drinking in order to cope with a traumatic life event. Childhood abuse is a known risk factor for early onset of drinking in adolescence and early adulthood. Stressful life events, such as divorce, job loss or being a victim of a violent crime are also a likely risk factor of alcohol disorders [34, 35]. Therefore it appears to be a direct pathway from chronic stress exposure in youth to adolescent problem drinking which culminates in alcohol and drug dependence in early adulthood [34].

Milivojevic and co-worker concluded in their study that adolescence is a sensitive age due to the effects of alcohol. Where as a daily twelve hour exposure to alcohol for seven days in late adolescence significantly increased voluntary alcohol consumption. It was sufficient to induce chronically increased alcohol preference in adulthood [36]

5.0 Alcohol at the emergency department (ED)

The operations of hospital ED are modified by the people attending the departments. Hansagi and co-workers used the following definition of ED: “Emergency department are designed to provide highly professional medical treatment to those who need urgent or emergency care” [37]. Nawar´s and co-workers definition was: “Emergency departments provide unscheduled care for a wide variety of persons for reasons that range from life-threatening conditions to problems that could be treated in a primary care setting” [38]. Patients who arrive at ED are categorized according to level of emergency of their complaints and condition, on the completion of visit they are assigned a diagnosis. After a diagnostic work-up the patients are accordingly offered treatment and advice. Patients are then either discharged home or admitted to one of the hospital wards.

Alcohol misuse constitutes a wide range of physical and mental alcohol-related problems, which results in a large number of visits to EDs [3]. A large number of attendances at EDs are associated with both dependant drinking and risky single episodes of intoxication, which often results in accidents, fights, assaults or other traumatic events requiring hospital care [3, 39, 40]. It should thus be possible to implement effective anti-alcohol intervention at emergency departments and decrease the burden of alcohol-related visits to the departments [3].

One of every seven attendances to the ED are alcohol related according to a Scottish study [41]. Other studies estimate a significantly higher alcohol related attendances. Malone and co-worker found that it could be as high as 29% of all attendances to the ED are alcohol related [4], and as much as half of all seriously injured are connected to alcohol [4] [42]. In the United States there are more than 100 million visits to the ED every year with a substantial portion of 2.6 million visits which are directly related to alcohol problems. Injury-related visits to the ED involving alcohol are significantly more prevalent than visits for other medical conditions [28].

Alcohol-related visits to the ED show an apparent pattern whereas they filled about 2% of daytime visits, the proportion rises after 8 o´clock in the evening and peaks between 2:00 AM and 3:59 AM with about 7% for visits being alcohol-related [28]. Adolescents alcohol-related ED visits are likely to occur between midnight and 6 AM [43]. The alcohol-related visits are known to be associated with weekends [33]. Thom and co-workers found out that a high portion of young ED users were related to alcohol use. Whereas young women are just as likely as young men to be admitted with alcohol-related injuries or conditions [40]. Alcohol use and misuse can pose problems at the ED and almost 99 % of ED staff has been victims of physical or verbal abuse from drunken patients. Ninety percent of senior ED staff in Britain agree that alcohol misuse is one of the most serious public health problems facing Britain. [4].

A demographic trend was observed in a study from 2004 by McDonald and co-workers among those patients who had a diagnosis that were 100 percent attributable to alcohol. Patients with such a diagnosis aged from 30-49 years consistently had the highest visit rate. The visit rate was higher in males and blacks than in women and whites from 1992-2000. The gender differences increased while the race differences decreased in between those years. Same study also showed that most patients visiting the ED with a diagnosis that are 100% attributable to alcohol were not admitted to an inpatient

unit, rather they were discharged with a risk of no follow-up medical care near the time of their illness or injury [44].

Cryer and co-workers conclude in their study that heavy alcohol users tend to be frequent users of medical services and under-users of preventative medical services. Similarly alcohol abstainers are also frequent users of ED and under-users of preventative services [45]. Compared to abstainers, moderate alcohol drinkers have lower morbidity and mortality rates [45].

In a study on ED users at Landspitalinn, who were discharged with the main diagnosis being alcohol abuse, Gunnarsdottir and co-worker found that these patients had high hazard ratio due to violent deaths, accidental poisoning and suicide [46]. Dischinger and co-workers found that patients, who test positive for alcohol or other drugs at time of admission to trauma centres are more likely than other trauma patients to die from a subsequent injury [16].

