Not Early Drinking but Early Drunkenness is a Risk Factor for Problem Behaviors among Adolescents from 38 European and North American Countries

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Short running head: Early Drinking and Adolescent Risk Behaviors

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Abstract

Background: Many studies have reported that the earlier the age at first drink the higher the later drinking levels and related problems. However, unless adolescents proceed into drunkenness, it is unclear why consuming small quantities at early age should lead to later problems. The present study investigates the link between age at first drink and problem behaviors (smoking, cannabis use, injuries, fights, and low academic performance) among 15-year olds who did and did not proceed into drunkenness. Among those with drunkenness experience, we tested whether age at first drink predicted problem behaviors over and above the age at first drunkenness. **Methods:** Multilevel structural equation models were estimated based on a sample of 44,801 alcohol-experienced 15-year olds from 38 North American and European countries and regions who participated in the Health Behaviour in School-aged Children (HBSC) cross-national survey. **Results:** Overall, there was a significant association between age at first drink and all five problem behaviors. However, this was the case only among those with drunkenness experiences but not among those never drunk. Among the former, age at first drunkenness was a strong predictor for all five problem behaviors, but time from first drink to first drunk did not predict problem behaviors. **Conclusions:** Not early alcohol initiation but early drunkenness was a risk factor for various adolescent problem behaviors at age 15, i.e. there was not consistent relationship for the time before the first drunkenness (i.e. since first drinking). Besides targeting early drinking, particular efforts are needed to impede early drunkenness to prevent associated harm in adolescence and beyond.

Keywords: Age at first drink, alcohol initiation, drunkenness, adolescents, cross-cultural study

Introduction

26   Many studies have documented associations between an early age at first drink (AFDrink)

27   and a variety of negative outcomes including drunkenness, dependence and alcohol-related

28   problems in adolescence and adulthood (Dawson et al., 2008; DeWit et al., 2000; Eliasen et

29   al., 2009; Fergusson et al., 1994; Grant and Dawson, 1997; Gruber et al., 1996; Hawkins et

30   al., 1997; Hingson et al., 2006; Hingson and Zha, 2009; Muthén and Muthén, 2000; Palmer et

31   al., 2010; Pitkänen et al., 2005; Rothman et al., 2008; van Diemen et al., 2008) and the use of

32   other psychoactive substances such as nicotine, cannabis, or cocaine (Gruber et al., 1996;

33   Komro et al., 2010; Rothman et al., 2008; van Diemen et al., 2008; Vieira et al., 2007). The

34   same was found for other problem behaviors such as low academic performance, violence,

35   injuries, and suicide (Buchmann et al., 2009; Fergusson et al., 1994; Gruber et al., 1996;

36   Hingson et al., 2009; Hingson et al., 2000; Hingson and Zha, 2009; Komro et al., 2010;

37   McGue et al., 2001; Peleg-Oren et al., 2009; Swahn et al., 2010; Swahn et al., 2008). The first

38   aim of the present study is to confirm these bivariate relationships among 15-year olds from

39   38 North American and European countries and regions between earlier AFDrink and higher

40   levels of problem behaviors such as tobacco smoking, cannabis use, injuries, physical fights,

41   and low academic performance.

42   Interpreting this association in a causal way, some authors have argued that an early AFDrink

43   per se is responsible for different problems in later life over and above personal and

44   environmental risk factors (Buchmann et al., 2009; Swahn et al., 2008; Zucker, 2008).

45   Recently, Komro et al. (2010, p. 14) concluded that "any use of alcohol in early adolescence

46   is associated with other high-risk behaviours and support the critical need for efforts to

47   prevent early initiation". Also, Palmer et al. (2010, p. 490) recently stressed that "it is

48   important to consider the best way to intervene with individuals at heightened risk due to

49   early age of drinking onset". Similarly, previous studies emphasized the importance of

50 delaying the AFDrink to prevent risky drinking and alcohol-related problems in adolescence

51 and later in life (DeWit et al., 2000; Eliasen et al., 2009; Gruber et al., 1996; Hingson et al.,

52 2009; Hingson et al., 2000; Hingson and Zha, 2009; Pitkänen et al., 2005; Swahn et al., 2008).

