Association between self-reported binge drinking and absenteeism in the Baltic countries

Indrek Saar

Estonian Academy of Security Sciences, Tallinn, Estonia
Tallinn University, Estonia

Viktor Trasberg

University of Tartu, Estonia
Estonian Aviation Academy, Estonia

Abstract

Objective: Substantial loss of productivity due to absenteeism is associated with alcohol use. This study examined the associations between absenteeism in the workplace and in schools and binge drinking across various beverage types in the Baltic countries. **Methods:** We utilised a dataset of 3,778 individuals compiled from 2015 to 2016 and performed multiple negative binomial regression analysis with multiple imputations to deal with missing data. Self-reported measures were used for both absenteeism and binge drinking. **Results:** We found evidence to support the claim that absenteeism, in terms of self-reported absence days, is positively associated with self-reported binge drinking, specifically with beer bingeing. On average, beer bingers reported 49% ($p < .05$) more absences than people who drink alcohol but do not binge on beer. For wine and spirits variables, the estimates indicated positive but statistically insignificant associations. No group differences were identified across gender and education. **Conclusions:** A considerable proportion of days absent from work and from school can be associated with beer bingeing. Therefore, it should be acknowledged that beverage-specific alcohol policies that are more lenient toward beer than other types of alcohol can inadvertently increase absenteeism and decrease workplace productivity.

Corresponding author:
Indrek Saar, Estonian Academy of Security Sciences, Indrek Saar, Estonian Academy of Security Sciences, Kase 61, 12012 Tallinn, Estonia.
Email: indreksr@gmail.com

Alcohol consumption is often considered a main risk factor behind socially detrimental phenomena such as traffic accidents, drownings, fires, diseases, and injuries (World Health Organization, 2018). While no amount of alcohol is entirely safe for one's health, some patterns of drinking are more harmful and entail higher risks than others. This is likely to be the case for binge drinking. The distinctive feature of binge drinking is its intake timescale: during a single and limited period of time, an individual consumes large amounts of alcohol that may lead to serious health or behavioural consequences (Labhart et al., 2018; Lannoy et al., 2019). Prior studies have related binge drinking – usually defined as drinking more than 40 to 60 grams of pure alcohol on a single occasion – to broken or damaged friendships, neglected responsibilities, unplanned pregnancies, risk of HIV infection, accidents that cause injury, physical fights, acts of breaking the law, arrests, impaired quality of life, and health problems such as adverse effects on blood pressure, cardiac rhythm, and fetal development (see Dormal et al., 2018; Gill, 2002; Hingson et al., 2017; Kraus et al., 2009; Labhart et al., 2018).

One line of research has investigated the relationship between drinking and absenteeism, and the resulting loss of productivity (Laslett et al., 2010; Lund & Moan, 2021; Marzan et al., 2021; Schou & Moan, 2016). Prior studies have pointed to various determining factors for absence from work, including health status, various workplace-related factors, home or family-related factors, socio-demographic factors and lifestyle factors, with the latter also including smoking and alcohol use (Beemsterboer et al., 2008). Drinking can cause absence from work, due either to intoxication shortly after the drinking occasion or to the long-term health effects of drinking (Salonsalmi et al., 2009; Schou & Moan, 2016). Also, a U-shaped association has often been found indicating that abstainers and heavy drinkers are both more likely to incur absences from work than moderate drinkers (Marzan et al., 2021; Schou & Moan, 2016). However, the causal mechanisms between drinking and absenteeism and the impact of confounding factors are not clearly understood (Marzan et al., 2021; Schou & Moan, 2016).

The relational context at work, like co-worker or supervisory support, has been found to play some role in absenteeism due to drinking (Bacharach et al., 2010). Some studies have reported that the association is stronger among people with lower socio-economic status, typically assessed via income or education, which can be explained as arising from worse and less flexible working conditions in this subgroup (Schou & Moan, 2016). However, it can also be argued that educational attainment itself affects the way people drink (Rosoff et al., 2019). Therefore, even when people with higher education binge drink, the behaviour may lead to less severe consequences. When it comes to gender differences, while the level of alcohol-related absenteeism tends to be higher among males, the same amount of alcohol makes an average female more intoxicated than an average male (see discussion in Schou et al., 2014). This could explain the results from some studies that have shown an even stronger association between drinking and absenteeism among females (Schou & Moan, 2016). That said, still relatively little is known about group differences in alcohol use and absenteeism across gender, health status, socio-economic status, occupation or age (Schou & Moan, 2016). In addition, the facts that the long-term effects of drinking develop gradually over time (Bacharach et al., 2010) and that drinkers often attempt to hide hangovers from recent binges (Blum et al., 1993; Schou & Moan, 2016) might complicate the analysis of this relationship.

Bacharach et al. (2010) have shown that the mechanism underlying the association between drinking and absenteeism is governed less by the frequency or quantity of alcohol consumed and more by the way it is consumed. Their empirical evidence indicates that heavy episodic drinking could be a much better predictor of absenteeism than the frequency or quantity of alcohol consumption. A positive association between binge drinking and absenteeism has been reported by several other authors (e.g., Frone, 2008; Norström & Moan, 2009; Schou & Moan, 2016). Studies have also presented substantial costs from alcohol-related absenteeism and have shown that these costs are strongly associated with binge drinking (Pidd et al., 2006; Sullivan et al., 2019). This means that alcohol-related absenteeism might be explained by an acute impairment from binge drinking episodes rather than arising from drinkers' long-term, chronic health problems (Bacharach et al., 2010).

When it comes to binge drinking, the type of beverage also matters. As Mäkelä et al. (2011) argue, it is not the physical form of the beverage types that matter but rather the customs around the consumption of that beverage or who drinks how much. Some evidence has been presented on the beverage-specific preferences of binge drinkers (Naimi et al., 2007; Pakovic et al., 2019) and the role of beverage preferences in alcohol-related injuries (Andreuccetti et al., 2014), illnesses (Mäkelä et al., 2007), violence (Snowden, 2019), and mortality (Kerr & Ye, 2011). Based on these few studies, the predominant view seems to be that both spirits and beer are more often associated with harm than other kinds of alcohol (Kerr & Ye, 2011; Norström & Moan, 2009; Ramstedt & Boman, 2011). Some studies have also suggested that the actual amount of alcohol intake is a more crucial factor and that the type of beverage does not make a large difference (Mäkelä et al., 2007; Snowden, 2019).

