Association of age at first drink and first alcohol intoxication as predictors of mortality: A birth cohort study

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Abstract

Background

More information on the health-related repercussions of age at onset of adolescent drinking is needed. The aim of this study was to examine the associations between self-reported age at first drink and age at first alcohol intoxication with the risk of death by age 30.

Methods

The sample (n=6,564; 49.1% males) included all participants of the Northern Finland Birth Cohort Study 1986 (NFBC1986) for whom the two measures of adolescent drinking were available. Self-reported age at onset of first drink and first alcohol intoxication were analysed along with background variables and data regarding subsequent psychiatric diagnoses. Adolescents were dichotomized into those reporting age at first drink and age at first intoxication before or after age 14. Cox regression was used to calculate hazard ratios (HRs) with 95% confidence interval (95% CI) for death by age 30.

Results

By the age of 30, 0.7% (n=47) of all 6,564 participants were deceased. In the multivariable models, male gender and a history of illicit substance use in adolescence were associated with both all-cause mortality and mortality due to accidents or suicide. After controlling for confounding variables, age at first alcohol intoxication was associated with all-cause mortality (HR 2.33; 95% CI 1.04-5.20) as well as death due to accidents or suicide (HR 2.99; 95% CI 1.11-8.05).

Conclusions

Earlier age at first intoxication carries long term repercussions with respect to premature loss of life. Efforts should be made targeting the prolongation of initiating binge drinking in adolescence to diminish this mortality risk.

Keywords: mortality; age at onset; alcohol intoxication; binge drinking; birth cohort study; suicide

Introduction

Young adults are seriously affected by alcohol with 13.5% of all annual deaths among 20–39-year-olds attributable to alcohol, compared to 5.3% of all alcohol-related deaths among the worldwide population as a whole. Alcohol use disorders (AUDs) are associated with a three to five fold increase in all-cause mortality compared with controls [1, 2]. A large proportion of the mortality attributable to alcohol arises from acute alcohol consumption. Binge drinking, defined as drinking with the intention to become intoxicated, puts individuals at risk for acute alcohol-related harm, specifically unintentional and intentional injuries, including road traffic crashes, violence, suicides, and fatal alcohol-related injuries [3].

Adolescent binge drinking is a risk-behaviour associated with significant adversity later in life [4]. Adolescent binge drinking has been linked to an increased risk of suicide attempts, as well, surpassing the influence of depression and other stressful life events [5]. In a cohort of young Swedish men, consuming ≥15 g ethanol/day during adolescence was associated with a relative risk of death of 1.37 by age 39 when compared to abstainers, after adjusting for confounders such as smoking [6]. Suicide and motor vehicle accidents were the most common causes of death in this Swedish cohort. Despite these risks, binge drinking in adolescence is fairly common. In recent years, a mean 35% of European adolescents reported binge drinking at least once and 17% three or more times during the previous 30 days [7, 8].

Young age at onset of drinking, and more recently, early age at first intoxication, have been reported to be associated with adverse consequences including subsequent alcohol use disorders later in life [9-11]. However, only one study has investigated the relationship between age at first intoxication with respect to subsequent mortality [12]. Hu et al. (2017) found that early age of first intoxication was associated with an excess mortality risk even in absence of AUD.

The health burden that is consequent to adolescent drinking is a major concern and further research specifically among long-term prospective cohort studies has been called for [13]. The aim of this study was to examine the predictive association between self-reported age at onset of drinking and first alcohol intoxication and the risk of subsequent death by the age of 30 in the Northern Finland Birth Cohort Study 1986 (NFBC1986).

Methods

During 2001-2002, a multidisciplinary NFBC1986 follow-up was conducted when the adolescents were 15–16 years of age. All participants first received a postal questionnaire and subsequently were invited to a field study. During the field study, the participants completed self-report questionnaires including questions on alcohol and illicit substance use. The final sample used in this study included 6,564 individuals (49.1% male). More information about the study and its design is available on the NFBC1986 webpage at http://www.oulu.fi/nfbc/node/ 40696.

The study was approved by the Ethical Committee of the Northern Ostrobothnia Hospital District in Finland. Informed consent for participation including the follow-ups was obtained from all participants and their parents.