53 Concerning possible rationales or mechanisms explaining why an early AFDrink should have

54 a direct impact on later problems, authors speculated that drinking small amounts of alcohol

55 early in life may (a) provoke changes in behavioral repertoire and identity or role that alter

56 developmental trajectories during adolescence leading to harmful drinking (Buchmann et al.,

57 2009; Pedersen and Skrondal, 1998), (b) narrow modes of action and weaken the ability to

58 control drinking habits in later life (Pitkänen et al., 2005; Swahn et al., 2008), (c) lead to

59 greater tolerance and habituation toward alcohol (Eliasen et al., 2009), (d) impede the

60 development of adequate coping strategies and problem-solving skills (Buchmann et al.,

61 2009; Swahn et al., 2008), and (e) negatively affect social relationships, connectedness, or

62 confidence (Pedersen and Skrondal, 1998; Swahn et al., 2008). In these explanations,

63 however, it appears that the AFDrink "is only important to the extent that enough alcohol was

64 consumed to generate a physiological reaction" (Warner and White, 2003, p. 2003) and not

65 any (small) amount of alcohol consumed early in life. Therefore, the second aim of the

66 present study was to investigate the link between AFDrink and problem behaviors according

67 to whether or not the adolescents had already consumed so much alcohol that they felt drunk.

68 Following the arguments above, early drinking should have an impact only among those who

69 had been drunk but not among those who never experienced drunkenness. For example, in

70 contexts (families or cultures) in which moderate drinking is highly valued or the norm, it

71 should not matter at what age people take their first sip or glass of alcohol.

72 The third aim was to investigate whether, among those who experienced drunkenness, the age

73 at first alcohol consumption (AFDrink) or the age at which drunkenness occurred for the first

74 time (AFDrunk) was associated with problem behaviors at age 15. Ward et al. (2010)

75 concluded in a recent literature review that the number of drunkenness episodes and the age at

4

76 which they occur are more likely to predict later problems than the AFDrink per se. Dawson

77 et al. (Dawson et al., 2008, p. 2158) concluded that "the most possible causal mechanisms

78 linking early AFDrink and increased risk of alcohol use disorders entail the assumption that

79 early drinking leads to heavy drinking during adolescence, with heavy exposure to ethanol

80 during a period of physical and neurological maturation constituting the primary direct risk

81 factor and/or marker of risk". In other words, the "duration of heavy alcohol use, independent

82 of AFDrink, is an important factor for certain alcohol-related consequences" (Rothman et al.,

83 2008, p. 39). Thus, we expect that the earlier the AFDrunk the higher the level of problem

84 behaviors.

85 However, whether an early AFDrink actually leads to an early AFDrunk and therefore

86 indirectly to a higher level of problem behaviors is less clear. Since AFDunk and AFDrink are

87 logically dependent (i.e. there is no drunkenness without drinking) the usual mediation testing

88 is not possible. Therefore, we investigated whether the time elapsed from AFDrink to

89 AFDrunk predicts the level of problem behaviors over and above the age at which the first

90 drunkenness occurred (AFDrunk). In other words, once the effect of the first drunkenness is

91 taken into account does it still matter at what age the first sip of alcohol was consumed?

92 **Methods**

93 *Study design*

94 The data used for the analyses were part of the 2005/06 "Health Behaviour in School-Aged

95 Children (HBSC)" study (Currie et al., 2008). In collaboration with the World Health

96 Organization (WHO), HBSC surveys have been conducted every four years since 1983

97 among 11-, 13-, and 15-year olds. Students were selected using a clustered sampling design,

98 where either single classes or schools served as the sampling units.

99 Data were collected on the basis of anonymous self-report questionnaires distributed in the

100 classroom. Each participating country obtained approval to conduct the survey from the

101   relevant ethics review board or equivalent regulatory institution. In each country, every effort

102   was taken to ensure that the international research protocol was followed to guarantee

103   consistency in survey instruments, data collection and processing procedures. Further

104   information can be found in Roberts et al. (Roberts et al., 2009) and online at www.hbsc.org.

105   *Sample*

106   The present analyses are based on 15-year olds since AFDrink and AFDrunk were assessed in

107   this age group only. The average response rate across the 38 countries was above 90% (Table

108   1). Since AFDrink and AFDrunk can only be investigated among drinkers, those who had

109   never drunk any alcohol were excluded from the analyses. Participants who did not answer all

110   the questions used in the analyses were excluded from the analyses (10.5% in total). The final

111   sample consisted of 21,479 boys and 23,322 girls aged 15 who had consumed alcohol.

