

- 15 Clark T, Fleming T, Bullen P, et al. Health and well-being of secondary school students in New Zealand: trends between 2001, 2007 and 2012. *J Paediatr Child Health* 2013;49:925–34.
- 16 Osaki Y, Tanihata T, Ohida T, et al. Decrease in the prevalence of adolescent alcohol use and its possible causes in Japan: periodical Nationwide Cross-Sectional Surveys. *Alcohol Clin Exp Res* 2009;33:247–54.
- 17 Skog OJ. The collectivity of drinking cultures: a theory of the distribution of alcohol consumption. *Br J Addict* 1985;80:83–99.
- 18 Ritchie H. Alcohol Consumption: <https://ourworldindata.org/alcohol-consumption> (20 January 2021, date last accessed).
- 19 Jaervinen M, Ostergaard J. *Governing Adolescent Drinking*. *Youth & Society* 2009;40:377–402.
- 20 Moeller K. The freedom to drink and the freedom to sell drink: a hundred years of Danish Alcohol-Control Policy. *J Policy Hist* 2012;24:499–517.
- 21 World Health Organization. Global Health Observatory data repository. Available at: <https://apps.who.int/gho/data/node.main.A1022?lang=en> (21 February 2021, date last accessed).
- 22 Arpa SB. European School Survey Project on Alcohol and Other Drugs: 2019. Malta National Report. Malta: Foundation for Social Welfare Services, 2020.
- 23 Ministry for the Family, Children's Rights and Social Solidarity. National Alcohol Policy. Malta: Ministry for the Family, Children's Rights and Social Solidarity, 2017.
- 24 Kuntsche E, Gabhainn SN, Roberts C, et al. Drinking motives and links to alcohol use in 13 European Countries. *J Stud Alcohol Drugs* 2014;75:428–37.
- 25 Pennay A, Holmes J, Törrönen J, et al. Researching the decline in adolescent drinking: the need for a global and generational approach. *Drug Alcohol Rev* 2018;37:S115–S9.
- 26 Oldham M, Holmes J, Whitaker V, et al. *Youth Drinking in Decline*. Sheffield: University of Sheffield, 2018.
- 27 Vashishtha R, Livingston M, Pennay A, et al. Why is adolescent drinking declining? A systematic review and narrative synthesis. *Addict Res Theory* 2019;28:1–14.
- 28 De Looze M, van Dorsselaer S, Stevens GWJM, et al. Van den Eijnden RJJM. The decline in adolescent substance use across Europe and North America in the early twenty-first century: a result of the digital revolution? *Int J Public Health* 2019;64:229–40.
- 29 Burton R, Henn C, Lavoie D, et al. A rapid evidence review of the effectiveness and cost-effectiveness of alcohol control policies: an English perspective. *Lancet* 2017;389:1558–80.
- 30 Siegfried N, Pienaar DC, Ataguba JE, et al. Restricting or banning alcohol advertising to reduce alcohol consumption in adults and adolescents. *Cochrane Datab Syst Rev* 2014;CD010704.
- 31 Gruenewald PJ. Regulating availability: how access to alcohol affects drinking and problems in youth and adults. *Alcohol Res Health* 2011;34:248–56.
- 32 Fairman BJ, Simons-Morton BG, Haynie DL, et al. State alcohol policies, taxes, and availability as predictors of adolescent binge drinking trajectories into early adulthood. *Addiction* 2019;114:1173–82.
- 33 Esser MB, Jernigan DH. Policy Approaches for regulating alcohol marketing in a global context: a public health perspective. *Annu Rev Public Health* 2018;39:385–401.
- 34 Wagenaar AC, Salois MJ, Komro KA. Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. *Addiction* 2009;104:179–90.
- 35 Leal-López E, Moreno-Maldonado C, Inchley J, et al. Association of alcohol control policies with adolescent alcohol consumption and with social inequality in adolescent alcohol consumption: a multilevel study in 33 countries and regions. *Int J Drug Policy* 2020;84:102854.
- 36 Shackleton N, Milne BJ, Jerrim J. Socioeconomic inequalities in adolescent substance use: evidence from twenty-four European countries. *Subst Use Misuse* 2019;54:1044–9.
- 37 Rogne AF, Pedersen W, Bakken A. Immigration and the decline in adolescent binge drinking. *Drug Alcohol Depend* 2019;203:35–43.
- 38 Jackson N, Denny S, Sheridan J, et al. Uneven reductions in high school students' alcohol use from 2007 to 2012 by age, sex, and socioeconomic strata. *Subst Abuse* 2017;38:69–76.
- 39 Currie C, Zanotti C, Morgan A, et al. *Social determinants of health and well-being among young people. Health Behaviour in School-Aged Children (HBSC) Study: International Report from the 2009/2010 Survey*. Copenhagen: WHO Regional Office for Europe, 2012.
- 40 Inchley J, Currie D, Young T, et al. *Growing up unequal: gender and socioeconomic differences in young people's Health and Well-Being. Health Behaviour in School-Aged Children (HBSC) study. International Report from the 2013/2014 Survey*. Copenhagen: WHO Regional Office for Europe, 2016.