To our knowledge, there is no empirical evidence for an association between absenteeism and the binge drinking of different alcoholic beverages. The overall purpose of an alcohol policy is to lessen the harmful consequences of drinking, not necessarily to prohibit the drinking itself. Therefore, it is important to find ways to reduce alcohol-related harm without seriously affecting the choices of infrequent or light drinkers. A good example of a balanced alcohol policy is the excise taxation designed to treat various kinds of beverages differently (see Rehm & Shield, 2017). In particular, changing the consumption of a beverage type through differential taxation or regulation may be a way to affect the most problematic drinkers and the drinking customs that cause the most harmful effects (Mäkelä et al., 2011). Some economists have actually derived specific excise rates for different alcoholic beverages to minimise the harm from drinking (Fogarty, 2012; Parry et al., 2009). To implement this general idea of differential treatment, a better understanding of the association between beverage type and alcohol-related harm is needed.

This article contributes to this branch of research by providing evidence from the Baltic countries focusing specifically on the relationship between binge drinking and absenteeism. The Baltic nations are known as heavy-drinking countries – the total alcohol consumption per capita in these countries (persons aged 15 years and older) is more than 10 litres of pure alcohol per year (World Health Organization, 2018). Binge drinking is also characteristic of Baltic drinking habits, at least partly related to those countries' Soviet history (Helasoja et al., 2007; Pomerlau et al., 2008) and their Nordic drinking culture. We probably would not be wrong in saying that in Nordic and Russian alcohol consumption cultures, an ability to tolerate large amounts of alcohol is often even admired (Hinote & Webber, 2012; Kobin, 2013). The latest evidence from the World Health Organization (2018) reveals that binge-drinking rates in the Baltic countries are among the highest in Europe, which is itself the region with the highest binge-drinking rates in the world. Therefore, we could also expect bingeing to affect absenteeism rates in the workplace. To our

knowledge, no evidence of this association is available for the Baltic region.

Based on the preceding discussion, the objective of this study is twofold. First, it aims to assess the associations between absenteeism and binge drinking across various beverage types. Second, it examines several confounding effects and group differences, focusing specifically on how the association is affected by the gender and socio-economic status of the drinker. To conduct this research, we utilised cross-sectional survey data from face-to-face interviews from 2015 to 2016, and employed multiple regression analysis to analyse the data.

Methods

Data and measures

We utilised the dataset from 3,778 individuals, collected between June 2015 and January 2016 for a study of the unrecorded alcohol market in Estonia, Latvia and Lithuania. A summary report about that study was compiled by Lang and Ringamets (2018). That study was initiated and designed by the International Alliance for Responsible Drinking (IARD) in collaboration with the project's Steering Group, with field work contracted from the Research Cube. Approval for the study was received from committees of ethics in all three Baltic countries.

A representative cross-sectional sample of individuals was compiled through door-to-door visits. Only participants older than 18 years of age were recruited, and responses were received through face-to-face interviews lasting around 40 minutes each. Anonymity of respondents was maintained and respondents were free to skip any questions or stop the interview at any time. For further details about the study and data collection see Lang and Ringamets (2018).

In the present study, absenteeism as a dependent variable was measured as the self-reported number of days respondents missed from work or school. To assess binge drinking, we categorised respondents as binge drinkers if they self-reported having a drink containing more

than 60 grams of pure alcohol on a single occasion at least 12 times per year. This is rather similar to the definition of heavy episodic drinking by the World Health Organization (2018), which is defined as consumption of 60 grams of pure alcohol on a single occasion at least once in the past 30 days.

We used responses to the following IARD survey questions to measure binge drinking and absenteeism:

- During the past 12 months, how often did you drink beer, wine, spirits (e.g., vodka, gin, whisky, brandy), or any other alcoholic beverage, such as surrogate, homemade, or home-mixed alcohol, even in small amounts?
- Can you please show me what you might have drunk on a typical day when you drank alcohol during the past 12 months?
- Can you remember the time when you drank the largest amount of alcohol within a 24-hour period over the past 12 months? Please show what amount and type of alcohol you drank at that time.
- During the past 12 months, how often did you drink about the same amount within a 24-hour period?
- How many days of work or study did you miss due to physical illness over the past 12 months?
- How many days of work or study did you miss due to mental or emotional health reasons over the past 12 months?

For the first and fourth questions, in addition to answering "Refuse" or "Don't know", respondents could choose from nine options on the frequency of drinking, from every day to never in the past 12 months. For the second and third questions, respondents were given the option to name up to eight different drinks from the following alcoholic beverages: beer; wine and sparkling wine; fortified wine; spirits and liqueurs; coolers; and surrogate alcohol. Altogether, there were 28 choices since, for each beverage, respondents could also choose the

size of each drink in litres (such as 330 mL, 500 mL, 1 L, 1.5 L, or 2 L for beer, and similar for other drinks). For each choice, respondents had to state the number of drinks consumed on the day in question and the alcohol content of each, in percentages. It was also possible for respondents to answer "Refuse" or "Don't know". We computed the pure alcohol consumed by each individual on a single occasion by multiplying the size of each drink (in litres) by the number of drinks consumed and then multiplying the resulting figure by the alcohol content (percentage). Since it was possible to report up to eight different drinks, as a final step we aggregated all the resulting quantities of pure alcohol over all eight drinks. We performed these operations separately for all drinks, beers, wines, and spirits.

As can be seen, the first two questions concern regular drinking, while the third and fourth relate specifically to the largest amount of alcohol respondents drank over the past 12 months. We first identified those individuals whose largest quantity of pure alcohol consumption and its frequency (third and fourth question) exceeded the threshold of binge drinking. Next, we identified binge drinkers based on regular drinking quantities and frequencies (first two questions). All individuals who met the criteria in either case were treated as binge drinkers. Individuals who reported that they had not drunk alcohol in the past 12 months were treated as abstainers.

For the last two questions, respondents provided the number of days they had missed from work or school (see the questions above). In this study, we added up the values each respondent gave for these two questions and used the resulting absenteeism figures as the values for our dependent variable. The dataset did not enable us to differentiate between absences from work and from studying. Therefore, in the following analysis, absenteeism includes both phenomena. However, since students represented only 7% of the sample and more than one-third of them also worked, reported absences are mostly related to work.