112   ----------Table 1 about here----------

113   *Measures*

114   The questionnaire was developed by an interdisciplinary research group from the participating

115   countries (detailed information in Currie et al. (Currie et al., 2008)). A centralized

116   translation/back translation procedure was used to guarantee language equivalence.

117   *Drunkenness prevalence*. The question was "Have you ever had so much alcohol that you

118   were really drunk?" (once or more=1, never=0).

119   Subsequently, *AFDrink* and *AFDrunk* were assessed with the introductory question "At what

120   age did you first do the following things?" The first item was "Drink alcohol (more than a

121   small amount)", the second was "Get drunk ". Response options included 'never' and ranged

122   from '11 years or younger' (=10.5; 11 minus half range to adjacent category: Wicki et al.,

123   2006) to '15 years' (=15). Moreover, among those who were at least once drunk in their lives,

124   a difference score was created by subtracting the AFDrink from the AFDrunk. This score

125   measures how many years elapsed from drinking initiation to the first time drunk.

126   Five *problem behaviour* variables were used as outcome measures:

127   *Smoking* was assessed with the question "How often do you smoke tobacco at present?"

128   Answer categories ranging from 'every day' (=30) to 'I do not smoke' (=0) were coded to

129   represent a 30-day frequency measure. To measure *cannabis use*, the question was "Have you

130   ever taken cannabis in the last 12 months?" The answer categories ranged from never to 40

131   times or more. Mid-points of categories were used and 45 occasions for the upper category

132   (40 times plus half range to mid-point of adjacent category: Wicki et al., 2006). Both

133   variables were log-transformed to approximate a normal distribution and reduce the impact of

134   extreme values (Tabachnick and Fidell, 2001).

135   *Injuries/fights.* The questions were "In the last 12 months" (a) "how many times were you

136   injured and had to be treated by a doctor or nurse?" and (b) "how many times were you in a

137   physical fight?" For both variables, the answer categories ranged from never (=0) to 4 times

138   or more (=4.5).

139   *Low academic performance*. The question was "In your opinion, what does your class

140   teacher(s) think about your school performance compared to your classmates?" Due to the

141   inverse coding of the answer categories (i.e., 'very good'=1, 'good'=2, 'average'=3, 'below

142   average'=4) the variable measures low performance.

143   *Analytic Strategy*

144   Due to the clustering of individuals within countries, we estimated multilevel structural

145   equation models using the Mplus 6.1 (Muthén and Muthén, 2010) software. Due to skewness

146   and ordinal scaling of dependent variables, Maximum Likelihood Robust (MLR) estimation

147   was used. The comparative fit index (CFI), the Tucker-Lewis index (TLI, both preferably .95

7

148   or higher) and the standardized root mean square residual (SRMR) and the root mean square

149   error of approximation (RMSEA, both preferably .08 or lower) served as model fit indices

150   (Chen et al., 2008; Iacobucci, 2010; Marsh et al., 2004). The ratio of the χ^2-value and the

151   degrees of freedom (χ^2/df) is also given.

152   In a first model, the five dependent variables (tobacco use, cannabis use, injuries, fights and

153   low academic performance) were regressed on AFDrink. Second, this relationship was

154   estimated separately among those who had experienced drunkenness at least once and those

155   who never had been drunk. Third, among those ever drunk, we included the AFDrunk to

156   predict the five problem behaviors. To do so, the time between age 15 and the AFDrink was

157   divided into the time between age 15 and AFDrunk and between AFDrunk and AFDrink.

158   Due to known differences in the magnitude of the five outcome variables across countries

159   (Currie et al., 2008), random intercepts models were estimated. In a subsequent step, also the

160   relationships with the independent variables described above were allowed to vary across the

161   countries (random intercept random slope models). The resulting slope variance represents an

162   indicator of the extent to which the reported overall relationships varied across the 38

163   countries and regions. Due to known gender differences in adolescent problem behaviour

164   (Currie et al., 2008), all models were estimated for boys and girls separately.

165   Due to the cluster sampling of schools or school classes instead of individuals, which can

166   artificially enhance test power by factor 1.2 to 1.6 (Kuntsche, 2004; Roberts et al., 2009;

167   Roberts et al., 2004), and the extremely large sample size, the usual 5% α-error threshold was

168   elevated to 0.1%. This was done to avoid reporting as significant very small parameter

169   estimates.