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Aim

The aim was to study the cause specific mortality of users of emergency department (ED), who receive a diagnosis of alcohol use disorder in comparison with mortality of all other users of the department, while taking into consideration other mental diseases and the frequency of visits.

Article

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Survival of patients with alcohol diagnosis discharged from an emergency department: A population based cohort study

Anna Steinunn Gunnarsdottir, Adalbjorg Kristbjornsdottir, Ragnhildur Gudmundsdottir, Oddny S Gunnarsdottir, Vilhjalmur Rafnsson

Author´s affiliation:

The Centre of Public Health Sciences, Faculty of Medicine, University of Iceland, Reykjavik, Iceland (ASG, AK, RG); Landspitali - the National University Hospital of Iceland, Reykjavik, Iceland (OSG); Department of Preventive Medicine, Faculty of Medicine, University of Iceland, Reykjavik, Iceland (VR).

Abstract

Objectives: The aim was to study the cause specific mortality of users of emergency department (ED) who received a diagnosis of alcohol use disorder in comparison with mortality of all other users of the department, while taking into consideration other mental diseases and the frequency of visits.

Methods: The study is a prospective cohort study of all individuals attending, and who were subsequently discharged home from the ED at Landspitali - the National University Hospital (LUH) during the years 2002 to 2008. We followed-up 107 237 patients by record linkage to a nation-wide cause of death registry. Altogether 1 210 patients were ever with alcohol use disorders (ICD-10 codes F10) as the main diagnosis and 106 027 were never with that diagnosis. Every visit (n=257 955) was filed with unique registration number, patients identification number, birth date, gender, date of visit, and discharge diagnosis. Death rates among patients who had received an alcohol diagnosis were compared with death rates among patients who had never received such a diagnosis, with hazard ratio (HR) and 95% confidence intervals (CI) in Cox model, adjusted for age, gender, mental and behavioural disorders, year of entrance, and number of visits to the ED.

Results: The adjusted HR for all causes of death for those who had received an alcohol diagnosis at the ED compared to those who had never received such a diagnosis was 1.91 (95%CI 1.51-2.42). The HR for alcohol use disorders was 47.68 (95%CI 11.56-196.59), for alcohol liver disease the HR was 19.06 (95%CI 6.07-59.87). The HR was also elevated for diseases of the circulatory system 2.52 (95%CI 1.73-3.68), and external causes of injury and poisoning 4.02 (95%CI 2.48-6.53) mainly due to accidental poisoning (HR=13.64, (95%CI 3.98-46.73)), suicide (HR=2.72 (95%CI 1.08-6.83)), and event of undetermined intent (HR=10.89 (95%CI 4.53-26.16)). The HR for all causes of death was significantly associated with gender, age, year of entry, mental diseases, and frequency of visits to the ED.

Conclusion: Alcohol diagnosis as the main diagnosis at the ED among patients, who were not admitted to a hospital ward, but discharged to home after diagnostic work up and treatment, seems to predict high mortality. However this increased mortality is not exclusively a direct result of alcohol related causes of death. The ED in the present study was intended to treat somatic diseases and injuries; there is another ED for psychiatry at the hospital. Thus, somatic diagnosis would usually have priority over alcohol diagnosis. As the results conclusively show the vulnerability of these patients one can question whether their needs are adequately met at the emergency department.

Keywords: alcohol use, emergency department, mortality, alcohol related diseases, suicide

Introduction

Alcohol use disorders have been associated with excess all-cause mortality in two meta-analyses (1, 2) and this has further been corroborated in recent population based cohort studies (3, 4). Important causes of death are injuries and suicide; these are increased among alcohol use disorders patients (2, 5). Mental disorders other than alcohol use disorders are associated with increased all-cause mortality (1), and suicide (5). Whereas alcohol dependence is significantly associated with all type of substance and psychiatric disorders (6), the co-occurrences of mental disorders and alcohol use disorders should thus be taken into account when studying outcome in patients with these disorders.

Alcohol related problems or alcohol use disorders have been described as a substantial burden at emergency departments (ED) (7-10), and increase in alcohol related visits and suboptimal management at the ED call for action (10). The imminent and long-term mortality risk of the drunken patients in the ED have only rarely been studied (11), although mortality investigations have been repeatedly undertaken on patients with clinical diagnosis of alcohol use disorders or persons with alcohol use disorders identified in the general population surveys (1-4). The setting at the ED of Landspitali - the National University Hospital of Iceland (LUH), which is the only acute care hospital serving the population of the capital area of Reykjavik, offers a unique opportunity to study the survival of those with alcohol diagnosis through nation-wide death registry.