The survey dataset also contained questions and answers about the respondents' socio-demographic and socio-economic characteristics, which made it possible to include confounding variables in the analysis. On the basis of the work of Beemsterboer et al. (2008) on the determinants of absenteeism due to sickness absence, we employed the responses of the respondents regarding their self-reported physical and mental health over the past 12 months (poor or not); occupation (managers, specialists, never been employed, other); and individual characteristics, such as gender (male or female), birth year, income level (low, medium, high), size of household (one, two to four, or more than four members), marital status (married or not), smoking status (whether respondent had smoked in the past 12 months or not), and education (higher education or not). Regarding the health variable, there were separate questions for physical and mental health conditions, but if the respondents reported either of them as poor, we considered those individuals to be in poor health. Controlling for respondents' health status helps to account for other potential health-related factors that could increase the number of absences. For example, current abstainers could be frequent absentees due to chronic health problems because of their excessive drinking patterns in the past. In the previous literature this aspect has been thoroughly addressed in only a few studies (Lund & Moan, 2021; Schou & Moan, 2016).

In the case of monthly income levels, low, medium, and high incomes were determined as up to 400 euros, 401–1,400 euros, and more than 1,400 euros, respectively, for Estonia. For Latvia and Lithuania, lower monthly income intervals were used due to the comparatively lower average incomes overall: up to 200 euros, 201–1,200 euros, and more than 1,200 euros, respectively. Drawing on the evidence from earlier studies (e.g., Roche et al., 2008), we also used the data about the type of area (rural or not) where respondents live. In addition, because there can be differences in drinking behaviour across the three Baltic countries and

Table 1. Background characteristics of respondents.

Characteristics	Total sample (*n* = 3,767)	Sample without missing dependent variable values (*n* = 2,481)
Absences (missed days) [mean (*SD*)]	6 (16)	6 (16)
Abstainers (abstainers/non-abstainers, %)	9/91	5/95
Binge drinkers (yes/no, %)		
Bingers	33/67	36/64
Beer binger	12/88	13787
Wine bingers	6/94	7/93
Spirits bingers	19/81	21/79
Gender ratio (female/male, %)	53/47	51/49
Country (%)		
Estonia	33	33
Latvia	34	30
Lithuania	33	37
Income (%)		
Low	9	4
Middle	81	83
High	10	13
Location ratio (rural/other, %)	28/72	26/74
Employment status (employed/not employed, %)	68/32	98/2
Occupation (%)		
Managers	10	11
Specialists	59	63
Never employed (mostly students)	28	23
Other	3	3
Language ratio (local/other, %)	75/25	76/24
Health status (fair/poor, %)	86/14	92/8
Smoking ratio (smokers/non-smokers, %)	36/64	38/62
Education ratio (higher/other, %)	26/74	30/70
Birth year [mean (*SD*)]	1970 (16)	1974 (13)
Household size (%)		
1 member	22	19
2–4 members	82	74
5 or more members	6	7
Marital ratio (married/not married, %)	51/49	52/48

the respondents' nationality in each country (Helasoja et al., 2007; McKee et al., 2000), respondents were also characterised according to their country of residence (Estonia, Latvia, or Lithuania) and primary language in the family (official or not, as a measure of nationality). We also used the information about respondents' employment status (employed or not) as currently employed persons may experience more absenteeism from work. Most of the confounding variables were binary (coded as 0 or 1) except for income, occupation, household size, and country

of residence (see the number of levels in Table 1 below).

Analysis

This study employed linear multiple regression analysis to determine the association between absenteeism and binge drinking. The reported number of absences was used as a dependent variable, and four different variables with three levels (drinker but non-binger, binger, and abstainer) for drinking status were used as independent

Table 2. Missing data (by number of respondents).

Characteristics	Sample without missing dependent variable values (n = 2,481)	Total sample (n = 3,767)
Drinker status	336	552
Country of residence	0	0
Gender	0	0
Birth year	0	1
Language	0	2
Income	213	324
Household size	6	22
Marital status	8	21
Smoking	24	44
Health status	11	25
Type of area	0	0
Employment status	159	97
Occupation	21	99
Education	2	10

variables. There were four variables because drinking status was determined separately for total bingeing, bingeing on beer, bingeing on wine, and bingeing on spirits. As the dependent variable is a count variable, we fit several Poisson and negative binomial linear generalised models with log-link function (see Zeileis et al., 2008).

First, we excluded 11 individuals who reported that they had missed more than 40% of their working days, or 100 or more days per year. We chose this threshold because the values equal to or higher than 100 were extremely rare. In addition, we wanted to exclude cases which were more likely related to erroneous reporting or long-term chronic illness than to the health effects of drinking.

As a second step, we performed the imputation of data since we noted that considerable data were missing for some questions (see Table 2). For alcohol content, if data were missing but the beverage type was known (this was the case for 354 respondents, not shown in Table 2), we used the following assumptions for alcohol by volume percentages: 5% for beer and coolers, 12% for wine, 20% for fortified wine, and 40% for spirits and surrogate alcohol.

For the remaining missing values, we performed a multiple imputation consisting of three steps (see Newman, 2014; van Buuren & Groothuis-Oudshoorn, 2011). First, the entire dataset (n = 3,767) was used to impute multiple datasets by using a specific imputation model for each variable. We applied the following imputation models: predictive mean matching for birth year and absences; logistic regression for language, employment status, health status, marital status, smoking status, education, and binge drinking; ordered logit model for income and size of household; and multinomial logit model for occupation. Second, the regression model for each dataset was estimated the same way it would have been if the data had been complete. However, considering recommendations from von Hippel (2007), while we used the entire dataset to impute multiple datasets in the first step, for this step we utilised only the data of individuals without missing values for the dependent variable (or the number of absences). In addition, as missing data for absences were mostly related to individuals who reported that they were not working currently, the exclusion of these respondents seemed reasonable.

Next, the estimation results were pooled into one estimate according to the approach outlined in Rubin (1987). Owing to the possible overdispersion problem in the case of a Poisson analysis, we estimated both Poisson and negative binomial models. In the first stage of the estimation we used total binge drinking as an independent variable (i.e., drinker status with three levels) and estimated unadjusted models, adjusted models to confounding variables, and finally adjusted models with interaction terms: these estimates led to six models altogether. In the second stage, three separate unadjusted Poisson and negative binomial models were estimated using beer bingeing, wine bingeing or spirit bingeing as an independent variable with three levels. Finally, the confounding variables were included as independent variables in all three regression models, initially without interaction terms and later with interaction terms.

Table 3. Negative binomial regression estimates for unadjusted models.

