

Age at first use of alcohol predicts the risk of heavy alcohol use in early adulthood: a longitudinal study in the United States

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Abstract

Background: Two ecological cross-sectional studies which relied on national survey data (U.S. and Australia) have shown that starting drinking at a younger age increases the frequency of heavy drinking in the general population, including those with good mental and physical health status. This study further investigates the hypothesis that age at first use of alcohol increases the risk of heavy alcohol use by applying data from a longitudinal study.

Method: This study used public-use data collected from Wave I, Wave III and Wave IV of the National Longitudinal Study of Adolescent Health in the United States. The association between age at first use of alcohol and heavy alcohol use (5+ drinks per occasion) was examined with two different multivariate analysis approaches with data from 2316 participants: ordered logistic regression models and Poisson regression models with longitudinal data settings. In addition, the newly developed proxy outcome approach was further used to estimate and adjust for unmeasured/unobserved confounding factors. **Results:** Age at first use of alcohol before 18 years was associated significantly higher risk of heavy alcohol use at follow-up. **Conclusion:** After adjusting for known and residual confounders, younger age at first use of alcohol was associated with significantly higher risk of heavy alcohol use, moreover, we posit that the association observed from this longitudinal study is probably causal. Abstinence from alcohol until the age of 18yrs will likely reduce individual risk of alcohol-related problems in adulthood. In the longer term, delayed onset of exposure with widespread abstinence among this age group is also likely to reduce the overall prevalence of alcohol-related problems in the general population.

Keywords: Alcohol, adolescents, epidemiology, alcohol related harm

Introduction

The association between age at first use of alcohol and risk of alcohol use disorders has been investigated in a number of studies. Observational studies suggest that alcohol use at an early age may increase the risk of alcohol use disorders during adulthood (DeWit, Adlaf, Offord, & Ogborne, 2000; Bonomo, Bowes, Coffey, Carlin, & Patton, 2004; Hingson, Heeren, & Winter, 2006; Dawson, Goldstein, Chou, Ruan, & Grant, 2008; von Diemen, Bassani, Fuchs, Szobot, & Pechansky, 2008; Agrawal, Sartor, Lynskey, Grant, Pergadia, et al., 2009). While it has been hypothesised that onset of heavy alcohol use is the intermediate step involved in the association between age at first use of alcohol and risk of alcohol use disorder (Liang & Chikritzhs, 2012), heavy alcohol use is also the cause for most (if not all) alcohol caused diseases and many mental disorders. Thus, if age at first use of alcohol influences frequency of heavy alcohol use, beginning alcohol use at a young age is a shared risk factor for alcohol caused morbidity. Recent analysis of data from the Australian National Drug Strategy Household (NDSH) survey and the U.S. National Survey on Drug Use and Health (NSDUH) showed significant positive associations between age at first use of alcohol and frequency of heavy drinking which were not affected by level of psychological distress or health status (Liang & Chikritzhs, 2012; Liang & Chikritzhs, 2013). However, evidence from prospective studies is required to support these cross-sectional findings (McCambridge, McAlaney, & Rowe, 2011). This study aims to test the hypothesis that age at first use of alcohol increases the risk of heavy alcohol use (5+ drinks per occasion) in later life by applying data from a longitudinal study with a representative U.S. sample. In addition, a newly developed analytical approach (Wenbin Liang & Tanya Chikritzhs, 2013; W. Liang & T. Chikritzhs, 2013; Liang, Zhao, & Lee, 2014; Tchetgen Tchetgen, 2014) was used to control for unmeasured confounding effects.