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Stronger alcohol-violence association when adolescents drink less? Evidence from three Nordic countries

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Background: Since 2000, adolescents' alcohol use and heavy episodic drinking (HED) have declined in the Nordic countries. However, little is known about corresponding trends in alcohol-related harm and possible changes in the alcohol-harm association. The aims are to examine (i) whether the decline in HED was accompanied by a decline in alcohol-related violence (AV) and (ii) whether the strength of the HED-AV association changed concomitant with the decline. **Methods:** Analysis of data from the European School Survey Project on Alcohol and Other Drugs (ESPAD), conducted among 15–16-year-olds in Iceland, Norway and Sweden in 2007 and 2015 ($n = 17\ 027$). Changes in proportions of AV and alcohol use past 12 months, and mean frequency of HED past 30 days were examined using Pearson's χ^2 -test and F-test, respectively. The HED-AV associations were estimated using logistic regression analysis. **Results:** HED and AV proportions decreased from 2007 to 2015 in all countries. Among current drinkers ($n = 8927$), both HED frequency and AV proportion decreased in Norway ($P < 0.001$) and remained stable in Iceland. In Sweden, AV decreased ($P < 0.001$) whereas HED remained stable. The magnitude of the HED-AV association increased in Norway ($\text{Beta}_{2015-2007} = 0.145$, 95% CI 0.054–0.236), remained the same in Iceland and decreased in Sweden ($\text{Beta}_{2015-2007} = -0.082$, 95% CI -0.158 to -0.005). **Conclusions:** Among youth in Iceland, Norway and Sweden, heavy episodic drinking and alcohol-related violence declined from 2007 to 2015. Among drinkers, the strength of the alcohol-violence association was moderated by the extent of heavy episodic drinking.

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Introduction

Inter-personal violence occurs frequently among young people, and violence-related injuries account for a considerable fraction of the health burden globally.¹ For instance, in 2013, interpersonal violence ranked fourth among the top causes of death in 15–19 year olds worldwide, accounting for 5.5% of all deaths in this age group, and interpersonal violence ranked tenth among the top causes of the disease burden (disability-adjusted life years) in this age group.¹ Thus, interpersonal violence among young people constitutes a substantial public health problem, particularly among young men.^{1,2} The association between alcohol use and aggression is well documented.^{3,4} While recent studies provide solid evidence for a decline in alcohol use and heavy episodic drinking among adolescents in the Nordic countries and several other countries since the turn of the century,^{5–12} several questions concerning the explanations for—and the impact of—this change, remain unanswered. Two of these questions are as follows: is the decline in adolescents' heavy episodic drinking accompanied by a decline in the prevalence of alcohol-related violence, and furthermore—has the decline in heavy episodic drinking been accompanied by a change in the magnitude of the association between alcohol use and alcohol-related violence? In this study, we examine these questions by employing comparable data from three Nordic countries: Iceland, Norway and Sweden, where alcohol use and heavy episodic drinking among adolescents declined to a larger extent than in most other European countries.¹³ By way of study motivation, we will in the following review the relevant literature for these research questions.

Experimental studies suggest a causal association between alcohol consumption and aggression; aggression is more easily triggered under the influence of alcohol, and with increasing blood alcohol concentration (BAC) level, the likelihood of aggressive behaviour increases.¹⁴ A high BAC level is typically the result of high alcohol intake within few hours, often referred to as heavy episodic drinking (HED). Moreover, survey studies have shown a significant association between aggressive behaviours on the one hand and frequency of HED on the other; thus, frequent HED elevates the risk of acting violently.⁴

Is the declining trend in heavy episodic drinking in the 2000s associated with a lower rate of alcohol-related violence? Along with the secular decline in adolescents' alcohol consumption in the 2000s, HED prevalence has decreased in several countries, including the Nordic countries in our study.⁶ For this reason, one could expect that the prevalence of alcohol-related violence among adolescents declined as well. On the other hand, the vast majority of HED occasions do not result in violent behaviour.¹⁵ It is therefore conceivable that a decrease in HED prevalence is not necessarily accompanied by a decrease in HED prevalence in the smaller group of violence-prone adolescents, and hence, it is not obvious that a decrease in alcohol-related violence should be expected. To this end, research addressing secular trends in alcohol-related violence among adolescents is limited, and the results are inconsistent. For example, a study from Western Australia showed that despite a marked decline in youth drinking, the rate of alcohol-related violence increased for boys and girls aged 13–17 years.¹⁶ On the other hand, a Swedish study of adolescents found that between 2000 and 2012, both alcohol consumption and alcohol-related harm declined, including alcohol-related violence.¹⁷