Measures

Outcome: Death

Information on causes of death until the end of 2015, i.e. follow-up to the age of 30 years, was obtained from the Population Register Data and Registry for Causes of Death which covers all deaths in Finland. The deaths were categorized based on cause of death according to the International Classification of Disease, 10th revision [14], and categorized into deaths due to somatic causes, accidents and suicide. An autopsy is routinely carried out in all unclear cases in Finland. In the cases of accidents were suicidal intent was unclear (n=3), the deaths were included in the accident- category.

Age at onset of first drink and first intoxication

The data on alcohol use was collected using questionnaires that the participants received during the field study in adolescence. The participants were asked at what age did they first drink the following alcoholic beverages: beer, wine, spirits. The response options were never; at age 11 or under; at age 12; 13; 14; 15 or 16. Based on these answers, a variable designating the age when any alcoholic beverage was consumed for the first time, was formed. The participants were also asked at what age they had first been intoxicated (same response options). Alcohol intoxication was determined in this study according to self-report i.e. no set cut-off for the amount of alcohol was used.

For both predictive variables, three groups were formed; those who had had their first drink or had first been intoxicated at age ≤14 or >14, and the reference group of participants who had never consumed alcohol or had never been intoxicated. Age 14 is often considered a boundary between early and middle adolescence.

Confounding variables

Parental education level and family structure

Parental education was categorized into ≥12 years corresponding to vocational or university studies and <12 years corresponding to primary school without a secondary degree. Information on family structure was gathered by combining information collected from parents at birth and when the cohort member was an adolescent. Family structure was classified as (a) intact (both parents living with the participant all the time) and (b) non-intact (other families).

Illicit substance use

Persons with substance use disorders (SUDs) have a significantly shorter life expectancy than the general population [15]. Data on illicit substance use were collected with several questions (no/yes) concerning, for example, cannabis use, prescription drug use, use of inhalants and other illicit drugs. These were combined as 'Illicit substance use (no/yes)'.

Psychiatric disorders

Individuals suffering from mental illness are at a greater risk for premature death when compared to the general population [15]. Diagnoses of psychiatric disorders according to the International Classification of Disease, 10th revision (ICD-10) [14] were obtained from four national registers until the end of 2015, i.e. by the age of 30 years: The Register of Primary Health Care Visits 2011 – 2015 and the Care Register for Health Care 2001 – 2015 of the National Institute for Health and Welfare, the medication reimbursement register of the Social Insurance Institution of Finland 2001 – 2015 and disability pensions of the Finnish Centre for Pensions 2001 – 2016. The Care Register contains information on patients discharged from inpatient care, and since 1998 also on specialized outpatient care. The Register of Primary Health Care Visits includes all outpatient primary health care delivered in Finland.

Previous research has shown that early onset of drinking and first intoxication are associated with subsequent SUDs [9-11], which in turn are associated with increased mortality [15]. To control for the confounding effect of SUDs on the relationship between age of onset of alcohol use and mortality, only the existence of psychiatric diagnosis other than SUDs was considered.

Attrition

An analysis of attrition for this sample of the NFBC1986 has been previously described [16]. Males were less likely to participate in the adolescent follow-up than females (67% v. 74%; $\chi 2$ test, $p<0.001$). Also, adolescents with register-based psychiatric diagnoses at follow-up (65.1% 74.2%, $p<0.001$) as well as maternal (65% v. 72%, $p<0.001$) or paternal (71% v. 81%, $p<0.001$) history of psychiatric disorders were less likely to participate than others.

Statistical analyses

Cross-tabulation and Chi-square-tests were used for studying the associations of background variables and psychiatric diagnoses with death. Effect sizes were computed using Cramer's V with >0.25 reflecting very strong, 0.16-0.25 strong, 0.11-0.15 moderate, 0.06-0.10 weak and 0-0.05 no or very weak associations [17].

Cox regression was used to analyse differences between survival rates for the groups categorized according to age at first drink and age at first intoxication. The confounding variables were included in the multivariate models when they were associated ($p<0.1$) with mortality in this study. The confounding background variables considered were gender, family structure (intact vs. non-intact), parental education (over or under 12 years), having a history of illicit substance use in adolescence and having any psychiatric diagnosis excluding SUDs. Separate multivariate models were created to evaluate the predictive significance of age at onset of first drink and first alcohol intoxication on mortality after adjusting for confounders in order to control for the collinearity between age at onset of first drink and first alcohol intoxication. HRs with 95% CIs were calculated. Finally, population-attributable fractions (PAFs), i.e. fractions expressing the expected percentage

reduction of cases if exposure at a specific level is eliminated, were calculated using the following formula $$PAF = \frac{\sum_{s=1}^{S} P(E_s)(RR_s - 1)}{1 + \sum_{s=1}^{S} P(E_s)(RR_s - 1)}$$.

