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Alcohol use disorders increase the risk of completed suicide — Irrespective of other psychiatric disorders. A longitudinal cohort study

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Abstract

Knowledge of the epidemiology of suicide is a necessary prerequisite for developing prevention programs. The aim of this study was to analyze the risk of completed suicide among individuals with alcohol use disorders (AUD), and to assess the role of other psychiatric disorders in this association. A prospective cohort study was used, containing three updated sets of lifestyle covariates and 26 years follow-up of 18,146 individuals between 20 and 93 years of age from the Copenhagen City Heart Study in Denmark. The study population was linked to four different registers in order to detect: Completed suicide, AUD, Psychotic disorders, Anxiety disorders, Mood disorders, Personality disorders, Drug abuse, and Other psychiatric disorders. Individuals registered with AUD were at significantly increased risk of committing suicide, with a crude hazard ratio (HR) of 7.98 [Confidence interval (CI): 5.27–12.07] compared to individuals without AUD. Adjusting for all psychiatric disorders the risk fell to 3.23 (CI: 1.96–5.33). In the stratified sub-sample of individuals without psychiatric disorders, the risk of completed suicide was 9.69 (CI: 4.88–19.25) among individuals with AUD. The results indicate that individuals registered with AUD are at highly increased risk of completed suicide, and that registered co-morbid psychiatric disorders are neither sufficient nor necessary causes in this association.

Keywords: Epidemiology; Psychotic disorders; Anxiety disorders; Mood disorders; Personality disorders; Drug abuse; Prospective study

1. Introduction

Globally, suicide rates have increased by 60% over the past 45 years and in 1998 suicide was estimated to represent 1.8% of the total burden of disease (World Health Organization, 2005). In 2001 the World Health

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Organization reported that self-inflicted injuries including suicide accounted for more than 800,000 deaths worldwide per year (World Health Organization, 2001), and in the United States alone, there are approximately 30,000 completed suicides per year (Sher, 2004). The Danish national suicide rate has been decreasing, though, over the past two decades, with the rate being 16.6 per 100,000 in 2001 (Christiansen and Jensen, 2007).

Evidence linking alcohol use and suicidal behavior has been reported in the literature for several decades (Bernal et al., 2007; Conner and Duberstein, 2004; Murphy and Wetzel, 1990; Roy and Linnoila, 1986). However, since data on nonfatal suicidal behaviors are more readily available than data on completed suicide, most studies on suicide among people with alcohol problems have focused upon suicidal ideation or attempted suicide. The distinction between attempted and completed suicide is important due to demographic, personality and clinical dissimilarities (Conner and Duberstein, 2004) and more studies are needed to unravel risk factors of completed suicide.

Suicide is most frequently considered to be a complication of a psychiatric disorder (Christiansen and Jensen, 2007; Bernal et al., 2007), and research has documented that major depressive episodes (Bernal et al., 2007; Moller, 2003), affective disorders (Allgulander et al., 1992; Moller, 2003), anxiety disorders (Sareen et al., 2005), and schizophrenia and other psychoses (Allebeck and Allgulander, 1990b; Allgulander et al., 1992) are independent risk factors for suicidal behavior. Furthermore, large epidemiological studies have shown that comorbid psychiatric disorders are frequent in patients with alcohol use disorders (AUD) (Kessler et al., 1997; Regier et al., 1990). However, to our knowledge, the potential confounding effect of psychiatric disorders upon the association between AUD and completed suicide is unknown.

The high incidence worldwide of AUD, the high prevalence of suicides in this population, and the consequences for individuals, families, and society are all factors indicating the need for more research. The availability of a 26-year follow-up study of a large population sample (Appleyard et al., 1989; Schnohr et al., 2001) together with the data from four Danish registers provided us with a unique opportunity to assess the association between AUD and completed suicide as well as to adjust for both lifestyle factors and psychiatric disorders. Our hypothesis was that individuals with AUD were at increased risk of committing suicide — irrespective of the presence of other psychiatric disorders.