Is the decline in heavy episodic drinking accompanied by a change in the strength of the alcohol-violence association? Let us first consider how the alcohol-aggression association can be explained. Within the conditional/interactive theoretical framework, the association between alcohol use and aggression is regarded as conditional upon other factors, that is, aggression results from the effects of alcohol only when in combination with predisposing and situational trigger factors.¹⁸ In line with this, experimental studies have shown that an aggressive predisposition moderates the alcohol-violence association, that is, the likelihood of responding

aggressively to some provocation is not only elevated when under the influence of alcohol but more so among persons who generally tend to behave aggressively.¹⁹ Correspondingly, impulsivity or a propensity for risk-taking can moderate the alcohol-violence relationship, and hence individuals with these characteristics are more likely than others to behave aggressively under the influence of alcohol.^{20–22} Thus, the alcohol-violence link reflects complex underlying mechanisms,²³ and the strength of the association across cohorts or populations is likely to be contingent on factors also at the societal level. One such factor is the dispersion of violence-prone individuals among alcohol users. In line with Jessor and Jessor's problem behaviour theory,²⁴ numerous studies among young people have shown that problem behaviours, including substance use, aggressive behaviours and risk-taking behaviours, tend to cluster and that such clustering is associated with individual characteristics, for example, impulsivity and low self-control.²⁵ While the proportion of individuals with such characteristics, or traits, are likely quite stable over time, in part due to their genetic underpinning,²⁶ the proportion of young people with problem behaviours, including aggressive behaviours and HED, typically vary over time.^{6,27} This suggests that trait characteristics like impulsivity and low self-control will contribute more to the occurrence of HED in time periods when HED is rare as compared to periods when HED is common.²⁸ Figure 1 illustrates this point. At Time 1, HED is prevalent, and individuals with a high risk of aggressive behaviour (group B) are few compared to others (group A). At Time 2, HED is less prevalent, and the high-risk group constitutes a larger fraction of those engaging in HED. Hence, group B contributes more to the risk of violence among those engaging in HED at Time 2 than at Time 1, implying a stronger HED-violence association at Time 2. We may therefore, *a priori*, hypothesize that the extent to which violence proneness is associated with HED, depends on how common—or deviant—HED is in a population. Or, in other words; the more deviant HED is, the more likely it is that those who engage in HED, are characterized by impulsivity and low self-control and hence are more likely to act aggressively. If this is the case, we may expect that the strength of the alcohol-violence association is stronger when HED is uncommon as compared to when HED is more widespread.

In the present study, we examine whether the alcohol-violence association among adolescents is moderated by the extent of HED, which declined since the turn of the century.^{5,6} To this end, few studies have addressed this topic. A previous study from Norway showed that the association between alcohol use and the risk of alcohol-related violence among 15–20-year-olds became significantly weaker when alcohol consumption increased.²⁹ Therefore, with declining HED prevalence among adolescents, one would expect the opposite pattern to emerge, that is, a strengthening of the relationship between HED and the risk of alcohol-related violence. No previous studies have examined whether the strength of the association between heavy episodic drinking and alcohol-related violence has changed concomitant with the decline in youth drinking using comparable data from the Nordic countries.

Aims

The aims were to examine (i) whether the decline in heavy episodic drinking (HED) among adolescents was accompanied by a decline in alcohol-related violence (AV) and (ii) whether the strength of the HED-AV association changed concomitant with the decline in HED.

Methods

A Nordic research collaboration project entitled 'Twenty years later: Explanations and consequences of the decline in adolescents' drinking in the Nordic countries' was established in 2020. The overall purpose of this project was to provide novel insights as to the reasons for and the implications of the decline in youth drinking that has been documented in the Nordic countries since the turn of the century.^{5,6,8–12}

Anonymized data from the European School Survey Project on Alcohol and Other Drugs (ESPAD) will be used to address the research questions in this project. The ESPAD survey is conducted every fourth year and includes samples of 10th graders (15–16 year olds) from almost all European countries.³⁰ Comparable questions on drinking behaviour and alcohol-related harms have been repeated over time, which provided an opportunity to examine our research questions.

The present analyses were based on data collected in Iceland, Norway and Sweden in 2007 and 2015. Comparable measures on alcohol-related violence prior to 2007 were not available from Iceland, Norway and Sweden. Data from the two other Nordic countries, Denmark and Finland, were not analyzed for various reasons. The net sample in the Danish 2007 survey was very small and not considered representative, whereas the Finnish surveys did not include comparable measures of alcohol-related violence at the two time points. Sample characteristics by country are described in [Supplementary table S1](#). We excluded respondents with inconsistent responses and/or missing observations on key variables, and hence the final sample included only those with valid answers to the questions on alcohol use past 12 months, frequency of heavy episodic drinking and alcohol-related violence ($n = 17\ 027$), whereof 8927 were current drinkers.

Measures

Alcohol-related violence

We considered the questions about alcohol-related violence in 2007 and 2015 as comparable measures: ‘Because of your alcohol use/ while under the influence of alcohol, how often during the past 12 months have you experienced the following’: a list of harmful events included ‘Physical fight’. Notably, in Sweden in the 2015 survey, ‘influence of alcohol’ was translated into ‘intoxicated’. For each of these harmful events, there were seven response options: 0 times, 1–2 times, 3–5 times, 6–9 times, 10–19 times, 20–39 times and 40 or more times. As we assumed that possible changes over time in the magnitude of the alcohol-violence association reflect changes in individual-level, rather than event-level risk, our focus is on violent individuals, not violent events. This is reflected in the analyses, and hence the response categories were dichotomized into 0 = none and 1 = once or more often.