All statistical analyses were performed using SPSS version 24.

Results

By the age of 30, of all 6,564 participants, 47 (0.7%) were deceased (Table 1), with males (n=38) comprising 80.9% of the early mortalities. The most common causes of death were suicide (46.8% of all deaths) and accidents (31.9%). Accidental deaths occurred at a slightly younger age than suicides or death due to somatic causes. Bivariate associations between background and alcohol use related variables, as well as psychiatric diagnoses (excl. SUDs), are presented in Table 1.

After bivariate analyses, the confounding variables entered into the multivariable models were gender, maternal education and history of illicit substance use. In the multivariable models, male gender and having a history of illicit substance use were associated with both all-cause mortality and mortality due to accidents or suicide in all models (Table 2). After controlling for the confounding variables studied, age at first alcohol intoxication ≤14 years remained associated with all-cause mortality (HR 2.33; 95% CI 1.04-5.20), as well as death due to accidents or suicide with a HR 2.99 (95% CI 1.11-8.05). No such association was found between age at first drink and death by age 30.

The PAFs for all deaths were 50.3% for age at onset of alcohol use and 41.9% for age at first intoxication when no alcohol use or intoxication were considered the ideal exposure scenario. The PAFs for accidental deaths and suicide were even higher; 74.7% for age at onset of alcohol use and 59.0% for age at first intoxication.

Discussion

Earlier age at first alcohol intoxication during adolescence was associated with increased risk of death by age 30, after adjusting for the potential confounders measured in this study. This association was found for both all-cause mortality and mortality due to accidents or suicide. The proportion of deaths, especially accidental deaths and suicide, related to age of onset of alcohol use and drinking to intoxication according to PAFs, was substantial. However, it seems that age at drinking onset is rather a red flag for other parameters associated with premature death, as age at first drink itself was not associated with mortality by age 30 after adjusting for potential confounders.

The most common causes of death in this analysis were suicide and accidents. Male gender was associated with both all-cause mortality risk and risk of death due to accidents or suicide. These findings are in concordance with previous literature reporting that binge drinking is a risk factor for death due to unintentional and intentional injuries [3]. Approximately half of all deaths from both unintentional and intentional injuries among 15–69 year old Finnish men are alcohol-related [18]. In addition, adolescents with a history of illicit substance use had an increased mortality risk compared to those without. Furthermore, psychiatric disorders other than SUDs were not associated with mortality.

This study has several strengths. The NFBC 1986 is one of the largest birth cohort studies with high genetic and ethnic homogeneity. The study utilized several nationwide registers where missing information is low. The wide range of information included in this data made it possible to address many potential confounders. Limitations of this study include an attrition rate of 26.2% at the 15–

16-year field study. Individuals from non-intact families and urban areas were less likely to participate, which is likely a source of bias. However, the attrition likely weakens the associations found in this study, rather than enhances them. The information on substance use was collected using self-reports, which typically underestimate substance use [19] and may lead to underestimation of true associations. Additionally, we were not able to adjust for potential confounding due to childhood or familial adversity.

Based on the results of the current study and some previous findings [9, 12, 13, 20], addressing adolescent drinking, specifically age at onset of binge drinking, may be important for preventing various long-term adverse consequences. Coordinated prevention and intervention efforts addressing adolescent binge drinking beginning by late childhood have been called for [21]. Such prevention efforts should preferably span multiple levels, such as the individual, family, community and national policy. It has also been argued that binge drinkers in adulthood are to a large extent comprised of individuals who were moderate drinkers or abstainers in adolescence, and thus interventions to decrease adolescent binge drinking could have limited impact on adult consequences with regard to heavy drinking and AUDs [22]. However, the proportion of premature deaths associated with early age of drinking onset and intoxication in this study was substantial.

This study was not able establish causal links between age at first intoxication and mortality by age 30. However, based on our results, further efforts at prolonging initiation of binge drinking in adolescence should considered to diminish this mortality risk.