2. Methods

2.1. Study population

Data from the Copenhagen City Heart Study (CCHS) were used (Appleyard et al., 1989; Schnohr et al., 2001). The CCHS is an ongoing series of studies conducted in the Danish population, initiated in 1976. An age-stratified sample of 19,698 men and women aged 20 to 93 years who lived in the Copenhagen area were randomly drawn from the Central Population Register, using the unique person identification number and invited by letter to answer self-administered questionnaires in 1976–78, where 14,223 respondents returned the questionnaire, corresponding to 74% of the invited individuals. In the 1981–83 follow-up (CCHS-II), the study population was supplemented with 500 new participants aged 20–29 years and nearly 3000 new participants were enrolled in the 1991–93 follow-up (CCHS III). Detailed descriptions of the study have been published elsewhere (Appleyard et al., 1989; Schnohr et al., 2001).

2.2. Suicide

All Danish residents who die in Denmark are recorded in the Danish Causes of Death Register (Juel and Helweg-Larsen, 1999), using the World Health Organization's International Classification of Diseases (ICD) to classify cause of death. Individuals invited to participate in the CCHS were linked to this register, using person identification numbers, in order to determine completed suicide. The database contains causes of death until March 2004. Classifications used to define completed suicide were in the subdivisions of "Suicide and self-inflicted injury" (ICD-8: E950–959) or "Intentional self-harm" (ICD-10: X60–84). Classifications in the subdivisions of "Injury undetermined whether accidentally or purposely inflicted" (ICD-8) and "Event of undetermined intent" (ICD-10) were *not* defined as completed suicides in this study.

2.3. Alcohol use disorders

The study population was linked to three different registers in order to determine alcohol use disorders: The *Danish Hospital Discharge Register* (Jurgensen et al., 1986) contains information on all admissions to Danish hospitals since 1976; the *Danish Psychiatric Central Register* (Munk-Jorgensen and Mortensen, 1997) contains records of all individuals that have been admitted to a psychiatric hospital in Denmark since 1969; and the

WINALCO-database (Becker, 2004) contains records of all individuals treated for alcohol problems in the Alcohol Unit, Hvidovre Hospital — an outpatient clinic for alcoholics covering the greater Copenhagen and Frederiksberg municipalities since 1954. Diagnoses in the registers are classified according to ICD, using the eighth revision until 1994 and the tenth revision from 1994 and onward. Individuals registered with an ICD of AUD in either the Danish Psychiatric Central Register or the Danish Hospital Discharge Register and individuals who were registered in the WINALCO-database were considered to have an AUD at the given time. In this study, AUD comprised the following diagnoses: ICD-8 (303.09; 303.19; 303.20; 303.28; 303.29; 303.90; 303.91; and 303.99) and ICD-10 (F10.1; F10.2).

2.4. Lifetime psychiatric diagnoses

All psychiatric admissions to Danish hospitals were obtainable in either the Danish Hospital Discharge Register (Jurgensen et al., 1986) or the Danish Psychiatric Central Register (Munk-Jorgensen and Mortensen, 1997). The following diagnostic categories were included as putative confounders in the analyses:

- Psychotic disorders: ICD-8 (295, 297, 298.1–9) and ICD-10 (F20–29)
- Anxiety disorders: ICD-8 (300.0, 300.2, 300.3) ICD-10 (F40–43)
- Mood disorders: ICD-8 (296, 300.4, 298.0) ICD-10 (F30–34, 38, 39)
- Personality disorders: ICD-8 (301) ICD-10 (F60)
- Drug abuse: ICD-8 (304) ICD-10 (F11–19 — for only points 1 and points 2)
- Other disorders: All other psychiatric diagnoses than those mentioned above, except from substance-induced disorders and organic mental disorders.
- All psychiatric disorders: All of the above mentioned categories.