Alcohol use

Alcohol use in the past 12 months was measured with one question: ‘On how many occasions (if any) have you had any alcoholic beverage to drink?’, with the same seven response options as used for alcohol-related harm. The responses were dichotomized in the same way: 0 = none, 1 = once or more often, and the latter category was termed ‘current drinkers’. Heavy episodic drinking (HED) was measured with the question ‘How many times (if any) have you had five or more drinks/alcohol units on one occasion during the past 30 days?’, with six response options (none, 1 time, 2 times, 3–5 times, 6–9 times and 10 or more times). In the analyses, we applied a dichotomized measure (none vs. 1+ times) and a semi-continuous measure. The latter was constructed using interval mid-points for two response categories and a conservative value for the upper response category, and hence the semi-continuous measure took the values 0, 1, 2, 4, 7.5, and 11 in the main analysis. In sensitivity analyses, we altered the values for the three upper categories, so that these took lower values (i.e. 3, 6 and 10) or higher values (i.e. 5, 9 and 15). While other thresholds have been proposed for HED (e.g. 8+ drinks and 12+ drinks), 5+ drinks on a single occasion is by far the most common definition of HED,³¹ and it is used in all seven waves of the ESPAD survey which is conducted in 35 European countries.³⁰

Analyses

All analyses were conducted for each country separately. Differences over time in proportions were assessed using cross-tabulations with Pearson’s χ^2 -test, while ANOVA with F-test was used to examine differences over time between means. These analyses were conducted for the full samples of adolescents and for sub-samples comprising current drinkers only (i.e. the at-risk population for alcohol-related violence).

Moreover, we applied logistic regression analyses for estimating the association between HED frequency and alcohol-related violence. These associations were conducted among current drinkers only. Possible differences in the magnitude of the HED-violence association between 2007 and 2015 were tested separately for each country using interaction terms (year*HED). Adjustment for gender was not appropriate, as the gender distribution did not change over time, and gender was not associated with HED frequency.

We also examined whether the results were consistent across gender, by conducting gender-specific analyses. Data management and analysis were performed using SPSS (version 26).

Results

Over the 8-year period from 2007 to 2015, the proportions of adolescents who reported any alcohol use in the past year or any heavy episodic drinking (HED) in the past month decreased in all three countries. Alcohol-related violence also decreased in all three countries ([table 1](#)), and all these changes were statistically significant ($P < 0.001$).

Among current drinkers, the prevalence of HED past month decreased in Iceland and Norway, whereas the average HED frequency decreased only in Norway ([table 2](#)). The prevalence of alcohol-related violence decreased significantly in Norway and Sweden but remained at the same level in Iceland.

Average HED frequency was markedly higher among the relatively few involved in alcohol-related violence as compared to other drinkers, across countries and survey year ([table 2](#)). However, changes over time among violent and non-violent adolescents differed by country. In Iceland and Norway, there was a statistically significant decrease in HED frequency among the non-violent, whereas average HED frequency remained at a high level among violent adolescents over time. In Sweden, on the other hand, the overall decrease in HED frequency was not statistically significant and this pertained to both violent and non-violent respondents ([table 2](#)).

Next, we examined whether the magnitude of the association between HED frequency and alcohol-related violence (i.e. the slope parameter estimate) increased from 2007 to 2015 ([table 3](#)).

Logistic regression model estimates showed that this was the case only in Norway ($\text{Beta}_{2015-2007} = 0.145$, 95% CI 0.054–0.236), whereas for Swedish adolescents the magnitude of the association decreased ($\text{Beta}_{2015-2007} = -0.082$, 95% CI -0.158 to -0.005) ([table 3](#)). In sensitivity analyses, we altered the values for the three upper categories of the HED frequency variable, so that these took lower values or higher values; however, the patterning of findings remained the same (not displayed).

Finally, we explored whether these findings were consistent across gender. While the prevalence of alcohol-related violence was clearly higher among boys than girls in all three countries, any changes in the magnitude of the alcohol-violence association over time were similar for boys and girls. That is, for both boys and girls, the magnitude of the association increased in Norway, remained the same in Iceland, and decreased in Sweden (findings not displayed).

Discussion

In Iceland, Norway and Sweden, there was an overall decrease from 2007 to 2015 in the proportions of adolescents who reported alcohol