Method

This study used data collected from the National Longitudinal Study of Adolescent Health (Add Health), which was conducted in the United States. Details of the Add Health study have been described in detail previously (K. Harris, 2011). Briefly, a representative sample of adolescents in between grade 7 (age 11/12) and grade 12 (age 17/18), mean age: 16, were initially recruited in 1994-1995 (Wave I), they were then followed up in 1996 (Wave II), in 2001- 2002 (Wave III), and in 2007-2008 (Wave IV) (mean age, 29). A combination of self-administered questionnaires and interviews were employed to collect social, psychological and health information, including demographics, risk behaviours, health status and family composition. In addition, Wave I survey also included a face-to-face interview with one parent (preferably the mother) of each participant to provide further information including parental alcohol use. This study used public-use data collected from Wave I, Wave III and Wave IV of the Add Health study. In the Wave I survey, participants were asked whether they had consumed a drink of beer, wine, or liquor—not just a sip for more than 2 or 3 times in their life. If the answer was yes, participants were then asked about their age at the first time they had a drink in the absence of their parents (K. M. Harris & Udry, 2013). This information was used to define age at first use of alcohol. For participants who had never consumed alcohol in the absence of their parents at Wave I, the information on age at first use of alcohol collected at Wave IV was used. Information on heavy alcohol use during young adulthood was collected in survey Waves III and IV. In these two survey waves, participants were asked to recall how many days they drank five or more drinks in a row during the 12 months before the interview.

Data analysis

The aim of the analysis was to investigate the association between age at first use of alcohol and heavy alcohol use (5+ drinks per occasion) during early adulthood and consisted of two different multivariate analysis approaches: (a) Multivariate ordered logistic regression models

predict frequency of heavy alcohol use in the past 12 months in Wave III and Wave IV separately using age at first use, while controlling for potential confounders including the age at baseline. This is because there is considerable physical and psychological development throughout the adolescent phase (age 12-19) (Hales, Yudofsky, & Gabbard, 2010). In these models heavy alcohol use was treated as an ordered categorical outcome variable as follows: 1) none, 2) 1 or 2 days in past 12 months, 3) once per month, 4) 2 to 3 days per month, 5) 3-5 days per week 6) almost every day or every day. Information on a number of potential confounding factors was obtained from Waves I and III and controlled for in the analysis including: age at baseline (Wave I), gender, race, frequency of alcohol use of parents at baseline (frequency of the more frequently drinking parent was used) (Wave I), had ever smoked at baseline (Wave I), median income of residence location at baseline (Wave I), whether had an academic degree or diploma (Wave III), general health status at baseline (Wave I) as well as at follow-up (Wave III and IV). (b) Poisson regression models for panel data were used to analyse frequency of heavy alcohol use in Waves III and IV combined. Frequency of heavy alcohol use in Waves III and IV were transformed into a time-dependent binary variable (whether heavy alcohol use occurred at least weekly in Wave III or IV; no=0, yes=1). All potential confounders adjusted for in the logistic regression models were also included in the Poisson models, as well as an additional time dependent variable: general health status at follow-up (Waves III and IV). To further strengthen the study, the newly developed proxy outcome approach (Wenbin Liang & Tanya Chikritzhs, 2013; W. Liang & T. Chikritzhs, 2013; Liang, et al., 2014; Tchetgen Tchetgen, 2014) was used to estimate and adjust for unmeasured/unobserved confounding factors. In the proxy approach, a time-dependent binary variable defined as whether or not the respondent had smoked in the last 30 days in Wave III or IV (no=0, yes=1), was used as the proxy outcome.

The public-use dataset included 2,881 participants who were younger than 18 yrs at Wave I, and successfully followed-up in Waves III and IV, consumed alcohol during the follow-up period (i.e. excluding lifetime abstainers). 2,316 participants (80% of 2,881) who provided information for all outcome and control variables were included in analyses. STATA Statistical Software: Release 11 developed by StataCorp LP was used to perform all analyses. Sampling weight provided by the Add Health study was used in the analysis.

Result

As shown in Table 1, when frequency of heavy alcohol use at Wave III and Wave IV were analysed separately, age at first use before 18 yrs was associated significantly higher risk of heavy alcohol use at both Waves III and IV, while age at first use at 21 yrs or older was associated with significantly lower risk of heavy alcohol use at both Waves. It is also interesting to note that the risk of heavy alcohol use in later life increased gradually and significantly with increasing frequency of parental alcohol use at baseline.

