

# Involvement in alcohol-related verbal or physical aggression. Does social status matter?

LUDWIG KRAUS & KALLE TRYGGVESSON & ALEXANDER PABST & ROBIN ROOM

## ABSTRACT

**INTRODUCTION** –The analyses (1) assessed the association between social status variables and aggression when controlling for volume of alcohol consumption and episodic heavy drinking (EHD), (2) tested whether social status moderates the association between volume or EHD and verbal as well as physical aggression, and (3) investigated whether EHD moderates the effect of volume on aggression. **METHODS** – Swedish Alcohol Monitoring Survey (2003 to 2011); N=104,316 current drinkers; response rate: 51 to 38%. Alcohol-related aggression was defined as involvement in a quarrel or physical fight while drinking. Social status was defined as the highest education, monthly income and marital status. **RESULTS** – The associations between social status variables and aggression showed mixed results. Verbal aggression was associated with education in males and with marital status in both genders. Physical aggression was associated with education in both genders. No associations with aggression were found for income. With few exceptions, these associations remained significant when controlling for drinking patterns; social status did not moderate the association between drinking and aggression; EHD moderated the effect of volume on physical aggression in males. **CONCLUSIONS** – Groups of lower educated and non-married individuals experience verbal or physical aggression over and above different levels of consumption. Individual differences in aggression vulnerability rather than differences in aggression predisposition account for higher risks of aggression in these groups. **KEYWORDS** – alcohol-related aggression, social status, volume, episodic heavy drinking, two-step model

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## Introduction

The relation between alcohol consumption and aggressive behaviour is very well documented, both by observational (Chermack & Giancola, 1997; Ito, Miller, & Pollock, 1996) and experimental studies (Lenke, 1990; Murdoch, Pihl, & Ross, 1990;

Wells, Graham, & West, 2000). Despite the strong alcohol-aggression relationship, only a minority of individuals exhibits aggressive behaviour or becomes a victim while intoxicated. Results of experimental studies indicate the significance of inter-

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personal differences among drinkers in explaining the link between alcohol use and aggression (Chermack & Giancola, 1997). Risk factors that have been identified to increase aggression include dispositional aggressivity (Giancola, 2002), suppressed anger (Norström & Pape, 2010), provocation (Giancola et al., 2002) or history of heavy drinking (Parrott & Giancola, 2006).

There is growing research on the alcohol-aggression link indicating that frequency of drinking is less predictive of aggressive incidents than quantity and drinking patterns (Bye & Rossow, 2010; Rehm et al., 2003; Rossow, 1996; Wells et al., 2000; Wells & Graham, 2003; Wells, Giesbrecht, Ialomiteanu, & Graham, 2011). In general, patterns of drinking have been highlighted to play a major role for many negative alcohol-related outcomes (for an overview see Rehm et al., 1996). There is evidence for an independent effect of both alcohol volume and frequency of heavy drinking on various social consequences such as road and work accidents, drunk driving, injury or damage to others, work and school absenteeism, family problems, problems with the police and physical aggression (Alvarez, Fierro, & del Rio, 2006; Gmel, Klingemann, Müller, & Brenner, 2001; Gmel, Rehm, Room, & Greenfield, 2000; Kraus, Baumeister, Pabst, & Orth, 2009; Rehm & Gmel, 1999). Predictions of social problems even revealed a strong interaction effect of alcohol volume and drinking patterns, indicating that at a given average daily alcohol intake the risk of experiencing negative consequences increases exponentially with the frequency of heavy drinking (Kraus et al., 2009).

The role of confounding influences in the nexus between alcohol and nega-

tive consequences has been repeatedly stressed (Wells et al., 2000; Scott, Schafer, & Greenfield, 1999). Consequently, most studies control for variables that may be associated with both drinking and negative consequences such as age, gender or other sociodemographic variables. From a public health perspective, however, it is of interest to examine which groups have a higher propensity for experiencing alcohol-related problems at a given level of drinking. Evidence from international literature suggests that socioeconomically disadvantaged groups experience higher rates of alcohol-related harm, although consumption at the population level is generally higher among advantaged groups (Karriker-Jaffe, Roberts, & Bond, 2013). For instance, studies on alcohol consumption and health inequality reported that groups of lower socioeconomically status had significantly higher rates of alcohol-attributable morbidity (Mäkelä, Keskimäki, & Koskinen, 2003) and mortality (Dietze et al., 2009; Mäkelä & Paljärvi, 2008; Probst, Roerecke, Behrendt, & Rehm, 2014).