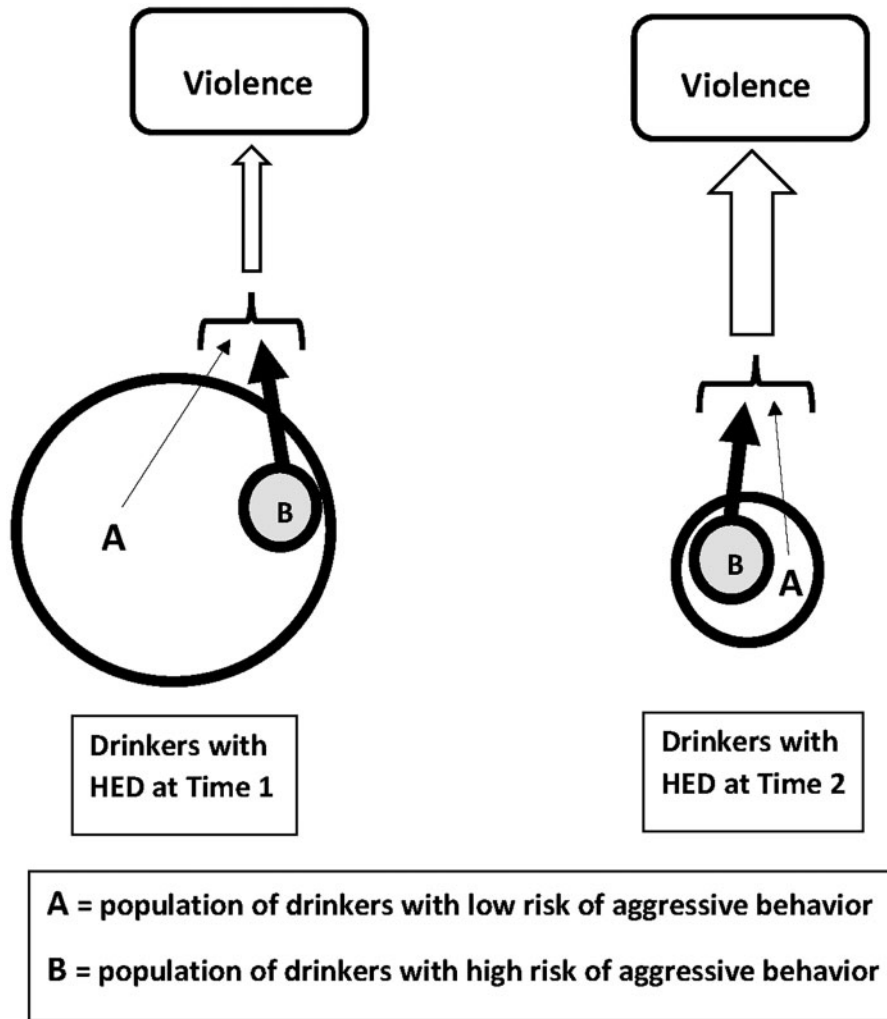


Figure 1 Illustration of relative strength of association between heavy episodic drinking (HED) and violence at two time points with different prevalence of HED and different proportion of high-risk individuals among drinkers.

use, heavy episodic drinking, and alcohol-related violence. Among current drinkers, that is, the at-risk population for alcohol-related violence, HED frequency decreased only in Norway. The magnitude of the association between HED frequency and alcohol-related violence increased from 2007 to 2015 in Norway, whereas in Sweden, the association decreased from 2007 to 2015.

This study adds to an emerging literature on aspects of the decline in youth drinking in many high-income countries.^{6,32} The decrease in drinking and HED among all tenth graders in these Nordic countries has been reported previously,⁶ and the observed concomitant decrease in alcohol-related violence is consistent with findings from a Swedish study conducted among adolescents between 2000 and 2012.¹⁷ Our *a priori* assumption that alcohol-related violence would be more strongly associated with HED frequency when such behaviour became less common, was empirically supported by data from Norway, and we will first address this part of our findings.

Our findings from Norway corroborate those from a few previous studies, which demonstrated that among young people, the association between drinking behaviour and violence or other aggressive behaviour varied over time, depending on how common alcohol consumption or drinking to intoxication was in the studied cohorts. A stronger association was found when consumption was less common, as compared to a period with more widespread consumption.^{29,33} Correspondingly, a stronger association between alcohol intoxication and various deviant behaviours (e.g. criminality and school misconduct) was found when alcohol intoxication became uncommon.²⁸ Of relevance in this respect, are also the findings from a study of the

association between alcohol intoxication and suicide attempt among Norwegian teenagers.³⁴ In this context, attempted suicide is of relevance as a self-directed aggressive behaviour, often of impulsive character and sometimes fuelled by alcohol intoxication. The study showed that this association became weaker over time when drinking to intoxication became more widespread. In contrast, one study reported no change in the magnitude of the association between alcohol intoxication and aggressive behaviour over a period when such drinking behaviour became more common, whereas associations between intoxication and other deviant behaviours (theft, pilfering and school misconduct) became weaker.³⁵ Thus, there is a small, and not entirely consistent literature, suggesting that the strength of the association between HED and aggressive—or other socially deviant—behaviour may be contingent upon the extent of HED at the societal level. Our findings from Iceland corroborate those from Norway as there was little change in the extent of HED and no significant change in the strength of the HED-violence association among drinkers.