Variables	Model for total bingeing		Model for beer		Model for wine		Model for spirits	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	1.60***	0.07	1.62***	0.05	1.65***	0.05	1.67***	0.06
Drinker status								
Non-binger (reference)	–	–	–	–	–	–	–	–
Binger	0.20*	0.11	–	–	–	–	–	–
Beer binger	–	–	0.36**	0.15	–	–	–	–
Wine binger	–	–	–	–	0.28	0.19	–	–
Spirits binger	–	–	–	–	–	–	0.04	0.13
Abstainer	0.35	0.22	0.36	0.22	0.33	0.22	0.31	0.22

Notes. The reference group for drinker status consists of respondents who drink alcohol (i.e., they are not abstainers) but do not binge on beer (model for beer), wine (model for wine) or spirits (model for spirits).
***$p < .01$. **$p < .05$. *$p < .10$.

As regards interaction terms, we examined the group differences across gender, socio-economic status, and the three Baltic countries. We chose the level of education as a measure of socio-economic status since it is probably a more easily comparable characteristic than income across the three Baltic countries. Education might not be a good measure of socio-economic status for students. Therefore, we also examined the sensitivity of the results with respect to restricting the sample to respondents aged 25 years and older ($n = 3,289$).

For all these operations, we used R software version 3.5.3, packages MICE and MASS, and the functions mice, glm, and glm.nb as well as followed the guidelines given by van Buuren and Groothuis-Oudshoorn (2011).

Results

Table 1 presents descriptive statistics of the respondents for both the complete sample and the sample used in the modelling. Slightly more than half of the respondents were female, and one third of all respondents were categorised as binge drinkers. The majority of these were spirits bingers, followed by beer bingers and wine bingers.

Tables 3, 4, 5 and 6 present key results from the negative binomial regression analysis.

While the Poisson regression estimates had smaller standard errors, the examination of the residuals deviance for degrees of freedom indicated the presence of overdispersion. Therefore, we do not present Poisson models here. For unadjusted negative binomial models in Table 3, only beer bingeing has a statistically significant association ($p < .05$) with absenteeism. For total bingeing, the regression estimate is significant at a 10% level.

For the adjusted models shown in Tables 4 and 5, total bingeing and beer bingeing proved statistically significant at the 5%. The magnitude of both coefficients was somewhat larger than in the unadjusted models. It can be inferred that self-reported beer bingers reported on average 49% (95% CI 10–102%) more absences than drinkers who did not binge on beer. The respective estimate for total bingeing in Table 4 was 32% (95% CI 1–71%) in the adjusted model without interaction terms and 65% (95% CI 1–170%) in the adjusted model with interaction terms.

For the wine and spirits variables, the estimates indicated positive associations between bingeing and absenteeism, but the coefficients were statistically insignificant at a 10% level. No statistically significant group differences were found at 10% level (see the coefficients for interaction terms in Tables 4 and 6).

Table 4. Negative binomial regression estimates for adjusted models with total bingeing as an independent variable.

Variables	Adjusted model		Adjusted model with interaction terms	
	Estimate	SE	Estimate	SE
Intercept	−10.02	8.20	−8.90	8.23
Drinker status				
Non-binger (reference)	–	–	–	–
Binger	0.28**	0.12	0.50**	0.25
Abstainer	0.27	0.22	−0.09	0.47
Country				
Estonia (reference)	–	–	–	–
Latvia	−0.17	0.13	−0.24	0.17
Lithuania	0.03	0.13	0.13	0.16
Male	−0.32***	0.11	−0.29**	0.13
Income				
Low (reference)	–	–	–	–
Medium	0.23	0.27	0.22	0.27
High	−0.24	0.31	−0.23	0.31
Rural	−0.02	0.11	−0.02	0.11
Employment status	−0.03	0.46	−0.09	0.46
Occupation				
Managers (reference)	–	–	–	–
Specialist	0.22	0.16	0.19	0.16
Never employed	0.15	0.19	0.14	0.19
Other	0.03	0.55	−0.03	0.55
Official language speaker	−0.27**	0.12	−0.28**	0.12
Smoker	0.17	0.11	0.17	0.11
Health status	1.12***	0.17	1.13***	0.17
Education	−0.11	0.11	−0.02	0.14
Birth year	0.01	0.00	0.01	0.00
Household size				
1 member (reference)	–	–	–	–
2–4 members	−0.10	0.14	−0.09	0.14
More than 4 members	−0.17	0.23	−0.15	0.23
Married	0.04	0.12	0.05	0.12
Binger × male	–	–	−0.15	0.24
Abstainer male	–	–	0.18	0.56
Binger × education	–	–	−0.37	0.24
Abstainer × education	–	–	0.38	0.48
Binger × Latvia	–	–	0.12	0.26
Binger × Lithuania	–	–	−0.21	0.25
Abstainer × Latvia	–	–	0.55	0.52
Abstainer ×Lithuania	–	–	−0.19	0.58

Notes. The reference group for drinker status consists of respondents who drink alcohol (i.e., they are not abstainers) but do not binge.
***$p < .01$. **$p < .05$. *$p < .10$.

Adjusted negative binomial models detected four additional statistically significant confounding variables. First, the number of absences strongly depends on the respondents' health status, as those with poor health reported approximately three times more absences than

Table 5. Negative binomial regression estimates for adjusted models with bingeing on beer, wine or spirits as an independent variable.

	Model for beer		Model for wine		Model for spirits	
	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	−9.22	8.19	−11.08	8.20	−11.73	8.23
Drinker status						
Non-binger (reference)	−	−	−	−	−	−
Beer binger	0.40**	0.16	−	−	−	−
Wine binger	−	−	0.20	0.19	−	−
Spirits binger	−	−	−	−	0.15	0.13
Abstainer	0.24	0.22	0.21	0.22	0.22	0.22
Country						
Estonia (reference)	−	−	−	−	−	−
Latvia	−0.20	0.13	−0.17	0.13	−0.18	0.13
Lithuania	0.00	0.12	0.00	0.13	0.01	0.12
Male	−0.32***	0.10	−0.24**	0.10	−0.29***	0.10
Income						
Low (reference)	−	−	−	−	−	−
Medium	0.28	0.28	0.27	0.28	0.27	0.28
High	−0.19	0.31	−0.17	0.31	−0.18	0.31
Rural	−0.03	0.11	−0.03	0.11	−0.04	0.11
Employment status	−0.08	0.46	−0.06	0.46	−0.09	0.46
Occupation						
Managers (reference)	−	−	−	−		
Specialist	0.22	0.16	0.23	0.16	0.22	0.16
Never employed	0.14	0.19	0.17	0.19	0.16	0.19
Other	0.00	0.54	0.01	0.55	−0.03	0.55
Official language speaker	−0.26**	0.12	−0.26**	0.12	−0.28**	0.12
Smoker	0.17	0.11	0.21**	0.11	0.20*	0.11
Health status	1.10***	0.17	1.14***	0.17	1.14***	0.17
Education	−0.11	0.12	−0.13	0.12	−01.3	0.12
Birth year	0.01	0.00	0.01	0.00	0.01	0.00
Household size						
1 member (reference)	−	−	−	−		
2–4 members	−0.09	0.14	−0.09	0.14	−0.09	0.14
More than 4 members	−0.16	0.23	−0.16	0.23	−0.16	0.23