The aim was to study the cause specific mortality of users of ED who receive a diagnosis of alcohol use disorders, in comparison with mortality of all other users of the department, while taken into consideration other psychiatric diagnosis and frequency of visits.

Methods

This was a prospective cohort study of all individuals who attended the ED at the LUH, and who were subsequently discharged home during the study period 2002 to 2008. The data consisted of computer records of patients 18 years and older, and contained 107 237 individuals and 257 955 visits to the ED. The records contained routinely collected data on every visit, including the unique registration number of each visit, personal identification number of the patients, gender, date of birth, time and date of admission, discharge diagnosis, recorded according to the International Classification of Diseases tenth revision (ICD-10), and time and date of discharge. The LUH and the ED were the only acute care hospital and ED operated for adults in the larger capital area of Reykjavik (the municipalities of Reykjavik, Kopavogur, Seltjarnarnes, Gardabaer, Hafnarfjordur, Alftanes, and Mosfellsbaer) during the study period. In 2005, the mid-year population aged 18 years and older of the Reykjavik capital area was 137 124 (12). The number of people, 107 237, attending the ED during the study period compose 78% of the area's inhabitants, thus the cohort may be considered population-based.

Personal identification numbers were used in record linkage with the National Cause-of-Death Registry to obtain information on vital status and, where applicable, the date and the cause of death according to death certificates. The causes of death were classified according to the ICD-10.

The users of the ED had on average visited the department more than twice during the study period, and as stated previously, received each time one main diagnosis recorded in the computer system. Any patient who were ever with alcohol diagnosis (ICD-10 codes F10) as the main diagnosis was defined into the exposed group (n=1210), while the 106 027 patients who never received an alcohol diagnosis constitute the comparison group. The total number of visits was counted per individual. The main diagnoses were also taken into account as covariates, except the first alcohol diagnosis in those ever with alcohol diagnosis was excluded as this diagnosis had already been used for categorizing them into the exposed group. In order to make those never with alcohol diagnosis comparable the first diagnosis was similarly excluded.

The follow-up of those ever with alcohol diagnosis started upon the day that the patient was first discharged from the ED with an alcohol diagnosis and concluded upon their death, or upon the closing date of the study, 31st of December 2008, whichever occurred first. Similarly the follow-up for those never with alcohol diagnosis started on the day of first visit and concluded upon their death, or closing date of the study, 31st of December 2008, whichever occurred first.

The Cox proportional model was used to estimate hazard ratio (HR) and 95% confidence intervals for all death and selected causes of death (13), comparing those ever with alcohol diagnosis with those never with that diagnosis. Person time at risk was calculated for each individual and covariates were gender, age, number of visits, year of entrance, and selected discharge diagnoses. Several calculations were performed, crude comparison without any adjustment, comparison with adjustment for gender and age only, and with adjustment for gender, age, number of visits, year of entrance, and several different discharge diagnoses. Gender and discharge diagnoses were introduced in the model as categorical variables and age, number of visits, and year of entrance as continuous variables. After

introducing the age and gender into the models the results were nearly identical. According to previous studies mental disorders and use of alcohol are related, and these in turn are both associated with mortality, thus mental disorders according to main diagnoses were adjusted for in the model (1, 2, 6). Several other main diagnosis were also tested as covariates in the model such as diseases of the circulatory system, diseases of the musculoskeletal system, symptoms, signs, abnormal clinical and laboratory findings, and injury. However these covariates did not change the results and were therefore omitted from the model. Survival function for all causes of death at mean of covariates, adjusted for gender, age, number of visits, year of entrance, and mental and behavioural disorders at discharge was calculated for those ever with alcohol diagnosis and those never with alcohol diagnosis and displayed as two separate curves.

The statistical analyses were made using the PASW SPSS software version 18, and Microsoft Excel 2007.

The National Bioethics Committee (VSNb2009020009/03.7), the Ethical Committee of the Landspitali University Hospital, and the Data Protection Commission (2009020152BRA/-) approved the study.

Results

The number of individuals aged 18 to 106 years attending the ED was 107 237 and all together the person-years were in total 408 194.