Results

Lifetime prevalence of alcohol consumption across all countries (Table 1) was 79.8%, varying from 51.9% in the United States to 89.9% in the Czech Republic. Shown in Table 2, on average, twice as many boys and over 50% as many girls had been drunk than had not been drunk. Also, the average age of first drink among the 15-year olds was 12.94 and average age of their first drunkenness experience (if ever) was 13.18. Participants smoked an average of five (5.19) times in the last 30 days (Table 2). They reported using cannabis 2.55 times, and were injured or involved in fights about once in the last 12 months. Those who reported drunkenness had a slightly lower AFDrink (t_{Boys}=17.2, p<.001; t_{Girls}=16.6, p<.001) than those without drunkenness experiences. The former had also a consistently higher level of problem behaviors than the latter.

----------Table 2 about here----------

The regression analyses indicate the lower the AFDrink the higher the level of problem behaviour (Model 1 in Table 3). This was consistently the case for all five problem domains. However, when the relationship was estimated separately according to lifetime drunkenness prevalence (Model 2), a different picture emerged. Whereas the negative relationship was about the same or slightly higher among those who were drunk at least once, there was no or almost no association among those who had been never drunk (Table 3). The only exceptions, in which significant associations in the latter group were found, were cannabis use (only girls) and fights (both genders). However, also in these cases, the coefficients were three to ten times lower than among those with drunkenness experiences. Additional analyses[1] revealed that the difference in association between the groups with and without drunkenness was also in these cases statistically significant at p < .001.

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[1] A separately estimated interaction model (results not shown but to be obtained from the authors upon request) demonstrated that, the difference between those who had been never drunk and those who were drunk at least once in terms of AFDrink was significant (p < .01) for both boys and girls and for each of the dependent variables.

193   ----------Table 3 about here----------

194   The subsequently estimated random intercept random slope models revealed that the cross-

195   country variance of the AFDrink slopes was very small (i.e., $V_{Boys}<.001$; $V_{Girls}<.007$)[2]. This

196   means that the results shown Table 3 is consistent across the 38 countries and regions

197   included.

198   Shown in Table 4, among those who had been drunk the effect of the AFDrunk and the time

199   that elapsed from the first drinking to the first drunkenness experience (Time from AFDrink

200   to AFDrunk) are shown. The first line (Model 2 in Table 4) among boys and girls shows the

201   effect of the total time from AFDrink to age 15 among those who with drunkenness

202   experiences, consistent with the data shown in Table 3. Subsequently, the five problem

203   behaviors were regressed on both the age at first drunkenness (AFDrunk) and the time from

204   AFDrink to AFDrunk (Model 3). The results revealed that the earlier the AFDrunk the higher

205   the level of all five problem behaviors. In contrast, significant associations for the time

206   elapsed between AFDrink and AFDrunk and problem behaviors were found only for injuries

207   (only girls) and fights (both genders). However, in this case, the coefficients were three to five

208   times lower than those of the AFDrunk. Thus, also among those who had been drunk,

209   AFDrink was of little significance for problem behaviors when AFDrunk was taken into

210   account.

211   ----------Table 4 about here----------

212   The subsequently estimated random intercept random slope models revealed that the cross-

213   country variance of the AFDunk slopes and of the slopes of the time elapsed between

214   AFDrink and AFDrunk were very small (i.e., $V_{Boys}<.002$; $V_{Girls}<.008$)[2]. This means that the

215   results shown in Table 4 did not vary considerably across the 38 countries and regions.

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[2] Results not shown but to be obtained from the authors upon request

Discussion

216

217 The aim of the present study was to investigate the association between the AFDrink and the

218 level of smoking, cannabis use, injuries, fights and low academic performance at the age of 15

219 when the AFDrunk was taken into account in a large sample of 15 year olds in 38 different

220 North American and European countries and regions.

221 In the first analyses (AFDrunk not taken into account), the reported negative association

222 between AFDrink and all five problem behavior outcomes were consistent with the findings

223 of the bulk of previous studies on the topic (Buchmann et al., 2009; Fergusson et al., 1994;

224 Gruber et al., 1996; Hingson et al., 2009; Hingson et al., 2000; Hingson and Zha, 2009;

225 Komro et al., 2010; Peleg-Oren et al., 2009; Rothman et al., 2008; Swahn et al., 2010; Swahn

226 et al., 2008; van Diemen et al., 2008; Vieira et al., 2007). Further analysis, however, revealed

227 that this link existed only among those who already 'had consumed so much alcohol that they

228 were really drunk' at least once by age 15. Unlike the consistent associations found for

229 AFDrunk, among those without drunkenness experience, the age at which they had consumed

230 their first alcohol was inconsistently related to the level of problem behaviors at age 15.