Notes. The reference group for drinker status consists of respondents who drink alcohol (i.e., they are not abstainers) but do not binge on beer (model for beer), wine (model for wine) or spirits (model for spirits).
***$p < .01$. **$p < .05$. *$p < .10$.

those with fair health ($p < .01$). In the case of gender, males reported less absenteeism than females. We can interpret the coefficient as follows: males spent 25–40% fewer days absent from work or school due to illnesses than did females. The results also indicate that individuals speaking the official language in the family experienced 30% fewer absences over the past 12 months. The models for wine and spirits revealed that smokers also tend to be more absent than non-smokers ($p < .10$).

Finally, sensitivity analysis with respect to exclusion of individuals aged younger than 25 years did not change the overall results, i.e., only bingeing on beer and total bingeing remained statistically significant predictors for absenteeism. However, the coefficients for the education variable became somewhat larger

Table 6. Negative binomial regression estimates for adjusted models with interaction terms and bingeing on beer, wine or spirits as an independent variable.

	Model for beer		Model for wine		Model for spirits	
	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	−8.98	8.20	−12.23	8.20	−11.78	8.23
Drinker status						
Non-binger (reference)	–	–	–	–	–	–
Beer binger	0.51	0.47	–	–	–	–
Wine binger	–	–	0.61	0.37	–	–
Spirits binger	–	–	–	–	0.39	0.33
Abstainer	−0.16	0.49	−0.13	0.49	−0.16	0.49
Country						
Estonia (reference)	–	–	–	–	–	–
Latvia	−0.26	0.14	−0.17	0.14	−0.21	0.15
Lithuania	0.03	0.14	0.07	0.13	0.05	0.14
Male	−0.32***	0.11	−0.23***	0.11	−0.26**	0.12
Income						
Low (reference)	–	–	–	–	–	–
Medium	0.29	0.28	0.27	0.28	0.26	0.28
High	−0.18	0.31	−0.15	0.31	−0.18	0.31
Rural	−0.04	0.11	−0.02	0.11	−0.04	0.11
Employment status	−0.07	0.46	−0.03	0.46	−0.08	0.46
Occupation						
Managers (reference)	–	–	–	–	–	–
Specialist	0.21	0.16	0.23	0.16	0.20	0.16
Never employed	0.13	0.19	0.16	0.19	0.15	0.19
Other	0.01	0.54	0.02	0.55	−0.05	0.55
Official language speaker	−0.27**	0.12	−0.26**	0.12	−0.29**	0.12
Smoker	0.17	0.11	0.20*	0.11	0.19*	0.11
Health status	1.12***	0.17	1.18***	0.17	1.16***	0.17
Education	−0.09	0.13	−0.16	0.12	−0.14	0.13
Birth year	0.01	0.00	0.01	0.00	0.01	0.00
Household size						
1 member (reference)	–	–	–	–	–	–
2–4 members	−0.09	0.14	−0.10	0.15	−0.08	0.15
More than 4 members	−0.16	0.23	−0.16	0.23	−0.14	0.23
Married	0.05	0.12	0.07	0.12	0.06	0.12
Binger × male	−0.06	0.44	−0.25	0.42	−0.20	0.30
Abstainer × male	0.21	0.47	0.11	0.47	0.14	0.47
Binger × education	−0.55	0.37	−0.04	0.44	−0.17	0.30
Abstainer × education	0.52	0.51	0.61	0.51	0.59	0.51
Binger × Latvia	0.17	0.37	−0.19	0.49	0.02	0.31
Binger × Lithuania	−0.06	0.36	−0.81	0.47	−0.17	0.30
Abstainer × Latvia	0.53	0.53	0.45	0.53	0.50	0.53
Abstainer × Lithuania	−0.29	0.55	−0.34	0.55	−0.30	0.55

Notes. The reference group for drinker status consists of respondents who drink alcohol (not abstainers) but do not binge on beer (model for beer), wine (model for wine) or spirits (model for spirits).
***$p < .01$. **$p < .05$. *$p < .10$.

(in absolute value) and statistically significant at 10% level in the models with bingeing on wine or spirits as an independent variable. The same happened to the smoking status variable in all models.

Discussion

This article has examined the association between absenteeism and binge drinking in Estonia, Latvia, and Lithuania. Statistically solid evidence was found to support the claim that absenteeism in terms of self-reported absences is positively associated with self-reported binge drinking and with beer binge drinking in particular. While the confidence intervals for regression coefficients were rather wide, estimates indicate that, on average, the number of absences due to health reasons for beer bingers is approximately 50% higher than those who consume alcohol but do not binge on beer. This finding is interesting, since the proportion of spirits bingers among the respondents is actually much higher than that of beer bingers (see Table 1). The results indicate that while spirits are more frequently present during binge-drinking sessions, absenteeism is relatively more common among beer bingers.

The overall results are in line with earlier literature, as the positive association between various measures of drinking and absenteeism has been reported by many researchers (Austin, 2012; Frone, 2008; Schou & Moan, 2016). However, the present study supports the reasoning presented by some authors (e.g., Bacharach et al., 2010; Mäkelä et al., 2011) that absenteeism can be strongly associated with the way people drink. Specifically, based on the definition of binge drinking in this study, drinkers who frequently consume large quantities of alcohol on a single occasion are absent more days than drinkers who drink smaller quantities on a single occasion (even if they do it frequently) or only rarely (less than 12 times per year) consume large quantities of alcohol. However, unlike many earlier studies we did not find statistically significant evidence for a

U-shaped association or increased level of absences among abstainers (Marzan et al., 2021; Schou & Moan, 2016).