Against this background, earlier research suggested a step-wise association between sociodemographics, alcohol consumption and problems, i.e. sociodemographic variables predict problems, but this association disappears when consumption is controlled for (Robins, Bates, & O'Neal, 1962). Recent research from Sweden confirms the two-step view by showing that social status indicators are weak predictors of alcohol-related negative consequences, once consumption was controlled for (Selin, 2005). The author concluded that at the same level of drinking the risk for problems is rather evenly distributed across different social classes.

Likewise, socioeconomic status (SES) has been shown to predict drinking patterns but not negative consequences independent of drinking (Huckle, You, & Casswell, 2010). However, research on alcohol-related social inequality of health outcomes is inconsistent. For instance, while controlling for drinking patterns, a Finnish study found higher risks for mortality and hospitalisation among manual workers than among non-manual workers (Mäkelä & Paljärvi, 2008); and a recent Australian study reported a reverse gradient with socioeconomically advantaged groups engaging at higher rates in alcohol-related risky behaviour than more disadvantaged groups even after controlling for alcohol consumption (Livingston, 2015).

Thus, for the link between alcohol and aggression involvement one may argue that differences in alcohol consumption may explain differences in aggressive behaviour between socioeconomic groups. Conversely, if alcohol use does not fully explain the relationship, other factors may be responsible. Psychological mechanisms facilitating aggression (Giancola, 2002; Giancola et al., 2002; Parrott & Giancola, 2006), dispositional aggressivity, increased reactivity to provocation, or suppressed anger may differ between various social groups. Giancola (2002), for instance, found that alcohol facilitates aggression not in all individuals, but only in those with high levels of predisposition (e.g., an aggressive personality). Most interestingly, while alcohol and provocation were effective in facilitating aggression in men, only provocation was an effective aggression-elicitor in women (Giancola et al., 2002). Moreover, Parrott and Giancola (2006) found that alcohol increased

aggression only in highly provoked men who reported a history of heavy drinking.

Using a large representative sample of the Swedish general population, the present study aims at investigating the association between social status, dimensions of drinking and alcohol-related verbal and physical aggression by taking age and gender into account. First, we will assess whether social status variables predict aggression when controlling for average volume of alcohol consumption and patterns of drinking. Second, we will examine interaction effects and test whether social group membership moderates the association between average volume or frequency of heavy drinking and aggression. Third, we will investigate whether frequency of heavy drinking moderates the effect of average alcohol volume on aggression.

## Methods

### *Study sample*

Data came from the Swedish Alcohol Monitoring Survey conducted between January 2003 and December 2011 (Ramstedt, Axelsson Sohlberg, Engdahl, & Svensson, 2009). Each month, approximately 1,500 individuals aged 16 to 80 years were interviewed by computer-assisted telephone interviews (CATI). Participants were randomly selected from a comprehensive telephone register. After a maximum of 30 unsuccessful attempts, a contact was coded as non-response. The total sample comprised 162,220 respondents, corresponding to an average response rate of 44%. Between 2005 and 2011, the response rates constantly decreased from 51% to 38%. Ethical approval was not required at the time the survey was implemented in the year 2000.

For the present analysis, the sample was restricted to respondents reporting alcohol consumption within the last 30 days and individuals that were given the questions on aggression, which was not the case in the first halves of the years 2003 and 2004 (N=105,606). Individuals with contradictory responses on average volume per drinking day and episodic heavy drinking were excluded (n=1,290; 1.20%): 359 respondents reported an intake of more than 60 g of ethanol per day but indicated no occasion of episodic heavy drinking, and 931 subjects reported at least one occasion of episodic heavy drinking but had altogether only consumed less than 60 g of ethanol in the last month. The analytical sample consisted of 104,316 current drinkers.

### *Measurements*

Alcohol volume. Alcohol consumption was assessed using a beverage-specific quantity-frequency measure based on the past 30 days: (i) "During the last 30 days, how often did you drink medium strength beer (strong beer, wine, strong wine, cider and spirits)?" (ii) "When you drank medium strength beer (strong beer, wine, strong wine, cider and spirits), how much did you drink?" Response categories for frequency were "almost daily", "4–5 days a week", "2–3 days a week", "once a week", "about 2–3 times", "about one time", and "never". Categories of consumed quantities were presented as different beverage-specific container sizes. Average weekly consumption (in cl ethanol) was calculated by multiplying frequency per week and quantity per drinking day using beverage-specific standard ethanol contents of 3.2 cl, 5.6 cl, 12.8 cl, 16.6 cl, 5.6 cl and 37.7 cl ethanol

per litre for medium strength beer, strong beer, wine, strong wine, cider and spirits, respectively. Volume was then converted into average intake in grams of ethanol per day.