231 Moreover, even among those who had been drunk at least once by age 15, AFDrunk was

232 much more predictive than AFDrink. In this group, we found consistently across problem

233 domains and for both boys and girls that the earlier someone experienced drunkenness the

234 higher was the level of problem behaviors at age 15. However, early onset of drinking (i.e. the

235 time between alcohol initiation and first episode of drunkenness) showed no consistent or

236 substantial associations with problem behaviors.

237 There are several possible explanations for these findings. First, heavy exposure to ethanol

238 during a period of physical and neurological maturation can constitute a primary direct risk

239 factor (Dawson et al., 2008) that alters developmental trajectories leading to problem

240 behaviors (Buchmann et al., 2009; Pedersen and Skrondal, 1998). Early heavy drinking might

241 also interfere with the development of adequate coping strategies, problem-solving skills

242 (Buchmann et al., 2009; Swahn et al., 2008) and social relationships (Pedersen and Skrondal,

243 1998; Swahn et al., 2008). Second, early heavy drinking can be a marker, symptom, or

244 component of a general problem syndrome rather than a specific and independent predictor of

245 problem behaviors in later life (Dawson et al., 2008; McGue and Iacono, 2005; Prescott and

246 Kendler, 1999). For example, early drunkenness could occur as a reaction to experienced

247 negative life events (e.g. abuse or trauma), having alcohol-dependent parents, or showing

248 severe conduct problems in childhood (Sartor et al., 2007; Zucker, 2008). Third, the small or

249 non-existent associations between AFDrink and problem behaviors after drunkenness was

250 taken into account suggests that early onset of drinking without transition to drunkenness in

251 early adolescence is of little or no importance for other problem behaviors. And even among

252 those with drunkenness experiences, what has happened before the first drunkenness (i.e. the

253 time elapsed since first drinking) was not consistently related to the level of problem

254 behaviors at age 15. Early moderate drinking might often occur in the family context, which

255 could provide normative influence on moderation, particularly within appropriate cultural

256 contexts (e.g. Mediterranean countries) (Ward et al., 2010). Alternatively, early age of first

257 drink may for some youths simply reflect normal experimentation not associated with

258 increased risk for problem drinking. More research is needed to identify characteristics of

259 early initiators who go on to early and frequent drunkenness and those who do not.

260 Nonetheless, our findings should not be interpreted as implying that early drinking should be

261 promoted in any way. Notably, it was shown that parents who have strict attitudes against

262 underage drinking contributed to low levels of drunkenness and other problem behaviors of

263 their adolescent children (Koutakis et al., 2008).

264 It should be emphasized that the findings were consistent across multiple countries. However,

265 a limitation of the study is the retrospective assessment of AFDrink and the AFDrunk which

266 is subject to recall bias (Parra et al., 2003). Fortunately, in the present study, the data

267 collection occurred rather close to the indicated AFDrink and AFDrunk which attenuate

268   possible measurement bias. This, however, implied that the period of 16 years and older was

269   not covered and led to the exclusion of one out of five participants who never consumed any

270   alcohol up to that age. Due to the lowest category of '11 years and younger' to measure

271   AFDrink (indicated by 19.2% among boys and 11.8% among girls) and AFDrunk (indicated

272   by 5.2% among boys and 2.3% among girls) we do not know at what age exactly these

273   participants initiated drinking and drunkenness. Moreover, childhood risk factors such as

274   heavily drinking parents and conduct disorders that are likely to lead to both early drinking

275   and early drunkenness could not be included in this study. This might also explain why even

276   in the links between AFDrunk and later problem behaviors the effect sizes were rather small

277   and indicate that even after drunkenness initiation many other factors may be responsible for

278   the level of different problem behaviors. However, the fact that we found consistent results in

279   the different models across all five problem behavior outcomes make us believe that even in

280   case of low effect sizes the reported effects are substantial and robust. Finally, the outcome