When Waves III and IV were analysed together, age at first use had a similar effect on the risk of heavy alcohol use as observed for the Wave specific models. Risk of heavy alcohol use reduced significantly as age at first use increased (Table 2).

In relation to unmeasured (residual) confounding effects, small but significant associations between age at first use of alcohol and likelihood of tobacco smoking at both Waves were observed for two age categories: age at first use before 15yrs and at 21yrs or older. After removing the detected residual confounding effects, the effect of age at first alcohol use on risk of heavy alcohol use remained significant for those younger than 18yrs at first use, although there was a small reduction in effect size (Table 2).

Discussion

This longitudinal study indicated that younger age at first use of alcohol is associated with an increased risk of heavy alcohol use. This association remained significant after controlling for a range of known potential confounders and further adjustment for residual confounding effects. These results are consistent with findings from both U.S. (Wenbin Liang & Tanya Chikritzhs, 2013) and Australian (Liang & Chikritzhs, 2012) population-based cross-sectional studies.

Although the causal mechanism underlying this observed association is not fully understood, it is clear that initiation of alcohol use is essential for heavy alcohol use to occur (Hermens, Lagopoulos, Tobias-Webb, De Regt, Dore, et al., 2013). In other words, prior to starting drinking, there is no risk of developing habitual heavy alcohol use. Recent research has also suggested that there is high prevalence of frequent heavy alcohol use among adolescents (MacArthur, Smith, Melotti, Heron, Macleod, et al., 2012; Swendsen J & et al., 2012), and therefore, habitual heavy alcohol use may develop during adolescence among those who started drinking at a young age. Beginning alcohol use at younger ages will, at the very least, increase the amount of time at risk for developing heavy alcohol use behaviour. In addition, it should be noted that in this study age at first use of alcohol is mainly measured by the age when adolescents have their first drink in the absence of their parents. The results are therefore not necessarily applicable to young people who drank at an early age but who did so while under the supervision of their parents. It is plausible that parental supervision and guidance on underage drinking may protect against future progression towards heavy drinking but this requires further investigation. Parental attitudes and behaviours during their children's initial exposure to alcohol may have substantial effects on their offspring's future consumption patterns (Dishion & Loeber, 1985; Windle, 2000; Hayes, Smart, Toumbourou, & Sanson, 2004; Komro, Maldonado-Molina, Tobler, Bonds, & Muller, 2007; Ryan, Jorm, & Lubman, 2010). The significant positive associations observed between parental alcohol use

and their offspring's risk of heavy alcohol use during adulthood in this study supports the notion that parental attitudes and behaviours are important risk (or protective) factors. Nevertheless, a key antecedent to the process of children and adolescents learning alcohol use behaviours from their parents is likely to be access to alcohol.

The causal relationship between heavy alcohol use and most alcohol-caused physical diseases (e.g. alcoholic liver cirrhosis) and mental disorders (e.g. alcohol abuse and alcohol dependence) are clear. Heavy alcohol use is a necessary condition for the development of these alcohol-caused conditions. It follows therefore that onset of alcohol use before the age of 18yrs would increase the risk of heavy alcohol use which leads to alcohol-caused diseases and conditions. It should be noted that similar to most of the epidemiological studies, alcohol use in this study was assessed based on information collected through interviews rather than direct physical measurements such as testing biomarkers in blood or urine samples, thus this study is not immune to some degree of bias due individual subjective recall (information bias).

Conclusion

After adjusting for known and residual confounders, younger age at first use of alcohol was associated with significantly higher risk of heavy alcohol use, moreover, we posit that the association observed from this longitudinal study is probably causal. Abstinence from alcohol until the age of 18yrs will likely reduce individual risk of alcohol-related problems in adulthood. In the longer term, delayed onset of exposure with widespread abstinence among this age group is also likely to reduce the overall prevalence of alcohol-related problems in the general population.