2.5. Life style characteristics

Several lifestyle factors were considered putative confounders in the association between AUD and suicide. The following variables were available from all three data-collection follow-ups: *Sex, Education* (less than 8 years, 8–12 years, and more than 12 years), *Income* (three monthly income groups: low, middle, and high, *Cohabitation status* (living alone, living with someone), *Marital status* (not currently married, currently married), *Divorce history* (never divorced, divorced), *Smoking* (current smoker, previous smoker, and never smoker), *Physical exercise in leisure time* (less than 2 h/week, 2–4 h/week, more than 4 h/week.

2.6. Statistical analyses

The purpose of the analyses was to estimate the risk of suicide among individuals with AUD. Data were analyzed by means of multiple Cox Regression analysis and by including age as the time variable the estimates were adjusted for confounding by age. Subjects were followed from their date of entry, when they received the questionnaire between 1976–93, to the date of suicide, death from other causes, disappearance, or emigration or until the end of follow-up (January 2002) — whichever occurred first.

In contrast to time-fixed covariates, all covariates in this study were time-dependent as they were measured repeatedly over time, with the number of observations and the time between the observations varying between subjects. For AUD and other psychiatric disorders, we defined the time of exposure to begin from the exact date of the first diagnosis. In order to avoid misclassification of AUD in the last years of follow-up, the end of follow-up was chosen to be the date where the first register (the Danish Psychiatric Central Register) ended its update. Data were reorganized in stacked risk sets to apply a Cox proportional hazards model with the time-dependent lifestyle covariates that were measured in 1976–78, 1981–83, and 1991–1993. At each event time, the patients at risk and the recent values of the time-dependent covariates were determined. These risk sets were stacked into one large data set and analyzed using Cox regression. In case of missing data about education, income, smoking, or physical exercise the last observation was carried forward to maintain a large study population. Cohabitation status, marital status, and divorce history were, as the only factors, not carried forward as we did not consider it rational to assume these to be constant factors. Analyses based only on register information included all invited individuals, while analyses including lifestyle covariates were based on the sub-sample who responded to at least one questionnaire.

Baseline characteristics for subjects who entered the study at the first examination in 1976–78 are shown in relation to completed suicide (Table 1) with chi-square tests. An overview of lifetime psychiatric disorders in relation to completed suicide is shown for the invited study population (Table 2). In order to investigate the effect of each possible confounder upon the time to completed suicide, hazard ratios were computed separately for each (Table 3). Next, hazard ratios were computed according to AUD, adjusted for: 1) No covariates, 2) Sex, 3) Lifestyle covariates 4) Psychotic disorders, 5) Anxiety disorders, 6)

Table 1
Baseline lifestyle characteristics (1976–78) in relation to completed suicide.

	Non suicide completers		Suicide completers		*df*	χ^2	*P*
	N	%	*N*	%			
Proportion	14,111	99.2	112	0.79	–	–	–
Proportion men	6451	45.7	60	53.6	1	3.66	0.056
Education, highest	1621	11.5	23	20.5	2	9.67	0.008
Income % lowest	3776	27.8	36	33.0	2	1.62	0.444
Living alone	3789	26.9	42	37.5	1	6.36	0.012
Currently married	9311	66.1	59	52.7	1	8.87	0.003
Had a divorce	1394	9.9	18	16.1	1	4.74	0.030
Current smoker	8935	63.3	84	75.0	2	6.59	0.037
Physical exercise, lowest	2807	19.9	31	27.7	2	4.44	0.109

Mood disorders, 7) Personality disorders, 8) Drug abuse, 9) All four psychiatric disorders, 10) Other psychiatric disorders, 11) All psychiatric disorders (Table 4). The interaction between AUD and psychiatric disorders with respect to risk of suicide was tested. Based on the results the study population was stratified according to the presence or absence of other psychiatric disorders (Table 5). All statistical analyses were conducted using the statistical software package SAS 9.1.