Our findings from Sweden, did—in part—contrast those from Iceland and Norway. While the proportion of drinkers and the extent and frequency of heavy drinking occasions decreased among all students in all three countries, Sweden differed from Iceland and Norway in some respects of likely importance in our context. Among current drinkers, both HED frequency and alcohol-related violence remained stable in Iceland and declined significantly in Norway, whereas in Sweden, HED frequency remained stable, and yet alcohol-related violence declined. One possible explanation for the latter finding is the change in the wording of the alcohol-related

Table 1 Drinking behaviour, heavy episodic drinking (HED) and alcohol-related violence (AV) by survey year and country, all respondents

Survey year (N)	Iceland			Norway			Sweden		
	2007(3423)	2015 (2589)	Test change	2007 (3294)	2015 (2416)	Test change	2007 (3032)	2015 (2273)	Test change
Proportion drinkers, past 12 months (%)	55	23	$P < 0.001$	66	46	$P < 0.001$	70	46	$P < 0.001$
Proportion HED, past 30 days (%)	21	7	$P < 0.001$	35	18	$P < 0.001$	34	22	$P < 0.001$
Average HED frequency, past 30 days	0.6	0.2	$P < 0.001$	1.3	0.5	$P < 0.001$	1.1	0.7	$P < 0.001$
Proportion AV, past 12 months (%)	7.5	3.2	$P < 0.001$	15.7	3.6	$P < 0.001$	10.3	4.3	$P < 0.001$

Table 2 Drinking behaviour, alcohol-related violence (AV) and heavy episodic drinking (HED) among those not involved and those involved in AV by survey year and country, current drinkers only

Survey year (N)	Iceland			Norway			Sweden		
	2007 (1886)	2015 (593)	Test change	2007 (2156)	2015 (1105)	Test change	2007 (2133)	2015 (1054)	Test change
Proportion HED ^a (%)	38	30	$P < 0.001$	54	41	$P < 0.001$	49	48	$P = 0.355$
Average HED frequency ^a	1.1	1.0	$P = 0.155$	1.9	1.1	$P < 0.001$	1.6	1.5	$P = 0.07$
Proportion AV ^b (%)	13.6	14.0	$P = 0.819$	24.0	7.9	$P < 0.001$	14.6	9.3	$P < 0.001$
Average HED frequency ^a									
Not involved in AV	0.9	0.6	$P = 0.009$	1.4	0.9	$P = 0.001$	1.7	1.2	$P = 0.396$
Involved in AV	3.0	3.3	$P = 0.490$	3.6	3.6	$P = 0.960$	4.4	3.5	$P = 0.050$

a: HED frequency is reported for past 30 days.

b: AV is reported for past 12 months.

Table 3 Associations between frequency of heavy episodic drinking (HED frequency) and likelihood of alcohol-related violence by survey year and country

Survey year (N)	Iceland			Norway			Sweden		
	2007 (1886)	2015 (593)	Difference 2015–2007	2007 (2156)	2015 (1105)	Difference 2015–2007	2007 (2133)	2015 (1054)	Difference 2015–2007
HED frequency									
Beta	0.297	0.373	0.076	0.248	0.393	0.145	0.334	0.252	−0.082
(95% CI)	(0.248 to 0.346)	(0.277 to 0.470)	(−0.032 to 0.185)	(0.212 to 0.284)	(0.310 to 0.476)	(0.054 to 0.236)	(0.292 to 0.376)	(0.188 to 0.316)	(−0.158 to −0.005)

Parameter estimates (beta) and 95% CIs from logistic regression models, current drinkers only.

violence measure from 2007 to 2015. Thus, the stronger HED-violence association observed in Sweden in 2015 as compared to 2007, may possibly reflect somewhat different wording of the outcome measure. However, other methodological explanations may also be considered, including possible sample differences over time in the distribution of risk factors for aggressive behaviour.

The issue of whether the alcohol-harm association is contingent upon the extent of alcohol use at the societal level is important in several respects. First, estimates of alcohol-harm associations are essential for estimating alcohol-attributable disease burden (and similar estimates of alcohol's social and other costs to society). If, as our findings may indicate, such associations do vary with the extent of alcohol use in a society, a fixed estimate of the alcohol-harm association may not apply across countries or within countries over time. Second, our findings corroborate with theories of complex associations between drinking behaviour and social harms, pertaining even to harms that are alcohol-attributable. While we do not fully understand the complexity of these associations, our findings may suggest that mechanisms also at the societal level are at play.

Methodological considerations and suggestions for future research

The present study employed a comparative approach with data from three Nordic countries, and extends a small research literature by examining how the decline in youth drinking has affected the alcohol-violence association. However, some methodological limitations warrant attention. First, the prevalence of HED and alcohol-related violence are likely underestimated for two reasons: heavy drinkers, including those with frequent HED, are typically underrepresented in survey samples, and—alcohol use is typically underreported by survey respondents.³⁶ However, whether, or to what extent, such underestimates are of importance for our analyses of changes over time in levels of—and associations between—drinking behaviour and alcohol-related violence, is difficult to determine. Second, the associations between HED and alcohol-related violence are likely underestimated because different time frames were used for these measures, that is, past 30 days and past 12 months, respectively. According to the principle of correspondence³⁷ or compatibility,³⁸ the predictor (e.g. HED) and the criterion (alcohol-related violence) should be measured at the same level of