Table 1 shows the characteristics of the cohort attending the ED in the years 2002 to 2008. The cohort comprised of 57 181 men, and 50 056 women. Those ever with alcohol diagnosis differed from the group never with alcohol diagnosis concerning age, and gender. In the group ever with alcohol diagnosis 63.7% were men and 36.3% women, and in the group never with alcohol diagnosis 53.2% were men and 46.8% women. The mean age for the group ever with alcohol diagnosis was 41.5 years while it was 43.5 years for the group never with alcohol diagnosis. Considering the number of visits to the ED there is a large difference between the groups; the majority or 47.2% of the group never with alcohol diagnosis came once to the ED compared to only 13.0% of the group ever with alcohol diagnosis. Of the group ever with alcohol diagnosis 34.8% had made seven visits or more to the ED but only 4.5% of the group never with alcohol diagnosis had made so many visits. Number of new attendances was highest in the first two years among those ever with alcohol diagnosis, while the number of new attendances had more equal distribution through the years among those never with alcohol diagnosis.

Selected discharge diagnoses, other than alcohol diagnosis, at the ED are shown in Table 2. The group ever with alcohol diagnosis had a higher percentage in all the selected discharged diagnosis. In the group ever with alcohol diagnosis 12.6% had received mental and behavioural disorder as a discharge diagnosis and only 1.1% in the group never with alcohol diagnosis. Furthermore 5.5% in the alcohol group was discharged with mental and behavioural disorders due to psychoactive substance use but only 0.2% in the non-alcohol group. In the alcohol group 11.2% had diseases of the circulatory system but only 4.4% in the non-alcohol group. In the alcohol group 22.6% had diseases of the musculoskeletal system; meanwhile 8.5% in the non-alcohol group had that diagnosis.

Figure 1 shows the survival function adjusted for age, gender, number of visits, year of entrance and mental or behavioural disorders at discharge among those ever with alcohol diagnosis (dashed line) and those never with alcohol diagnosis (black line) for all causes of death.

The HR and 95% CI of all causes of death and selected causes of death are shown in Table 3, for both gender combined. The HR for all causes of death was 1.91 (95% CI 1.51-2.42). The HR for mental and behavioural disorders was 7.62 (95% CI 2.76-21.07) and for mental and behavioural disorder due to alcohol 47.68 (95% CI 11.56-196.59). The HR for diseases of the circulatory system was 2.52 (95% CI 1.73-3.68) and for diseases of the digestive system 4.58 (95% CI 1.95-10.81). The HR for chronic liver disease was 14.69 (95% CI 4.99-43.28) and for an alcoholic liver disease 19.06 (95% CI 6.07-59.87). For external causes of injury and poisoning the HR was 4.02 (95% CI 2.48-6.53), for accidental poisoning 4.02 (95% CI 2.48-6.53), for suicide and intentional self-harm 2.72 (95% CI 1.08-6.83), and for events of undetermined intent 10.89 (95% CI 4.53-26.16). The HR for all causes of death was significantly associated with gender, age, year of entry, mental diseases, and frequency of visits to the ED.

Table 4 shows number of deaths, HR, and 95% CI for all causes of death and selected causes of death among men and women separately. In the group ever with alcohol diagnosis 57 men had died and 15 women, the pattern of the results among men was similar as when the gender were analysed combined, but among women the number of deaths were too few for a meaningful calculation for many of the causes of deaths in the model.

Discussion

This population-based study showed increased all-cause mortality among people who visited the ED and received an alcohol diagnosis compared to those never with alcohol diagnosis while taking in consideration mental disorders other than alcohol use disorders, frequency of visits, age, and gender.

The HR for all causes of death is almost double (HR=1.91), consistent with results from previous studies which have shown a significant relationship between alcohol abuse and increased mortality ratio (1, 2, 14). According to Roerecke and Rehm´s meta-analysis the relative risk for combined sex in population studies was 1.95 (CI 1.49-2.55) (2). A care must be taken in this comparison since Roerecke and Rehm (2) included studies which are either based on patients with clinical diagnosis of alcohol use disorders, or persons with alcohol use disorders identified through surveys in the general population, while present study is based on patients diagnosed at the ED.

Considering the differences in genders Roerecke and Rehm state that the RR for men were lower than for women with alcohol use disorders (2), and that was also consistent with previous meta-analysis (1). Thorarinsson found a mortality ratio of 2.24 for alcoholic males (15). Our HR of 1.88 (CI 1.44-2.47) for men do not contradict that finding since different methods were use in identifying the exposed group.