3. Results

Of the 23,189 individuals invited to the study, 209 persons (0.90%) committed suicide, while 1756 persons (7.6%) were registered at least once with AUD. Psychiatric disorders, other than AUD, were registered in 9.2% of the population without AUD and in 50.3% of the population with AUD. 18,146 respondents completed at least one questionnaire and of these, 123 persons (0.68%) later committed suicide while 1200 persons (6.6%) were registered with AUD. Among the non-respondents, 1.71% committed suicide and 11.03% were registered with AUD. The mean age of individuals committing suicide was 59.8 years for women and 57.3 years for men, with ages ranging from 30 years to 93 years.

Table 2
Lifetime psychiatric disorders in relation to completed suicide for the entire invited study population.

	Non suicide completers (*N*=22,980)	Suicide completers (*N*=209)	*df*	χ^2	*P*
Proportion (%)	99.1	0.9	–	–	–
Alcohol use disorder (%)	7.4	27.3	1	116.9	<0.0001
Psychotic disorder (%)	2.5	10.5	1	53.0	<0.0001
Anxiety disorder (%)	1.8	5.3	1	13.5	0.0002
Mood disorder (%)	5.1	20.1	1	93.6	<0.0001
Personality disorder (%)	3.7	23.0	1	209.7	<0.0001
Drug abuse (%)	2.0	13.9	1	141.8	<0.0001
Other psychiatric disorders[a] (%)	3.6	13.9	1	60.3	<0.0001
Any psychiatric disorder except from AUD (%)	12.0	49.3	1	267.4	<0.0001

[a] Other than: Psychotic disorders, Anxiety disorders, Mood disorders, Personality disorders, Drug abuse.

3.1. Baseline characteristics of suicide completers

Chi-square tests of baseline characteristics in 1976–78 and completed suicide later on (Table 1) show that, compared with people who did not commit suicide,

Table 3
HRs for completed suicide according to updated putative confounders.

Putative confounders	Hazard ratio (95% confidence interval)
Women	1.00 (reference)
Men	1.70 (1.19–2.44)
Education up to 8 years	1.00 (reference)
Education 8–11 years	0.71 (0.47–1.07)
Education 12+ years	1.38 (0.84–2.25)
High income	1.00 (reference)
Middle income	1.35 (0.79–2.30)
Low income	2.18 (1.23–3.85)
Living with someone	1.00 (reference)
Living alone	1.36 (0.93–1.98)
Currently married	1.00 (reference)
Not currently married	1.45 (1.01–2.08)
Never divorced	1.00 (reference)
Divorced	1.43 (0.89–2.29)
Never smoker	1.00 (reference)
Previous smoker	1.08 (0.56–2.07)
Current smoker	1.87 (1.12–3.13)
Exercise, more than 4 h	1.00 (reference)
Exercise, 2–4 h	1.03(0.67–1.57)
Exercise, less than 2 h	1.77 (1.09–2.88)
No psychotic disorder	1.00 (reference)
Registered with psychotic disorder	7.89 (4.24–14.65)
No anxiety disorder	1.00 (reference)
Registered with anxiety disorder	7.69 (3.76–15.76)
No mood disorder	1.00 (reference)
Registered with mood disorder	11.34 (7.49–17.15)
No personality disorder	1.00 (reference)
Registered with personality disorder	9.01 (5.77–14.07)
No drug abuse	1.00 (reference)
Registered with drug abuse	10.78 (6.05–19.21)
No “other psychiatric disorder”	1.00 (reference)
Registered with “other psychiatric disorder”	11.79 (8.26–16.81)
No psychiatric disorder	1.00 (reference)
Registered with a psychiatric disorder (AUD not included)	12.87 (9.00–18.40)

Table 4
HRs for completed suicide according to alcohol use disorders.