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Table 1: The effect of age at first use of alcohol on the frequency of heavy alcohol use: estimates from multivariate ordered logistic regression models

	Odds Ratio	95% Confidence Interval		Odds Ratio	95% Confidence Interval	
		Wave III			Wave IV	
<i>Age first use of alcohol</i>						
<15 yrs	1.65	1.28	2.11	1.77	1.38	2.29
15 - 17 yrs	1.66	1.32	2.10	1.38	1.09	1.75
18 - 20 yrs	1.00			1.00		
21 yrs or older	0.26	0.17	0.39	0.54	0.38	0.78
<i>Age at Wave I</i>						
1st strata (< 14.25 yrs)	1.00			1.00		
2nd strata (14.25 - 15.49 yrs)	1.09	0.84	1.40	0.84	0.66	1.07
3rd strata (15.50 - 16.74 yrs)	1.02	0.79	1.31	0.66	0.51	0.84
4th strata (16.75 - 17.99 yrs)	1.01	0.79	1.29	0.69	0.54	0.88
<i>Gender</i>						
Male	1.00			1.00		
Female	0.38	0.32	0.45	0.48	0.40	0.57
<i>Race</i>						
White	1.00			1.00		
Black	0.33	0.24	0.46	0.64	0.48	0.84
Other	0.65	0.44	0.96	1.08	0.66	1.78
<i>Frequency of parental alcohol use (Wave I)</i>						
Never	1.00			1.00		
< 1 per month or less	1.29	1.02	1.65	1.23	0.97	1.56
2 -3 per month	1.47	1.07	2.02	1.49	1.09	2.02
1 - 2 per week	1.83	1.37	2.44	2.00	1.52	2.62
3 or more per week	1.74	1.29	2.34	1.65	1.23	2.21
<i>Median household income of residential area by quartiles (Wave I)</i>						
1st strata (lowest)	1.00			1.00		
2nd strata	0.88	0.65	1.18	1.10	0.83	1.46
3rd strata	1.03	0.78	1.37	1.06	0.81	1.40
4th strata	1.20	0.90	1.61	1.43	1.08	1.90
<i>Diploma or degree (Wave III)</i>						
No	1.00			1.00		
Yes	1.54	1.04	2.27	1.27	0.87	1.84
<i>Health status (Wave I)</i>						
Excellent	1.00			1.00		
Very good	0.85	0.70	1.05	0.95	0.78	1.15
Good	0.76	0.59	0.96	0.85	0.66	1.10
Fair or poor	0.71	0.49	1.04	0.85	0.53	1.35
<i>Ever smoked (Wave I)</i>						
No	1.00			1.00		
Yes	1.29	1.06	1.58	1.18	0.97	1.43

*Heavy alcohol use in Wave III and IV were analysed separately. *Heavy alcohol use in Wave III and IV were analysed separately. The outcome is an ordered categorical variable with the following categories: 1) none, 2) 1 or 2 days in past 12 months, 3) once per month, 4) 2 to 3 days per month, 5) 3-5 days per week 6) almost every day or every day.

Table 2: The effect of age at first use of alcohol on the risk of weekly heavy alcohol use: Estimates from Poisson regression model for panel data with additional adjustment for unmeasured confounding effects

	Risk of weekly heavy alcohol use		Risk of smoking in the last month (proxy outcome)		Risk of weekly heavy alcohol use (adjusted for unmeasured confounding effects)	
	IRR*	95% Confidence Interval	IRR*	95% Confidence Interval	IRR*	95% Confidence Interval
Age first use of alcohol						
<15 yrs	1.62	1.29 - 2.04	1.20	1.05 - 1.38	1.34	1.07 - 1.69
15 – 17 yrs	1.32	1.06 - 1.65	1.09	0.94 - 1.26	1.32	1.06 - 1.65
18 - 20 yrs	1.00		1.00		1.00	
21 yrs or older	0.39	0.22 - 0.69	0.60	0.45 - 0.81	0.64	0.36 - 1.14

*Incidence Rate Ratio

Heavy alcohol use weekly, smoking in the last 30 days (proxy outcome) in Wave III and IV were analysed together controlling for all potential confounding factors listed in Table 1.