An analysis of group differences fails to find any evidence that absence–bingeing association is stronger among people with low socio-economic status, as has been reported by some earlier authors (Schou & Moan, 2016). For the Baltic region, Helasoja et al. (2007) have reported that binge drinking is more common among less educated Estonian and Latvian men and among younger and less educated women in all three Baltic countries. Therefore, assuming different drinking behaviour among individuals with lower education (Rosoff et al., 2019) we expected them to be absent more frequently. Our sensitivity analysis also showed that higher education could predict less absenteeism but the association between bingeing and absenteeism was not found to be related to education. One reason behind our results may be related to the way we measured education. We only observed whether an individual has higher education or not. For example, Lund and Moan (2021) used the same approach to measure the level of socio-economic status and reported similar results for Norway. We also found that the identified bingeing–absence relationship applies to both genders. While females may have lower alcohol tolerance, which should lead to a stronger association compared to males (Schou et al., 2014), we did not find statistically significant evidence to support that claim. This could be related to the way female bingers drink compared to males. However, in our sample, all the coefficients of bingeing–gender interaction terms showed that female bingers have more absences than male bingers. Therefore, group differences across education and gender certainly deserve closer analysis in future studies.

The present article not only provides additional evidence on the relationship between binge drinking and absenteeism but also re-examines the magnitude of the association. Specifically, the estimate that beer bingers experience approximately 50% more days of

absence than those who do not binge on beer, seems rather large. But it is not that surprising considering some earlier estimates. For example, Salonsalmi et al. (2009) found that binge drinkers who binge once a week or more had a 30% excess rate of sickness-related absences among men and 10% among women. Pidd et al. (2006) have reported that in Australia, weekly binge drinkers take 30–50% more days off due to illnesses or injuries compared to abstainers or low-risk drinkers.

Interpreting the size of the bingeing effect in the Baltic context, we first note that in the entire sample, the average absences per respondents was 6.1. This is very close to the estimate for Estonia in 2012, that was around 7.5 days per employee (Aaviksoo & Kiivet, 2014). Taking this as a starting point and using the estimate from present study, the amount of additional time beer bingers might miss annually, compared with non-bingers, remains around 2–3 days. Assuming that 12% of the entire working-age population of around three million persons in the Baltic states (Eurostat, 2019a) are beer bingers – as seemed to be indicated by the percentages from the sample in the current article – it can be estimated that there are 0.5 million beer bingers who miss around 1.0–1.5 million working or school days annually that can be associated with alcohol. We can monetise this figure by using the average GDP per hour worked in Baltic countries from the Organisation for Economic Co-operation and Development (2019) database (around US$35) to get a productivity loss of over 50 million euros that can be associated with binge drinking. This represents approximately 0.06% of the GDP of the Baltic countries (Eurostat, 2019b).

The findings of this study also provide some insights for appropriate beverage-based alcohol policies. Specifically, mild alcoholic beverages are often taxed more lightly than strong ones because they are not considered as risky. This is the case in the European Union (European Commission, 2018). Moreover, in many societies the use of alcohol is a natural part of everyday life or culture. For instance, drinking wine

or beer with one's meal (Sornpaisarn & Österberg, 2017) is customary and not associated with any harmful effects. However, the results of our study do not support this type of argument in favour of light alcoholic drinks in the context of alcohol policies, since only the association of absenteeism with beer bingeing turned out to be significant. The estimates for spirits bingeing did not show any sign of being large or significant. While wine bingeing was also not statistically significant, the estimated coefficient was positive and higher than that for spirits. In that respect, the results of this study are in accord with those presented by Ramstedt and Boman (2011) and Snowden (2019). While Snowden found that the availability of beer and wine in the United States is a more important predictor of robberies than the availability of spirits, Ramstedt and Boman found an association between drinking strong beers and experiencing alcohol-related problems in Sweden.

We could speculate on the reasons why beer bingeing in the Baltic countries seems to predict a higher rate of absenteeism than spirits bingeing. First, as discussed above, alcohol policies tend to regulate strong beverages more strictly than lighter drinks. This could give consumers price incentives to prefer lighter drinks over spirits in large quantities. Second, while it is easier to exceed the bingeing threshold of spirits due to their higher alcohol content, the contexts of occasions for spirits bingeing might be considerably different from those of beer bingeing (Mäkelä et al., 2007). Beer may be consumed without a special occasion, just for thirst or with meals, and this may accidentally grow into bingeing. Spirits, on the other hand, are more often drunk at special occasions or celebrations, such as birthdays, weddings or funerals. Such events are usually planned beforehand and are not that spontaneous, and often occur at weekends or non-working days, which is why bingeing in that context might lead less frequently to absenteeism than bingeing on beer. For example, Kobin (2012) has described in her qualitative study that for the young Estonian adults, more excessive drinking

takes places at weekends but also for "no specific reason" but to party and relax. However, further studies are needed to achieve better understanding about the true patterns behind the results.

This article has several limitations. To begin with, the analysis is completely based on self-reported data, which means a higher likelihood of underreporting or non-response errors, at least to some degree (Johnson, 2014). According to the World Health Organization (2018), for example, roughly half of the adult population in the Baltic countries have 60 or more grams of pure alcohol on a single occasion at least once per month, but only one-third of the respondents in our study reported that amount of drinking. Accordingly, the heaviest drinkers were most likely underrepresented in our sample and some bingers might have been erroneously categorised as non-bingers due to underreporting. However, the results would be affected only if the drinking and absenteeism behaviour of these groups is different from those defined as bingers in the present study. For example, if underreporting is more common among spirits bingers who are also frequent absentees, the validity of the result about beer bingers being more frequently absent than spirit bingers could be undermined.

In addition, considering that our regression models were adjusted for respondents' health status, estimated associations between bingeing and absenteeism rather reflect short-term effects of binge drinking. Since binge drinking also has certain long-term consequences (Lannoy et al., 2019), the results probably underestimate the strength of the relationship in the Baltic region.

Also, this study did not address causality mechanisms behind the relationship between absenteeism and binge drinking. A handful of socio-economic and demographic variables were controlled for, such as age, gender, education, income, occupation, or smoking and health status. Nonetheless, we cannot rule out the possibility of omitted variable bias from factors such as work stress or of reverse causality, neither of which has been explored here. Therefore, any type of conclusion about causal relationships between the studied phenomena remains beyond the scope of this article.