Adjusted for	Hazard ratio	95% Confidence interval
Unadjusted	7.98	(5.27–12.07)
Sex	7.36	(4.82–11.23)
Lifestyle covariates [a]	5.91	(3.76–9.27)
Psychotic disorders	6.88	(4.48–10.55)
Anxiety disorders	7.17	(4.69–10.97)
Mood disorders	4.72	(2.99–7.44)
Personality disorders	4.54	(2.73–7.55)
Drug abuse	5.95	(3.71–9.56)
All five disorders [b]	3.44	(2.10–5.64)
Other psychiatric disorders [c]	6.02	(3.80–9.56)
All psychiatric disorders [d]	3.23	(1.96–5.33)

(Reference group is: individuals never registered with AUD).
[a] Adjusted for: Sex, Education, Income, Cohabitation status, Marital status, Divorce history, Smoking, and Physical exercise.
[b] Psychotic disorders, Anxiety disorders, Mood disorders, Personality disorders, Drug abuse.
[c] Other than: Psychotic disorders, Anxiety disorders, Mood disorders, Personality disorders, Drug abuse.
[d] Psychotic disorders, Anxiety disorders, Mood disorders, Personality disorders, Drug abuse, and "other psychiatric disorders".

suicide completers are more likely to: be men, have a low education, live alone, be unmarried, having had a divorce, and being a smoker. In addition, suicide completers were more likely to have had a lifetime psychiatric diagnosis: 49.3% were registered with a psychiatric diagnosis, other than AUD, at some point. AUD was registered in 27.3% of all suicide completers, personality disorders in 23.0%, and 20.1% of all suicide completers were registered with mood disorders (Table 2). The univariate analyses in Table 3 show the effect of each possible confounder upon the time of completed suicide taking place.

3.2. Risk of suicide for individuals with AUD

Subjects registered with AUD were at significantly higher risk of committing suicide (Table 4). The crude hazard ratio (HR) of completed suicide was 7.98 (95% CI 5.27–12.07) for subjects with AUD compared to subjects without AUD. Adjusting for sex, the risk diminished slightly, and adjusting for all lifestyle covariates available, the risk fell to 5.91 (95% CI 3.76–9.27). All five groups of psychiatric diagnoses were significant confounders in the association between AUD and completed suicide with the hazard ratio dropping down to 4.54 (95% CI 2.73–7.55) when adjusting for personality disorders (Table 4). Including all five groups of diagnoses in the model at the same time reduced the risk of completed suicide among individuals with AUD to 3.44 (95% CI 2.10–5.64), and with adjustment for all psychiatric disorders the risk fell to 3.23 (95% CI 1.96–5.33).

3.3. Stratifying by psychiatric disorders

Because of a significant interaction between AUD and psychiatric disorders ($P=0.0006$) with respect to risk of completed suicide (data not shown), the study population was stratified according to psychiatric disorders other than AUD. This analysis showed that the risk of completed suicide among individuals with AUD was substantially different in the two sub-samples (Table 5). Among people with psychiatric disorders, the risk of completed suicide was 2.21 (95% CI 1.29–3.80), while the risk among people without psychiatric disorders was 9.69 (95% CI 4.88–19.25) (Table 5). Lifestyle covariates reduced the HRs most in the sub-sample with no psychiatric disorders.

4. Discussion

Our results suggest that individuals registered with AUD are at increased risk of committing suicide, and that the risk continues to be significant after adjusting for all psychiatric disorders. We found a 7.98-fold elevated risk of completed suicide among individuals who had been registered with an AUD diagnosis compared to individuals, who were never registered with AUD. Adjusting for five categories of psychiatric disorders that are frequently co-morbid with AUD, the risk dropped to 3.44, and adjusting for all psychiatric disorders the risk fell to 3.23. Stratifying our study population according to psychiatric disorders we found a 9.29-fold risk of completed suicide among individuals with AUD in the sub-sample with no psychiatric disorders.

Table 5
HRs for completed suicide according to alcohol use disorders, stratified by presence of psychiatric disorders.

	Registered with a psychiatric disorder (other than AUD)			Never registered with a psychiatric disorder (other than AUD)		
	Unadjusted	Adjusted for sex	Adjusted for lifestyle covariates [a]	Unadjusted	Adjusted for sex	Adjusted for lifestyle covariates [a]
Registered with AUD	2.21 (1.29–3.80)	2.02 (1.16–3.53)	1.94 (1.08–3.49)	9.69 (4.88–19.25)	7.61 (3.77–15.37)	5.86 (2.83–12.15)

(Reference group is: individuals never registered with AUD).
[a] Adjusted for: Sex, Education, Income, Cohabitation status, Marital status, Divorce history, Smoking, and Physical exercise.