Parlesak (16) and Kinney (17) suggested an explanation on the differences between genders, how women´s bodies are more susceptible to alcohol. Our results indicated that men ever with alcohol diagnosis are more likely to die from most causes of death compared with men who never had alcohol diagnosis. Women ever with alcohol diagnosis are more likely than women never with alcohol diagnosis to die from alcohol related diseases such as alcohol use disorders, mental and behavioural disorders, diseases of the circulatory system, and from events of undetermined intent. However, women in this study were too few to allow us to generalise due to smallness of the material. Population based studies on alcohol use disorders and mortality among women seem to be lacking (2), so present study has a unique position, however small.

Physical consequences

Britton and McKee (15) showed the relationship between alcohol use and increased mortality rate due to cardiovascular diseases. Our results indicate that those ever with alcohol diagnosis have more than double the risk of dying from diseases of the circulatory system. There were few deaths due to ischemic heart diseases, and not possible to conclude from the results.

Alcohol is a major cause of chronic liver diseases world-wide (18), and our results are certainly in agreement, the HR for chronic liver disease, and alcohol liver disease were 14.69 and 19.06, respectively.

Mental disorder

Psychological factors such as stress, anxiety and depression are associated with alcohol misuse, and tend to lead to premature mortality (1, 2, 6). Our results indicate the same findings (table 2) as those ever with alcohol diagnosis have higher percentages of attendances regarding mental and behavioural disorders compared to the group never with alcohol diagnosis. There was nearly eight-fold increase in mortality due to mental and behavioural disorders.

In the present study death from alcohol use disorders (ICD-10 code F10) is almost 50 fold, and this includes alcohol psychosis. These results indicate that among the patients ever with alcohol diagnosis at the ED were individual with long-term alcohol problems. According to McDonald and co-workers, and Shultz and co-workers alcohol use disorders is classified as alcohol-related diagnosis with alcohol-attributable fraction 1 (10, 19).

There is an association between alcohol use and suicide (5). Mental disorders are also associated with suicide (20). The present findings were in line with these as the ratio was high for suicide, and also for accidental poisoning, and events of undetermined intent.

Emergency department

Our findings show that patients ever with alcohol diagnosis are frequent users of the ED, and this has been found repeatedly in previous studies (7, 8). Other studies found, that alcohol users are not only frequent users of medical services like EDs; they are also under users of preventative services (21).

Strength

The use of the comprehensive population registries and the personal identification number, which enabled easy and accurate record linkage, strengthen the study. Thus, vital status was ascertained through the National Cause-of-Death Registry for all individuals in the exposed cohort and the comparison group. Only 0.2% of the causes of death among the total cohort were reported on the death certificates as due to unknown and unspecified causes. This low proportion is indicative of the quality of the information on the death certificates.

Death certificates in Iceland are issued by a physician, and if the deceased person's physician is not able to attest the cause of death or when the circumstances of the death are unexplained, unusual, suspicious, due to intoxication, or following an accident, the death is reported to the police and the medical examiner, who according to conditions arranges for an autopsy and forensic investigations before the death certificate is issued (22). A particular study on the quality of the recording of the cause of death on death certificates in Iceland is not available. However, when Mather and co-workers studied death registration at a global level, the quality of registration data from Iceland was categorized as high overall and ranked in the same category as data from 23 developed countries including the US and the UK (23).

The universal use of the personal identification number in the files of the ED enabled an accurate registration of whether and when the patients made repeated visits to the ED through record linkage, and thus counting the number of visits and identifying the discharge diagnosis. The setting is favourable for counting the number of visits to the ED and the discharge diagnosis since the ED and the hospital were the only acute health care institutes of this kind serving the population in the catchment area, and therefore did not have any competition from other similar institutes.

Limitations

The study material originates from single academic health care institution in an urban setting serving as a number one trauma centre and a community hospital. This may limit the generalisability of the results, but the size and the characteristics of the background population are known and the population is homogenous, being 99% white Caucasian and the health care system had uniform financing. In the study we used the cumulative clinical information at the ED, which may lack systematization, however are considered to reflect the routine operation of the ED, and the comprehensive population registries are used in a prospective design.

Another limitation of this study is the sole use of the main diagnosis at discharge from the ED, and that we have only taken them into account as ever/never phenomenon. Many of the users of the ED surely also had other diagnosis in the paper records not registered in the computerized records. Nevertheless, the main diagnosis at discharge is considered to reflect the main clinical evaluation of the attending physician taking into account the patient's complaints and his/her condition at the time of the visit.