Finally, although our focus was on binge drinking, we were unable to differentiate between various subgroups of drinkers within that category. For example, some individuals categorised as bingers in this article might actually belong to a subgroup of alcoholics or addicts whose behaviour is probably very different from those who occasionally drink or binge drink. In other words, the analysis does not reveal the various patterns behind binge drinking that might also be associated with absenteeism.

To conclude, the results of this study confirm that a considerable proportion of absences from work or school can be associated with binge drinking in the Baltic countries. Although there may be various factors behind this correlation, alcohol is obviously an important contributing factor to the scale of absenteeism. This phenomenon seems to apply to both genders and to people with and without higher education. In addition, our results indicate that, in the Baltic countries, beer bingeing is a better predictor of absenteeism than bingeing on spirits or wine. Therefore, it should be acknowledged that beverage-specific alcohol policies that are more lenient toward beer than other types of alcohol can inadvertently increase absenteeism and decrease workplace productivity.

Declaration of conflicting interests

Funding

ORCID iD

Indrek Saar 🔟 https://orcid.org/0000-0003-2751-3722

References

Aaviksoo, E., & Kiivet, R.-A. (2014). Sickness absenteeism in Estonia. In S. Lehtinen (Ed.), *Sickness absenteeism in BSN countries: Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Russian Federation and Sweden* (pp. 6–9). Finnish Institute of Occupational Health.

Andreuccetti, G., Carvalho, H. B., Ye, Y., Bond, J., Monteiro, M., Borges, G., & Cherpitel, C. J. (2014). Does beverage type and drinking context matter in an alcohol-related injury? Evidence from emergency department patients in Latin America. *Drug Alcohol Dependence*, *137*, 90–97.

Austin, W. A. (2012). The effects of alcohol use on high school absenteeism. *The American Economist*, *57*(2), 238–252.

Bacharach, S. M., Bamberger, P., & Biron, M. (2010). Alcohol consumption and workplace absenteeism: The moderating effect of social support. *Journal of Applied Psychology*, *95*(2), 334–348.

Beemsterboer, R. S., Groothoff, J., & Nijhuis, F. (2008). The influence of sick leave frequency determinants on homogeneous groups in two socio-economically comparable, but socio-culturally different regions in the Netherlands. *Central European Journal of Public Health*, *16*(4), 151–160.

Blum, T. C., Roman, P. M., & Martin, J. K. (1993). Alcohol consumption and work performance. *Journal of Studies on Alcohol*, *54*(1), 61–70.

Dormal, V., Bremhorst, V., Lannoy, S., Lorant, V., Luquiens, A., & Maurage, P. (2018). Binge drinking is associated with reduced quality of life in young students: A pan-European study. *Drug and Alcohol Dependence*, *193*, 48–54.

European Commission. (2018). *Excise duty tables*. https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/taxation/excise_duties/alcoholic_beverages/rates/excise_duties-part_i_alcohol_en.pdf

Eurostat. (2019a). *Population by sex, age, citizenship and labour status (1 000)*. https://ec.europa.eu/eurostat/web/lfs/data/database

Eurostat. (2019b). *GDP and main components (output, expenditure and income)*. https://ec.europa.eu/eurostat/web/national-accounts/data/database

Fogarty, J. J. (2012). Optimal alcohol taxes for Australia. *Forum for Health Economics & Policy*, *15*(2). 10.1515/1558-9544.1276

Frone, M. R. (2008). Employee alcohol and illicit drug use: Scope, causes, and consequences. In J. Barling & C. L. Coopes (Eds.), *The Sage handbook of organizational behavior (Vol 1: Micro approaches)* (pp. 519–540). Sage.

Gill, S. J. (2002). Reported levels of alcohol consumption and binge drinking within the UK undergraduate student population over the last 25 years. *Alcohol & Alcoholism*, *37*(2), 109–120.

Helasoja, V., Lahelma, E., Prättälä, R., Petkeviciene, J., Pudule, I., & Tekkel, M. (2007). The socio-demographic patterning of drinking and binge drinking in Estonia, Latvia, Lithuania and Finland, 1994–2002. *BMC Public Health*, *7*, 1–7.

Hinote, B. P., & Webber, G. R. (2012). Drinking toward manhood: Masculinity and alcohol in the former USSR. *Men and Masculinities*, *15*(3), 292–310.

Hingson, R. W., Zha, W., & White, A. M. (2017). Drinking beyond the binge threshold: Predictors, consequences, and changes in the US. *American Journal of Preventive Medicine*, *52*(6), 717–727.

Johnson, T. P. (2014). Sources of error in substance use prevalence surveys. *International Scholarly Research Notices*, *2014*, Article ID 923290.

Kerr, W. C., & Ye, Y. (2011). Beverage-specific mortality relationships in United States population data. *Contemporary Drug Problems*, *38*(4), 561–578.

Kobin, M. (2012). Managing drinking time, space and networks as strategies for avoiding alcohol-related harm among young Estonian adults. *Studies of Transition States and Societies*, *4*(2), 20–34.

Kobin, M. (2013). Gendered drinking: Meanings and norms among young Estonian adults. *Nordic Studies on Alcohol and Drugs*, *30*(4), 277–295.

Kraus, L., Baumeister, S. E., Pabst, A., & Orth, B. (2009). Association of average daily alcohol consumption, binge drinking and alcohol-related social problems: Results from German epidemiological surveys of substance abuse. *Alcohol & Alcoholism*, *44*(3), 314–320.

Labhart, F., Livingston, M., Engels, R., & Kuntsche, E. (2018). After how many drinks does someone

experience acute consequences: Determining thresholds for binge drinking based on two event-level studies. *Addiction*, *113*(12), 2235–2244. https://doi.org/10.1111/add.14370

Lang, K., & Ringamets, I. (2018). *Unrecorded alcohol in the Baltic states: Results of a population survey*. International Alliance for Responsible Drinking. https://www.iard.org/science-resources/detail/Unrecorded-Alcohol-in-the-Baltic-States-Results-of

Lannoy, S., Billieux, J., Dormal, V., & Maurage, P. (2019). Behavioral and cerebral impairments associated with binge drinking in youth: A critical review. *Psychologica Belgica*, *59*(1), 116–155. https://doi.org/10.5334/pb.476

Laslett, A.-M, Catalano, P., Chikritzhs, Y., Dale, C., Doran, C., Ferris, J., Jainullabudeen, T., Livingston, M., Matthews, S., Mugavin, J., Room, R., Schlotterlein, M., & Wilkinson, C. (2010). *The range and magnitude of alcohol's harm to others*. AER Centre for Alcohol Policy Research, Turning Point Alcohol and Drug Centre, Eastern Health.