specificity or generality. This notion has received considerable empirical support.^{38,39} Third, in contrast to what is generally observed regarding response rates over time, the ESPAD surveys experienced an increase in response rates from 2007 to 2015 in all three countries. This could possibly impact on sample comparability over time, and if so, the observed changes over time may partly reflect differences in sample representativity. Fourth, our hypothesis that the alcohol–violence association was moderated by the extent of HED among young people, draws on assumptions about changes in the distribution of characteristics of young drinkers as a result of drinking behaviour becoming more marginal, both statistically and socially. These assumptions could not be put to empirical test in the absence of relevant measures of such characteristics. Further studies are therefore warranted, to examine whether aggregate-level changes in drinking behaviour are associated with changes in the distribution of characteristics of drinkers. Such characteristics include personality traits, for example, impulsivity, and deviant behaviours, including anti-social behaviours, which may moderate the alcohol–harm association.^{20–22} Thus, to enhance our understanding of the mechanisms underlying the association between alcohol use and violence, future studies should aim to incorporate such factors to determine their importance for drinking behaviour relative to the level of drinking, and further to determine their possible moderating impact on the alcohol-violence association.

Conclusion

This study showed that along with the decline in youth drinking in Iceland, Norway and Sweden since the turn of the century, there has been an overall decline in alcohol-related violence among adolescents in these countries. The strength of the alcohol-violence association increased from 2007 to 2015 in Norway, where heavy episodic drinking declined. Thus, this study provides some support for the notion that the association between alcohol consumption and aggressive or other deviant behaviours is stronger in populations where heavy drinking episodes are less common. The findings suggest that by reducing the frequency of heavy episodic drinking, there is a potential to curb violent behaviour and thereby enhance the health and wellbeing among youth.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

- Along with the decline in heavy episodic drinking in Iceland, Norway and Sweden since the turn of the century, there has been an overall decline in alcohol-related violence among youth in these countries.
- The alcohol-violence association increased from 2007 to 2015 in Norway thus providing some support for the notion that the association between alcohol consumption and violence is stronger in populations where heavy drinking episodes are less common.
- In Sweden, however, the alcohol-violence association decreased between 2007 and 2015.
- The findings partly support the assumption that the alcohol-violence association is moderated by the extent of heavy episodic drinking.
- An implication of the findings is that by reducing the frequency of heavy episodic drinking, there is a potential to curb violent behaviour and thereby enhance the health and wellbeing among youth.

References

- 1 Mokdad AH, Forouzanfar MH, Daoud F, et al. Global burden of diseases, injuries, and risk factors for young people’s health during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2016;387:2383–401.
- 2 Baxendale S, Cross D, Johnston R. A review of the evidence on the relationship between gender and adolescents’ involvement in violent behavior. *Aggress Violent Behav* 2012;17:297–310.
- 3 Parnanen K, Cousineau MM, Brochu S, Sub F. Proportions of crimes associated with alcohol and other drugs in Canada. Canadian Centre on Substance Abuse 2002; Available at: <http://www.ccsa.ca/Resource%20Library/ccsa-009105-2002.pdf> (18 January 2021, date last accessed).
- 4 Rossow I, Bye EK. The problem of alcohol-related violence: an epidemiological and public health perspective. In: M, McMurran, editor. *Alcohol-related Violence: Prevention and Treatment*, Vol. 57. John Wiley & Sons, 2013.
- 5 de Looze M, Raaijmakers Q, ter Bogt T, et al. Decreases in adolescent weekly alcohol use in Europe and North America: evidence from 28 countries from 2002 to 2010. *Eur J Public Health* 2015;25:69–72.
- 6 Pape HP, Rossow I, Brunborg GS. Adolescents drink less: how, who and why? A review of the recent research literature. *Drug Alcohol Rev* 2018;37:S98–S114.
- 7 Vashishtha R, Livingston M, Pennay A, et al. Why is adolescent drinking declining? A systematic review and narrative synthesis. *Addict Res Theory* 2020;28: 275–88.
- 8 Arnasson A, Kristofersson GK, Thoroddr B. Adolescent alcohol and cannabis use in Iceland 1995–2015. *Drug Alcohol Rev* 2018;37:49–57.
- 9 Kraus L, Seitz N-N, Piontek D, et al. ‘Are The Times A-Changin’? Trends in adolescent substance use in Europe. *Addiction* 2018;113:1317–32.
- 10 Kristjansson AL, Sigfusdottir ID, Thorlindsson T, et al. Population trends in smoking, alcohol use and primary prevention variables among adolescents in Iceland, 1997–2014. *Addiction* 2016;111:645–52.
- 11 Larm P, Livingston M, Svensson J, et al. The increased trend of non-drinking in adolescence: the role of parental monitoring and attitudes toward offspring drinking. *Drug Alcohol Rev* 2018;1:34–41.
- 12 Raitasalo K, Simonen J, Tigerstedt C, et al. What is going on in underage drinking? Reflections on Finnish European school survey project on alcohol and other drugs data 1999–2015. *Drug Alcohol Rev* 2018;1:76–84.
- 13 ESPAD Group. ESPAD Report 2019: Results from the European School Survey Project on Alcohol and Other Drugs, EMCDDA Joint Publications, Publications Office of the European Union, Luxembourg, 2020.
- 14 Lipsey MW, Wilson DB, Cohen MA, Derzon JH. Is there a causal relationship between alcohol use and violence? A synthesis of evidence. In: M Galanter, editor.