Altogether 22 deaths, consisting of 0.45% of all deaths in the present study, were without cause of death in the National Cause-of Death Registry, four in the exposed cohort and 18 in the comparison group, at the time we collected the information, in mid-year 2009. This is not to be considered as a lack of quality of the registry, rather that the information had not been entered into the registry at that time.

There is an inherent weakness in cohort studies comparing mortality of severe cases of alcohol use disorders to the general population, since majority of those with alcohol use disorders in the general population are undiagnosed, and never receive treatment, as pointed out in earlier discussion (2). The comparison group in these studies are contaminated with considerable number of alcoholics, thus underestimating the mortality risk. Similar previous comparison studies, which are based on population surveys for alcohol use disorders, may also be handicapped because a lack of accuracy in the diagnostic process (not clinical), and due to the fact that some of those with alcohol dependency or misuse are in renunciation, and are not detected in the surveys, but remain in the comparison groups. In accordance with this discussion the increased mortality risk found in present study may also be an underestimation of the mortality risk.

Conclusion

Alcohol use disorders as the discharge diagnosis at the ED, among patients who were not admitted to a hospital ward, but discharged to home, predicts high overall mortality when taking into consideration age, gender, mental disorders, year of entrance, and number of visits. The mortality was specifically increased for alcohol related diseases such as mental and behavioural disorder due to alcohol, and alcohol liver diseases; and further for diseases of the circulatory system, accidental poisoning, suicide, and events of undetermined intent. As the results conclusively show the vulnerability of these patients one can question whether their needs are adequately met at the emergency department.

Authors' contribution

The authors designed the study, planned the analysis, did the statistical analysis, drafted the article, and interpreted the conclusions, agreeing on the final version. Rafnsson initiated the study and is the guarantor.

Conflict of interest disclosures:

The authors have completed the ICMJE uniform disclosure, and the authors have no competing interest.

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Role of the Sponsors:

The sponsors had no role in the design and conducting of the study; in the collection, analysis, and interpretation of the data; or in the preparation, review, or approval of the manuscript.

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Table 1 - Baseline characteristics at the emergency department 2002-2008 among those ever or never with alcohol diagnosis

	Ever alcohol diagnosis N (%)	Never alcohol diagnosis N (%)
Number of patients	1 210 (100)	106 027 (100)
Gender		
Men	771 (63.7)	56 410 (53.2)
Women	439 (36.3)	49 617 (46.8)
Age, year		
Mean ± SD	41.5 ± 17.1	43.5 ± 19.1
Median, IQR (0.25; 0.75)	41 (25 ; 54)	41 (27 ; 57)
Number of visits		
1	157 (13.0)	50 044 (47.2)
2	199 (16.4)	24 714 (23.3)
3	136 (11.2)	13 057 (12.3)
4	133 (11.0)	7 074 (6.7)
5	89 (7.4)	4 060 (3.8)
6	75 (6.2)	2 350 (2.2)
7+	421 (34.8)	4 728 (4.5)
Year of attendance		
2002	442 (36.5)	19 537 (18.4)
2003	269 (22.2)	20 074 (18.9)
2004	166 (13.7)	16 272 (15.3)
2005	127 (10.5)	14 248 (13.4)
2006	92 (7.6)	12 837 (12.1)
2007	69 (5.7)	11 996 (11.3)
2008	45 (3.7)	11 063 (10.4)

Abbreviations: SD, standard deviation; IQR, interquartile range

Table 2 - Selected diagnosis at discharge from the emergency department excluding the diagnosis received at the first visit among those ever or never with alcohol diagnosis

Discharged diagnosis (ICD-10)	Ever alcohol diagnosis N (%)	Never alcohol diagnosis N (%)
Mental, behavioural and neurodevelopmental disorders (F00-F99)	153 (12.6)	1 152 (1.1)
Mental and behavioural disorders due to psychoactive substance use (F11-F19)	67 (5.5)	247 (0.2)
Diseases of the circulatory system (I00-I99)	135 (11.2)	4 654 (4.4)
Ischaemic heart diseases (I20-I24)	35 (2.9)	639 (0.6)
Diseases of the musculoskeletal system (M00-M99)	273 (22.6)	9 010 (8.5)
Symptoms, signs, abnormal clinical and laboratory findings (R00-R99)	441 (36.4)	13 274(12.5)
Injury of certain body regions (S00-S99)	457 (37.8)	20 584(19.4)
Injuries of head (S00-S02)	111 (9.2)	2727 (2.6)
Fracture of rib (S22.3)	27 (2.2)	583 (0.5)
Injuries involving multiple body regions (T00-T98)	65 (5.4)	2 777 (2.6)
Poisoning by drugs, medicaments and biological substances (T36-T50)	12 (1.0)	129 (0.1)
Factors influencing health status and contact with health services (Z00-Z99)	25 (2.1)	1 324 (1.2)
No discharge diagnosis are displayed	89 (7.4)	7 028 (6.6)