Episodic heavy drinking (EHD) was specified as the intake of an equivalent of approximately 60 g of ethanol of any alcoholic beverage at a single occasion. The frequency was assessed by asking "During the last 30 days, how often did you, at the same occasion, drink alcohol equivalent to: a bottle of wine (75 cl), 5 glasses of spirits (25 cl) or 4 cans of strong beer/strong cider or 6 cans of medium strength beer?". Response categories were "almost daily", "4–5 days a week", "2–3 days a week", "about once a week", "about 2–3 times", "about once" and "never". EHD was collapsed into "never 5+", "1 day", "2–4 days" and "5 or more days" within the last 30 days.

Alcohol-related aggression. Alcohol-related verbal aggression was assessed with the question "During the last 12 months, have you ever been involved in a quarrel when you have been drinking alcohol at the same time? With the term quarrel I mean a verbal quarrel with aroused emotions not including a physical fight". Alcohol-related physical aggression referred to the question "During the last 12 months, have you gotten into a fight when you had been drinking?" Responses to both questions were coded as "no" or "yes".

Indicators of social status. Questions on the highest education and income of the respondents were taken as indicators of social status. Education was collapsed into

three levels by coding any school level below high school into “low”, high school into “middle” and university into “high”. Income was measured categorically in Euros per month before tax and combined into three levels: low (< 1500 €), middle (1500–3299 €) and high ( $\geq$  3300 €). Marital status was assessed with the question “Do you live with another person as married or cohabitant, i.e. in a marriage or a ‘marriage-like’ relationship?”.

### *Statistical analyses*

Unadjusted differences in age, social status and drinking behaviour between individuals reporting verbal or physical aggression and those not reporting such incidents were tested using Pearson  $\chi^2$  tests for categorical variables and Wilcoxon two-sample tests for continuous variables.

By collapsing data collected over a longer period of time, the relation between sociodemographic status variables such as education or income and aggression may be biased by changes in the education system or inflation. To control for these biases, we computed riddit scores (Bross, 1958) to produce a relative index of inequality (RII) for both original variables of education (8 categories) and income (6 categories) (Mackenbach & Kunst, 1997). These analyses were stratified by age group (16–24, 25–39, 40–59 and 60+ years), gender and survey year (Hayes & Berry, 2002). The riddit assigns to each individual the proportion of the sample that has a higher education/income plus half of the proportion having the same educational/income level. The RII score is a continuous (linearised) measure of relative education/income ranging from 0 to 1 (excluding 0 and 1). For instance, a low score in education

of 0.2 implies that 80% of individuals in the sample with the same age and gender and in the same survey year have a higher education. For testing our hypotheses, logistic regression models predicting alcohol-related aggression (verbal or physical) were performed for each gender. Three models were run: model I included education, income and marital status; in model II, alcohol volume and episodic heavy drinking were added; a third model was run adding residual interactions between social status and drinking variables and between the two drinking variables (model III). To account for linear and non-linear effects, age and age<sup>2</sup> were included as control variables in all regression models.

In regression analysis, main predictors  $X_1$  and  $X_2$  may be highly correlated with the cross-product  $X_{1 \times 2}$ , leading to multicollinearity and confounding of interaction and main effects. In order to avoid these problems, we followed the cross-product residual-centering method for testing interaction effects suggested by Lance (1988). The approach regresses the interaction term on the constituent main predictors ( $X_{1 \times 2} = c_1 X_1 + c_2 X_2 + d$ ), constructs the cross-product residuals ( $d_{1 \times 2} = X_{1 \times 2} - \hat{X}_{1 \times 2}$ ) and uses the residual interaction term in the full model ( $Y = b_1 X_1 + b_2 X_2 + b_3 d_{1 \times 2} + d_y$ ). Due to the left-skewed distribution of the volume measure, the natural logarithm of this variable was taken.