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Conflict of interest

JL has received funding from Juho Vainio Foundation and speaker fees (AbbVie, Lundbeck, Fioca Ltd.) AM has received funding from Emil Aaltonen Foundation, Juho Vainio Foundation, Olvi Foundation and the Finnish Cultural Foundation. SN has received funding from Juho Vainio foundation, Sohlberg foundation, speaker fees (Shire-Takeda), and travel fees (Shire-Takeda, Sunovion). MS, RR, JM, JK and A-EN declare no conflicts of interest.

Key points

- Early age at first alcohol intoxication was associated with all-cause mortality.
- Early age at first intoxication also associated with accidental deaths and suicide.
- Prevention efforts targeted at postponing onset of adolescent drinking are needed.

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Table 1. Associations of background and alcohol related variables to mortality, (Chi-squared test).

	Total n	n=6,564		Alive n=6,517		Deceased n=47		p-value	Effect size[1]
		n	%	n	%	n	%		
Gender	6,564								
Male		3,224	49.1	3,186	48.9	38	80.9	*<0.001*	0.054
Female		3,340	50.9	3,331	51.1	9	19.1		
Family type	5,611								
Two parents		4,437	79.1	4,408	79.2	29	69.0	0.109	0.021
One parent or other		1,174	20.9	1,161	20.8	13	31.0		
Mother's education	5,583								
≥12 years		1,851	33.2	1,843	33.3	8	19.0	0.051	0.026
<12 years		3,732	66.8	3,698	66.7	34	81.0		
Father's education	5,354								
≥12 years		1,024	19.1	1,017	19.1	7	17.9	0.851	0.003
<12 years		4,330	80.9	4,298	80.9	32	82.1		
History of illicit substance use	6,550								
No		6,169	94.2	6,129	94.2	40	85.1	*0.008*	0.033
Yes		381	5.8	374	5.8	7	14.9		
Any psychiatric disorder excl. SUD[2]	6,301								
No		5,407	85.8	5,370	85.8	37	82.2	0.489	0.009
Yes		894	14.2	886	14.2	8	17.8		
Age at first drink	6,564								
No alcohol use		1,406	21.4	1,401	21.5	5	10.6	0.245	0.035
≤11 years		742	11.3	735	11.3	7	14.9		
12 years		1,172	17.9	1,159	17.8	13	27.7		
13 years		1,555	23.7	1,543	23.7	12	25.5		
14 years		1,159	17.7	1,154	17.7	5	10.6		
15 years		495	7.5	490	7.5	5	10.6		

16 years		35	0.5	35	0.5	0	0.0		
Age at first alcohol intoxication	6,564								
Never intoxicated		2,165	33.0	2,156	33.1	9	19.1	0.123	0.039
≤11 years		102	1.6	100	1.5	2	4.3		
12 years		367	5.6	362	5.6	5	10.6		
13 years		1,281	19.5	1,269	19.5	12	25.5		
14 years		1,564	23.8	1,550	23.8	14	29.8		
15 years		985	15.0	980	15.0	5	10.6		
16 years		100	1.5	100	1.5	0	0.0		

[1]Cramer's V; >0.25 very strong, 0.16-0.25 strong, 0.11-0.15 moderate, 0.06-0.10 weak and 0-0.05 no or very weak associations [2]Substance use disorder

Table 2. Hazard ratios (HRs) for all-cause mortality and mortality due to accidents and suicides calculated with Cox regression for survival analysis.

	All-cause mortality			Mortality due to accidents and suicides		
	HR	95% CI		HR	95% CI	
		lower	upper		lower	upper
Male gender	4.55	2.11	9.85	6.02	2.32	15.62
Mother's education <12 years	2.10	0.97	4.53	1.54	0.69	3.42
History of illicit substance use	3.45	1.50	7.92	3.79	1.53	9.39
Age at first drink[1]						
>14 years	2.50	0.63	10.00	5.04	0.92	27.52
≤14 years	2.12	0.74	6.04	3.32	0.78	14.15
Male gender	4.77	2.20	10.31	6.38	2.46	16.54
Mother's education < 12 years	2.06	0.95	4.45	1.52	0.68	3.37
History of illicit substance use	2.77	1.19	6.42	2.98	1.19	7.45
Age at first alcohol intoxication[2]						
>14 years	1.02	0.31	3.40	1.64	0.44	6.13
≤14 years	2.33	1.04	5.20	2.99	1.11	8.05

[1] Self-reported age at consuming first alcoholic beverage, never used alcohol used as reference

[2] Self-reported age at first subjective intoxication, never been intoxicated used as reference