- Recent Developments in Alcoholism: Alcohol and Violence, Vol. 13.* New York: Plenum Press, 1997; 245–82.
- 15 Bye EK, Rossow I. The impact of drinking pattern on alcohol-related violence among adolescents: an international comparative analysis. *Drug Alcohol Rev* 2010; 29:131–7.
 - 16 O'Donnell M, Sims S, Maclean MJ, et al. Trends in alcohol-related injury admissions in adolescents in Western Australia and England: population-based cohort study. *BMJ Open* 2017;7:e014913.
 - 17 Norström T, Raninen J. Drinking trajectories of at-risk groups: does the theory of the collectivity of drinking apply? *Drug Alcohol Rev* 2018;37:15–21.
 - 18 Pernanen K. Theoretical aspects of the relationship between alcohol and crime. In: JJ Collins, editor. *Drinking and Crime: Perspectives on the Relationship between Alcohol Consumption and Criminal Behaviour*. New York: Guilford Press, 1981: 1–69.
 - 19 Giancola PR. Alcohol-related aggression during college years: theories, risk factors and policy implications. *J Stud Alcohol Suppl* 2002;14:129–39.
 - 20 Lang AR. Alcohol-related violence: psychological perspectives. In: SE Martin, editor. *Alcohol and Interpersonal Violence: Fostering Multidisciplinary Perspectives. Research Monograph, Vol. 24.* Rockville, MD: U.S. Department of Health and Human Services, Washington, 1993; 121–48.
 - 21 Giancola PR. Alcohol and aggression: theories and mechanisms. In: M McMurran, editor. *Alcohol-related Violence Prevention and Treatment*. Chichester, UK: John Wiley & Sons, 2012: 37–60.
 - 22 Howard R, McMurran M. Alcohol and violence in developmental perspective. In: M McMurran, editor. *Alcohol-related Violence Prevention and Treatment*. Chichester, UK: John Wiley & Sons, 2013: 81–102.
 - 23 Room R, Rossow I. The share of violence attributable to drinking. *J Subst Use* 2001; 6:218–28.
 - 24 Jessor R, Jessor SL. *Problem Behavior and Psychosocial Development: A Longitudinal Study of Youth*. New York: Academic Press, 1977.
 - 25 Meader N, King K, Moe-Byrne T, et al. A systematic review on the clustering and co-occurrence of multiple risk behaviours. *BMC Public Health* 2016;16:657.
 - 26 Bevilacqua L, Goldman D. Genetics of impulsive behaviour. *Philos Trans R Soc Lond B Biol Sci* 2013;368:20120380.
 - 27 Collishaw S. Annual research review: secular trends in child and adolescent mental health. *J Child Psychol Psychiatry* 2015;56:370–93.
 - 28 Pape H, Rossow I. Less adolescent alcohol and cannabis use: more deviant user groups? *Drug Alcohol Rev* 2021;40:118–25.
 - 29 Bye EK, Rossow I. Is the impact of alcohol consumption on violence relative to the level of consumption? *J Scand Stud Criminol Crime Prev* 2008;9:31–46.
 - 30 ESPAD Group. ESPAD Report 2015: results from the European School Survey Project on Alcohol and Other Drugs, Publications Office of the European Union, Luxembourg, 2016.
 - 31 Jackson KM. Heavy episodic drinking: determining the predictive utility of five or more drinks. *Psychol Addict Behav* 2008;22:68–77.
 - 32 Raninen J, Livingston M. Exploring the changing landscape of youth drinking—we are still drawing the map. *Drug Alcohol Rev* 2018;37:6–8.
 - 33 Landberg J, Hübner L. Changes in the relationship between volume of consumption and alcohol-related problems in Sweden during 1979–2003. *Alcohol Alcohol* 2014; 49:308–16.
 - 34 Rossow I, Grøholt B, Wichstrøm L. Intoxicants and suicidal behaviour among adolescents: changes in levels and associations from 1992 to 2002. *Addiction* 2005; 100:79–88.
 - 35 Pape HP, Rossow I, Storvoll EE. Wetter and better? Changes in associations between drunkenness and other problem behaviors among Norwegian youth. *Eur Addict Res* 2008;14:61–70.
 - 36 Johnson TP. Sources of error in substance use prevalence surveys. *Int Sch Res Notices* 2014;2014: doi:10.1155/2014/923290.
 - 37 Fishbein M, Ajzen I. *Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley, 1975.
 - 38 Ajzen I. *Attitudes, Personality, and Behavior*. Milton-Keynes, England: Open University Press, 1988.
 - 39 Siegel JT, Navarro MA, Tan CN, Hyde MK. Attitude–behavior consistency, the principle of compatibility, and organ donation: a classic innovation. *Health Psychol* 2014;33:1084–91.