Table 3 - Number of all causes and selected causes of death among those ever or never with alcohol diagnosis, hazard ratio (HR), 95% confidence intervals (CI) adjusted for age, gender, number of visits, year of entrance, and mental and behavioural disorders at discharge.

Causes of death (ICD-10)	Ever alcohol diagnosis p-yr 5 703 N (%)	Never alcohol diagnosis p-yr 402 491 N (%)	HR	95% CI
All causes (A00-Y89)	72 (6.0)	4 807 (4.5)	1.91	1.51-2.42
Mental and behavioural disorders (F00-F99)	4 (0.3)	127 (0.1)	7.62	2.76-21.07
Alcohol use disorders (F10)	4 (0.3)	6 (0.0)	47.68	11.56-196.59
Diseases of the circulatory system (I00-I99)	28 (2.3)	1 646 (1.6)	2.52	1.73-3.68
Ischaemic heart diseases (I20-I25)	3 (0.2)	366 (0.3)	1.41	0.45-4.41
Diseases of the respiratory system (J00-J99)	4 (0.3)	334 (0.3)	2.11	0.78-5.70
Diseases of the digestive system (K00-K93)	6 (0.5)	138 (0.1)	4.58	1.95-10.81
Chronic liver disease (K70,K73-K74)	5 (0.4)	24 (0.0)	14.69	4.99-43.28
Alcoholic liver disease (K70)	5 (0.4)	16 (0.0)	19.06	6.07-59.87
External causes of injury and poisoning (V01-Y89)	22 (1.8)	298 (0.3)	4.02	2.48-6.53
Accidental poisoning (X40-X49)	4 (0.3)	18 (0.0)	13.64	3.98-46.73
Suicide and intentional self-harm (X60-X84)	6 (0.5)	102 (0.1)	2.72	1.08-6.83
Events of undetermined intent (Y10-Y34)	9 (0.7)	35 (0.0)	10.89	4.53-26.16

Abbreviations: p-yr, person years

Table 4 - Number of all causes and selected causes of death among men and women separately who ever or never attended the ED with alcohol diagnosis, hazard ratio (HR), 95% confidence intervals (CI) adjusted for age, number of visits, year of entrance, and mental and behavioural disorders at discharge

Men	Ever alcohol diagnosis p-yr 3 681	Never alcohol diagnosis p-yr 216 978		
Causes of death (ICD-10)	N (%)	N (%)	HR	95% CI
All causes (A00-Y89)	57 (7.4)	2 443(4.3)	1.88	1.44-2.47
Mental and behavioural disorders (F00-F99)	3 (0.4)	47 (0.1)	7.05	2.12-23.40
Alcohol use disorders (F10)	3 (0.4)	5 (0.0)	41.27	8.23-206.91
Diseases of the circulatory system (I00-I99)	20(2.6)	863 (1.5)	2.09	1.33-3.28
Ischaemic heart diseases (I20-I25)	2 (0.3)	202 (0.4)	1.12	0.28-4.54
Diseases of the respiratory system (J00-J99)	3 (0.4)	139 (0.2)	1.79	0.55-5.82
Diseases of the digestive system (K00-K93)	6 (0.8)	64 (0.1)	7.14	2.92-17.47
Chronic liver disease (K70,K73-K74)	5 (0.6)	17 (0.0)	21.25	7.08-63.85
Alcoholic liver disease (K70)	5 (0.6)	13 (0.0)	27.20	8.70-85.04
External causes of injury and poisoning (V01-Y89)	20 (2.6)	190 (0.3)	5.10	3.03-8.60
Accidental poisoning (X40-X49)	4 (0.5)	8 (0.0)	32.56	8.83-120.05
Suicide and intentional self-harm (X60-X84)	6 (0.8)	74 (0.1)	3.90	1.53-9.96
Events of undetermined intent (Y10-Y34)	7 (0.9)	16 (0.0)	14.13	4.76-41.90
Women	p-yr 2 022	p-yr 185 512		
	N (%)	N (%)	HR	95% CI
All causes (A00-Y89)	15 (3.4)	2 364 (4.8)	1.63	0.98-2.71
Mental and behavioural disorders (F00-F99)	1 (0.2)	80 (0.2)	8.42	1.14-62.00
Alcohol use disorders (F10)	1 (0.2)	1 (0.0)	75.80	4.37-1317.01
Diseases of the circulatory system (I00-I99)	8 (1.8)	783 (1.6)	4.00	1.98-8.06
Ischaemic heart diseases (I20-I25)	1 (0.2)	164 (0.3)	2.48	0.34-17.81
Diseases of the respiratory system (J00-J99)	1 (0.2)	195 (0.4)	2.01	0.28-14.47
Diseases of the digestive system (K00-K93)	0 (0.0)	74 (0.1)	-	-