4.1. Comparison with other studies

The estimated hazard ratio of 7.98 for suicide among individuals with AUD is in accordance with the estimates given in a Norwegian study that examined risk of suicide among alcohol abusers in military conscripts and found a crude risk of 6.7 among male alcohol abusers (Rossow and Amundsen, 1995). In addition, our findings contribute to support findings from previous studies demonstrating higher suicide mortality among alcohol abusers (Murphy and Wetzel, 1990; Bernal et al., 2007; Roy and Linnoila, 1986) and higher prevalence of alcohol abusers among suicide victims in retrospective post-mortem studies (Conwell et al., 1996). We found that 49.3% of the 209 persons who committed suicide had been registered with a lifetime psychiatric diagnosis other than AUD, which is somewhat higher than a Swedish study that found a prevalence of only 44% (including AUD) among suicide completers (Allebeck and Allgulander, 1990a). In this study mood disorders and drug abuse were studied and found to be the strongest independent predictors of completed suicide with a more than 10-fold increased risk. This is in accordance with a Swedish study showing that the highest risk of completed suicide was found among individuals with affective disorders, unspecified psychoses, paranoid psychoses, addiction to prescription drugs, and schizophrenia (Allgulander et al., 1992). We found that male sex, low income, being unmarried, smoking, and low physical exercise were significant independent risk factors for completed suicide (Table 3). The findings are in agreement with previous studies investigating risk factors for both suicidal behavior and completed suicide (Agerbo et al., 2007; Bernal et al., 2007; Conner and Duberstein, 2004; Murphy et al., 1992). Especially the role of smoking has gained much attention in suicide research. In this study we found an unadjusted 1.87-fold increased risk of completed suicide among smokers, while other studies have found more than twofold elevated risk of suicide attempts among smokers after adjusting for psychiatric disorders (Riala et al., 2007).

4.2. AUD and suicide

There are several ways in which the positive association between AUD and completed suicide may be explained. Apparently, a large part of the association between AUD and suicide is explained by the co-morbidity of AUD and other psychiatric diseases — either by psychiatric disorders mediating the effect of AUD on suicide or by AUD being the consequence of the psychiatric disorder. However, the risk of suicide among individuals with AUD did not become insignificant after adjusting for all psychiatric diseases, and our stratified HR in Table 5 showed a 9.69-fold risk of suicide among individuals with AUD and no co-morbid psychiatric diseases. Therefore, some of the elevated risk may be attributed to a direct association between AUD and suicide. This could be explained by the fact that AUD often cause personal and social problems — factors that increase the risk of suicide. Moreover, suicide may be a direct consequence of a large alcohol intake creating a disinhibiting effect, which may increase the risk of suicidal behaviors; or be an indirect consequence of a long-lasting large alcohol intake, affecting mood and aggressive/impulsive traits and undermining social relationships or support, thereby increasing suicidal thoughts. It is, however, very likely, that AUD and suicide are manifestations of the same underlying traits that were not registered in this study. Based on a thorough review, a model of suicidal behavior among individuals with alcoholism has recently been proposed (Conner and Duberstein, 2004). Predisposing factors presumed to increase the risk of suicide were aggression/impulsivity and severity of alcoholism together with negative affect and hopelessness. Major depressive episodes and stressful life events – particularly interpersonal difficulties – were conceptualized as precipitating factors (Conner and Duberstein, 2004). Abnormal serotonergic function has been associated with suicidal behavior (Mann and Malone, 1997), aggression, and alcoholism (Mann, 1994), and it has been proposed that abnormal serotonergic activity to some extent mediates the genetic and developmental predispositions for suicide, aggression and alcoholism (Mann et al., 1999). Human and animal studies have indicated that serotonin abnormalities can result in increased disinhibitory psychopathology (indicative of suicide), impulsive aggression, alcoholism and drug abuse (Crabbe et al., 1996; Saudou et al., 1994; Mann et al., 2001). Our finding of elevated risk of completed suicide among cigarette smokers may also be related to serotonin dysfunction.