281   measures were simple frequency measures and fairly crude indicators of involvement in

282   various health and social hazards. Additional information about these behaviors would

283   probably have provided a more nuanced picture of the outcome measures. To overcome these

284   limitations, future research should include childhood risk factors and use longitudinal designs

285   following adolescents into young adulthood. Moreover, as the vast majority of the study

286   participants were European and mostly from countries where onset of drinking occurs before

287   or around early adolescence, it would be important to assess whether these findings are valid

288   also in populations in which onset of drinking occurs at significantly older ages. The major

289   strength of the study is the large multi-national sample representing various parts of North

290   America and Europe, and the standardization of its instrument and methods.

291   *Conclusions*

292   This study has important implications for both research and prevention. In contrast to

293   previous studies (Buchmann et al., 2009; Komro et al., 2010; Swahn et al., 2008; Zucker,

13

2008), we did not see that an early AFDrink per se is a direct risk factor for later problem behaviors. Since there is no drunkenness without drinking, those who were already drunk had a somewhat lower AFDrink (cf. Table 2). However, even in this group, the AFDrink failed to be a strong and consistent predictor of problem behaviors at age 15 when the AFDrunk was taken into account, which is consistent with previous studies (Rothman et al., 2008; Sartor et al., 2007). Drunkenness rather than drinking per se is associated with various immediate detrimental consequences such as blackouts, hangovers, violence, and injuries (Gmel et al., 2003; Windle, 2003) and is particularly dangerous early in life when physical and neurological maturation still takes place (Dawson et al., 2008).

Also in contrast to previous arguments (Buchmann et al., 2009; DeWit et al., 2000; Eliasen et al., 2009; Gruber et al., 1996; Hingson et al., 2009; Hingson et al., 2000; Hingson and Zha, 2009; Komro et al., 2010; Palmer et al., 2010; Pitkänen et al., 2005; Swahn et al., 2008), we cannot recommend that simply delaying the AFDrink is important to prevent problem behaviors. The presented results are rather in line with the conclusion of Prescott and Kendler (Prescott and Kendler, 1999, p. 106) formulated more than one decade ago: "measures designed to interrupt the path from early use to heavy drinking may be a more fruitful approach for decreasing risk for alcoholism [and other problems later in life] than attempts to delay initiation of alcohol use". Thus, consistent with the principles of harm reduction (Marlatt, 1998), interventions should focus mainly on adolescent drunkenness, with its obvious potential for harm, and less on the age at which people consume their first alcohol.

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457

Table 1: Response rates, percentage of those who had consumed alcohol and final sample size in each country

	Response rate[1]	Prevalence of alcohol use	Final sample size[2]	Prevalence of drunkenness[2]
Austria	87.7	87.1	1,215	65.7
Belgium (Flemish)	97.3	88.1	1,346	54.2
Belgium (French)	-[3]	80.6	998	52.1
Bulgaria	100	83.1	1,318	77.6
Canada	92.3	71.7	1,526	73.9
Croatia	100	85.2	1,307	66.3
Czech Republic	100	89.9	1,390	57.8
Denmark	94.4	88.7	1,184	79.7
England	-[3]	84.6	1,072	76.0
Estonia	100	87.7	1,316	76.0
Finland	89.4	70.0	1,006	81.7
France	79.1	69.4	1,470	56.3
Germany	46.7	85.2	1,986	53.3
Greece	96.3	86.7	1,112	43.3
Greenland	-[3]	78.2	221	80.5
Hungary	98.1	87.1	921	58.5
Iceland	99.2	56.7	1,024	77.5
Ireland	98.9	72.0	1,043	66.8
Italy	95.5	74.1	902	45.7
Latvia	98.1	84.0	540	80.4
Lithuania	100	94.8	1,643	81.6
Luxemburg	74.3	83.7	1,157	48.0
FYRO Macedonia	100	61.9	1,140	50.1
Malta	-[3]	71.5	229	55.9
The Netherlands	99.1	85.9	1,128	49.6
Poland	100	88.9	1,980	56.4
Portugal	86.4	79.8	1,006	42.7
Romania	100	77.3	1,144	60.4
Russia	82.2	78.7	1,830	70.3
Scotland	75.8	85.9	1,705	73.7
Slovakia	-[3]	87.1	970	56.8
Slovenia	98.2	83.0	1,215	69.1
Spain	94.0	74.3	2,123	54.1
Sweden	90.2	63.9	765	62.1
Switzerland	85.7	82.1	1,079	47.6
Ukraine	-[3]	85.1	1,362	72.5
United States	99.1	51.9	293	71.7
Wales	56.8	90.7	1,135	83.3
Total	91.1	79.8	44,801	63.6