Chronic liver disease (K70,K73-K74)	0 (0.0)	7 (0.0)	-	-
Alcoholic liver disease (K70)	0 (0.0)	3 (0.0)	-	-
External causes of injury and poisoning (V01-Y89)	2 (0.5)	108 (0.2)	1.57	0.37-6.72
Accidental poisoning (X40-X49)	0 (0.0)	10 (0.0)	-	-
Suicide and intentional self-harm (X60-X84)	0 (0.0)	28 (0.1)	-	-
Events of undetermined intent (Y10-Y34)	2 (0.5)	19 (0.0)	6.77	1.32-34.82

Abbreviations: p-yr, person years

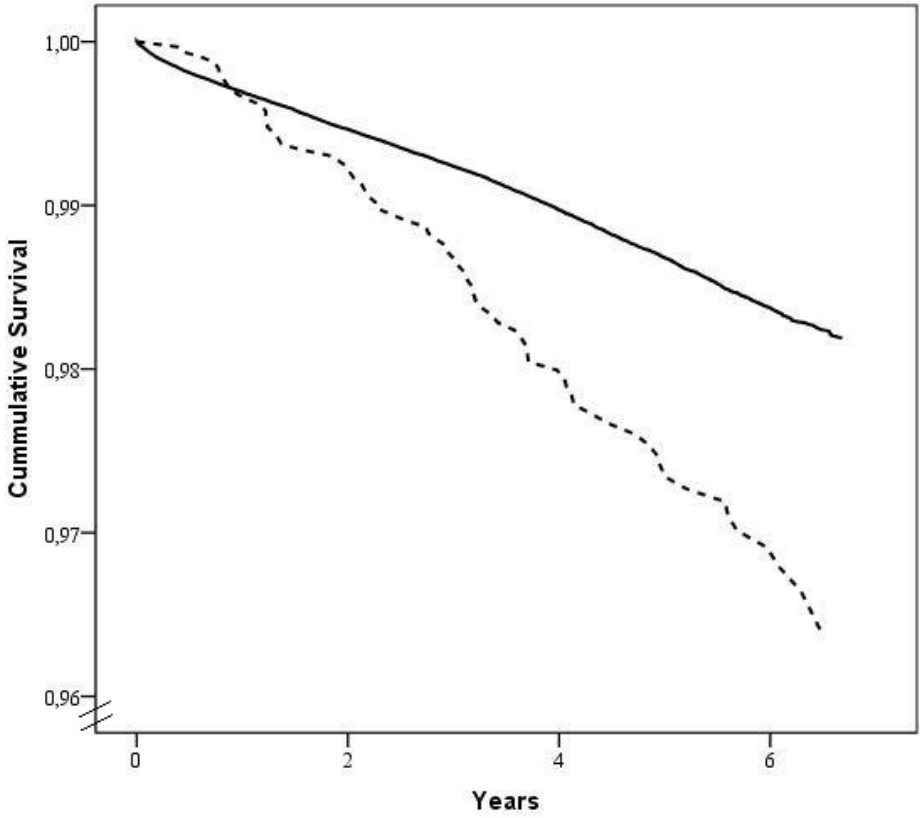

Figure 1 Survival function at mean of covariates, adjusted for gender, age, number of visits, year of entrance, and mental and behavioural disorders at discharge. Dashed line indicates those ever with alcohol diagnosis, and black line those never with alcohol diagnosis.