4.3. Methodological issues

The advantages of this study are the prospective design, the large study population, a long follow-up time, several updated measurements of lifestyle covariates, and register information on psychiatric diagnoses. Due to the prospective design, selection and recall bias was minimized, and 26 years follow-up time means that registration of cases with AUD and cases with completed suicide should be optimal for a register based study. In Denmark,

all residents have equal access to psychiatric hospitals and all treatments are free of charge. However, misclassification of psychiatric disorders is still plausible, as the registers only included diagnoses leading to hospital admission. Assuming that we only included the most severe cases of AUD in this study and assuming that there is a dose–response relationship between AUD and suicide, it is very likely that we would have found a weaker association between AUD and suicide if we had used a more comprehensive measure of AUD than registration at a hospital or an outpatient clinic.

Underestimation of the prevalence of completed suicides is possible, as the boundary between completed suicide and accidental death in some cases can be complex to determine thus leading to possible misclassification in the Danish Causes of Death Register. The diagnoses of death used in this study are all in the subcategories of "Suicide and self-inflicted injury" (ICD-8) or "Intentional self-harm" (ICD-10). However, diagnoses of "Injury undetermined whether accidentally or purposely inflicted" (ICD-8: E980–989) and "Event of undetermined intent" (ICD-10: Y10–Y34) were not defined as completed suicides in the study, and we might have lost cases that were wrongly diagnosed in these subcategories. However, such misclassification would probably lead to underestimation of the significance of our findings.

As register information was available also for non-respondents, we know that there was a higher percentage of both suicide and AUD among the non-respondents than among the respondents. In analyses where lifestyle covariates were included non-respondents were excluded. This may have affected our obtained hazard ratios, as there are reasons to believe that these non-respondents are different from the general population.

4.4. Generalization

The results are based only on individuals that were registered at a hospital or at an outpatient clinic and can possibly only be generalized to individuals with the most severe AUD and other psychiatric disorders. For these patients the presented results may largely be generalizable to the Danish population as well as other Western societies. Considerable speculations have been proposed concerning the effect of place of residence on suicide risk (Durkheim, 1952). The impact of AUD on suicide presumably varies with the prevalence of suicide and with cultural differences in drinking cultures, including societal reactions to AUD. However, a Danish study found that the variation in prevalence of suicide in different geographical areas could be explained by the proportion of high-risk individuals living in particular areas rather than the characteristics of the areas themselves (Agerbo et al., 2007). If these results apply to suicides in general, it suggests that our results can be generalized not only to the Danish population but that the enlarged risk of suicide among individuals with AUD exists in many societies.

5. Conclusion

We suggest that individuals registered with AUD are at increased risk of committing suicide irrespective of the presence of other psychiatric disorders. Although the risk decreased when adjusting for psychiatric disorders, the risk among individuals with AUD was still significantly elevated by more than 3 times that of individuals without AUD after adjusting for all psychiatric disorders. In addition, our stratified results showed that individuals with no co-morbid psychiatric disorder to their AUD had an increased risk of more than 9 times that of individuals with neither a psychiatric disorder nor AUD. Our results can only be generalized to cases of AUD resulting in hospital admissions, but we consider our findings to be of noteworthy importance due to the unique data material, capturing updated lifetime information on both lifestyle factors and psychiatric disorders from a large study population.

It is estimated that 50% of those who commit suicide had sought professional help within 1 month prior to the act (Isacsson et al., 1992). Our results emphasize the importance for professionals to treat AUD and to be especially aware of potential suicide ideation in this population — irrespective of occurrences of other psychiatric disorders. Clinicians should be aware that suicidal behavior is common in individuals with AUD and should evaluate all patients with AUD for suicide risk regardless of possible psychiatric co-morbidity.

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