Lund, I., & Moan, I. S. (2021). The role of alcohol use and cigarette smoking in sickness absence: Are there social inequalities? *International Journal of Drug Policy*, *94*. https://doi.org/10.1016/j.drugpo.2021.103190

Mäkelä, P., Hellman, M., Kerr, W., & Room, R. (2011). A bottle of beer, a glass of wine or a shot of whiskey? Can the rate of alcohol-induced harm be affected by altering the population's beverage choices? *Contemporary Drug Problems*, *38*(4), 599–619.

Mäkelä, P., Mustonen, H., & Österberg, E. (2007). Does beverage type matter? *Nordic Studies on Alcohol and Drugs*, *24*(6), 617–631.

Marzan, M., Callinan, S., Livingston, M., Leggat, G., & Jiang, H. (2021). Systematic review and dose–response meta-analysis on the relationship between alcohol consumption and sickness absence. *Alcohol and Alcoholism*. Advance online publication. 10.1093/alcalc/agab008

McKee, M., Pomerleau, J., Robertson, A., Pudule, I., Grinberga, D., Kadziauskiene, K., Abaravicius, A., & Vaask, S. (2000). Alcohol consumption in the Baltic republics. *Journal of Epidemiology and Community Health*, *54*, 361–366.

Naimi, T. S., Brewer, R. D., Miller, J. W., Okoro, C., & Mehrotra, C. (2007). What do binge drinkers drink? Implications for alcohol control policy. *American Journal of Preventive Medicine*, *33*(3), 188–193.

Newman, D. A. (2014). Missing data: Five practical guidelines. *Organizational Research Methods*, *17*(4), 372–411.

Norström, T., & Moan, I. S. (2009). Per capita alcohol consumption and sickness absence in Norway European. *Journal of Public Health*, *19*(4), 383–388.

Organisation for Economic Co-operation and Development. (2019). *GDP per hour worked (indicator)*. 10.1787/1439e590-en

Pakovic, L., Todorovic, J., Santric-Milicevic, M., Bukumiric, D., & Terzic-Supic, Z. (2019). The association between social characteristics, alcoholic beverage preferences, and binge drinking in a Serbian adult population. *Nordic Studies on Alcohol and Drugs*, *36*(1), 36–50.

Parry, I. W. H., West, S. E., & Laxminarayan, R. (2009). Fiscal and externality rationales for alcohol policies. *The B.E. Journal of Economic Analysis & Policy*, *9*(1), 1–48.

Pidd, J. K., Berry, J. G., Roche, A. M., & Harrison, J. E. (2006). Estimating the cost of alcohol-related absenteeism in the Australian workforce: The importance of consumption patterns. *The Medical Journal of Australia*, *185*(11), 637–641.

Pomerlau, J., McKee, M., Rose, R., Haerpfer, C. W., Rotman, D., & Tumanov, S. (2008). Hazardous alcohol drinking in the former Soviet Union: A cross-sectional study of eight countries. *Alcohol and Alcoholism*, *43*(3), 351–359.

Ramstedt, M., & Boman, U. (2011). Is spirits really the most harmful alcoholic beverage? Evidence from a recent alcohol survey in Sweden. *Contemporary Drug Problems*, *38*(4), 579–597.

Rehm, J., & Shield, K. D. (2017). Taxation and pricing policies among countries worldwide: Results from the 2012 Global Survey on Alcohol and Health. In B. Sornpaisarn, K. D. Shield, E. Österberg, & J. Rehm (Eds.), *Resource tool on alcohol taxation and pricing policies*

(pp. 45–51). World Health Organization. https://www.who.int/substance_abuse/publications/tax_book/en/

Roche, A. M., Pidd, K., Berry, J. G., & Harrison, J. E. (2008). Workers' drinking patterns: The impact on absenteeism in the Australian work-place. *Addiction*, *103*(5), 738–748.

Rosoff, D. B., Clarke, T.-K., Adams, M. J., McIntosh, A. M., Smith, G. D., Jung, J., & Lohoff, F. W. (2019). Educational attainment impacts drinking behaviors and risk for alcohol dependence: Results from a two-sample Mendelian randomization study with ∼780,000 participants. *Molecular Psychiatry*. 10.1038/s41380-019-0535-9

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. John Wiley and Sons.

Salonsalmi, A., Laaksonen, M., Lahelma, E., & Rahkonen, O. (2009). Drinking habits and sickness absence: The contribution of working conditions. *Scandinavian Journal of Public Health*, *37*, 846–854.

Schou, L., & Moan, I. S. (2016). Alcohol use-sickness absence association and the moderating role of gender and socioeconomic status: A literature review. *Drug and Alcohol Review*, *35*, 158–169.

Schou, L. A., Storvoll, E. E., & Moan, I. S. (2014). Alcohol-related sickness absence among young employees: Gender differences and the prevention paradox. *European Journal of Public Health*, *24*(3), 480–485.

Snowden, A. J. (2019). The relationship between alcohol beverage types and violence. *Journal of Drug Issues*, *49*(1), 183–200.

Sornpaisarn, N., & Österberg, E. (2017). General implementation issues of alcohol taxation and pricing policies. In B. Sornpaisarn, K. D. Shield, E. Österberg, & J. Rehm (Eds.), *Resource tool on alcohol taxation and pricing policies* (pp. 54–63). World Health Organization.

Sullivan, T., Edgar, F., & McAndrew, I. (2019). The hidden costs of employee drinking: A quantitative analysis. *Drug and Alcohol Review*, *38*(5), 543–553.

van Buuren, S., & Groothius-Oudshoorn, K. (2011). mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software*, *45*(3), 1–67.

von Hippel, P. T. (2007). Regression with missing y's: An improved strategy for analyzing multiply imputed data. *Sociological Methodology*, *37*, 83–117.

World Health Organization. (2018). *Global status report on alcohol and health 2018*. https://www.who.int/substance_abuse/publications/global_alcohol_report/en/

Zeileis, A., Kleiber, C., & Jackman, S. (2008). Regression models for count data in R. *Journal of Statistical Software*, *27*(8), 1–25.