Note. [1]at class level in percent; [2]of those who consumed alcohol at least once; [3]not available

Table 2: Means and Standard Deviations in brackets of the variables used in this study according to gender and drunkenness status

	Total	Never been drunk	Drunk at least once
Boys (N)	21,479	7,301	14,178
Age at initiation			
AFDrink (in years)	12.94 (1.5)	13.18 (1.5)	12.81 (1.5)
AFDrunk (in years)	--	--	13.83 (1.2)
Problem behaviors			
Smoking occasions[1]	5.19 (10.9)	1.11 (5.3)	7.29 (12.4)
Cannabis use[2]	2.55 (8.7)	0.35 (3.1)	3.69 (10.3)
Injuries[2]	0.94 (1.2)	0.73 (1.1)	1.04 (1.3)
Fights[2]	1.15 (1.5)	0.73 (1.2)	1.36 (1.6)
Low academic performance[3]	2.47 (0.8)	2.33 (0.8)	2.54 (0.8)
Girls (N)	23,322	9,026	14,296
Age at initiation			
AFDrink (in years)	13.24 (1.4)	13.43 (1.4)	13.12 (1.3)
AFDrunk (in years)	--	--	14.03 (1.0)
Problem behaviors			
Smoking occasions[1]	5.36 (11.0)	1.23 (5.5)	7.98 (12.7)
Cannabis use[2]	1.46 (6.2)	0.16 (1.7)	2.28 (7.7)
Injuries[2]	0.67 (1.1)	0.52 (1.0)	0.76 (1.1)
Fights[2]	0.48 (1.0)	0.27 (0.8)	0.62 (1.2)
Low academic performance[3]	2.34 (0.8)	2.18 (0.8)	2.44 (0.8)

Note. [1]in the last 30 days; [2]in the last 12 months; [3]answer categories were 'very good' coded as 1, 'good' coded as 2, 'average' coded as 3, and 'below average' coded as 4.

Table 3: Problem behavior regressed on Age at First Drink separately by gender and drunkenness status

	Smoking	Cannabis use	Injuries	Fights	Low academic performance
Boys					
Model 1: AFDrink among boys in general	-.10***	-.17***	-.06***	-.13***	-.03***
Model 2: AFDrink among those never drunk	.01	-.03	-.02	-.06***	.02
Model 2: AFDrink among those drunk at least once	-.09***	-.16**	-.06***	-.13***	-.04***
Girls					
Model 1: AFDrink among girls in general	-.14***	-.16***	-.07***	-.12***	-.04***
Model 2: AFDrink among those never drunk	-.02	-.05***	-.02	-.05***	.01
Model 2: AFDrink among those drunk at least once	-.13***	-.17***	-.07***	-.13***	-.04***

Note. Model fit: CFI > .98, TLI > .97, χ^2/df < 144, RMSEA < .02, SRMR < .01 for all models; *** $p < .001$; shown are standardized regression coefficients

Table 4: Problem behavior regressed on Age at First Drunkenness (AFDrunk) and the time in years from the Age at First Drink and the Age of First Drunkenness (cf. Table 3) among those having experienced drunkenness at least once

	Smoking	Cannabis use	Injuries	Fights	Low academic performance
Boys					
Model 2: AFDrink among those drunk at least once	-.09***	-.16**	-.06***	-.13***	-.04***
Model 3: AFDrunk	-.17***	-.23***	-.08***	-.16***	-.06***
Model 3: Time from AFDrink to AFDrunk	.03	-.01	-.01	.04***	.00
Girls					
Model 2: AFDrink among those drunk at least once	-.13***	-.17***	-.07***	-.13***	-.04***
Model 3: AFDrunk	-.21***	-.26***	-.08***	-.17***	-.06***
Model 3: Time from AFDrink to AFDrunk	.01	.02	.03***	.04***	.00

Note. Model fit: CFI > .98, TLI > .97, χ^2/df < 144, RMSEA < .02, SRMR < .01 for all models; ** $p < .01$; *** $p < .001$; shown are standardized regression coefficients