Data of all surveys were weighted to represent the demographic characteristics of the general population of Sweden in each survey year and the analyses were controlled for month of data collection. Missing values on predictors (volume and EHD) and covariates (education, income and marital status) ranged from 0.02%

**Table 1:** Sociodemographic characteristics of the sample for alcohol-related verbal and physical aggression by gender

	Females			Males		
		Verbal	Physical		Verbal	Physical
	52,904	2,342	292	51,412	3,093	864
Age group; n, %						
16–24	4,689	19.4	3.2	5,165	23.5	10.8
25–39	12,631	6.4	0.5	13,617	8.3	1.5
40–59	20,114	2.3	0.2	18,531	2.8	0.4
60+	15,470	0.9	0.2	14,099	1.1	0.2
Education; n, %						
Low	9,396	8.0	1.7	9,761	9.5	4.7
Middle	21,461	6.1	0.6	24,511	8.3	2.4
High	22,047	3.3	0.3	17,140	3.6	0.5
Income; n, %						
Low	16,678	9.1	1.4	8,770	15.1	6.7
Middle	28,968	3.6	0.3	26,832	6.0	1.5
High	7,258	2.7	0.3	15,810	3.6	0.6
Marital status; n, %						
Married/cohabitating	34,369	3.7	0.4	35,338	4.5	1.0
Not married/cohabitating	18,535	9.7	1.5	16,074	14.4	5.9

Unweighted n, weighted %; Pearson Chi<sup>2</sup> tests; all tests significant with p<.001.

(marital status) to 4.9% (income), and were imputed using multivariate imputation by chained equations (Royston, 2005). Imputation was warranted by significant differences in both outcomes between respondents reporting no missing responses and those with at least one missing response on any of the variables used in the analysis. All analyses were conducted using the Stata 12.1 SE software package (Stata Corp LP, College Station, TX).

Results

Sample description

Involvement in verbal aggression was reported by 5.3% (females) and 7.0% (males), and physical aggression by 0.7% (females) and 2.2% (males). Individuals reporting alcohol-related verbal or physical aggression

were generally younger than those not reporting such incidents, and more males than females were involved in both aggressive behaviours. In both genders, the proportion of alcohol-related verbal or physical aggression was highest among the low educated and lowest in the high educated group. The same pattern was observed for income. Moreover, verbal or physical aggression was reported less often in females and males who were married compared to those who were not married (Table 1). Mean volume of drinking was more than twice as high among females and males who got involved in verbal or physical aggression than among respondents without such incidents (Table 2). Involvement in verbal or physical aggression was also significantly more often reported by males

**Table 2:** Volume in grams per day by alcohol-related verbal and physical aggression and gender

	Females, verbal aggression		Females, physical aggression	
	No	Yes	No	Yes
	50,562	2,342	52,612	292
Volume (gr per day), M (SD)	7.56 (9.68)	16.57 (21.87) *	7.95 (10.62)	20.82 (27.67) *
	Males, verbal aggression		Males, physical aggression	
	48,319	3,093	50,548	864
	48,319	3,093	50,548	864
Volume (gr per day), M (SD)	14.32 (17.46)	30.06 (31.14) *	14.97 (18.24)	35.24 (38.79) *

Unweighted; Mean (SD): weighted; Wilcoxon tests; M mean; D standard deviation; \* =  $p < 0.001$ .

and females who had more frequently engaged in episodic heavy drinking (Table 3).

#### *Predicting alcohol-related verbal and physical aggression*

The results of the logistic regressions on alcohol-related verbal and physical aggression are shown in Table 4 and Table 5, respectively. Social status indicators show a mixed pattern in predicting both aggressive behaviours. While being unmarried was significantly associated with verbal aggression in females, no association was

found for education and income. In contrast, among males a significant association with verbal aggression was found for lower education, higher income and unmarried status (Table 4, model I). With the exception of marital status in females and income in males, the associations remained significant in both genders when alcohol volume and episodic heavy drinking were added to the models. However, reverse results were found as well. The association between being married and verbal aggression in females and between higher income

**Table 3:** Episodic heavy drinking (EHD) by alcohol-related verbal and physical aggression and gender

	Females		
	52,904	Verbal aggression	Physical aggression
	52,904	Verbal aggression	Physical aggression
Episodic heavy drinking; n, %			
No	41,810	2.5	0.3
1 time	5,997	9.8	1.1
2–4 times	4,419	19.3	2.6
5 or more times	678	29.3	4.6
	Males		
	51,412	Verbal aggression	Physical aggression
	51,412	Verbal aggression	Physical aggression
Episodic heavy drinking; n, %			
No	28,567	2.3	0.7
1 time	8,798	6.5	1.9
2–4 times	11,333	13.9	4.6
5 or more times	2,714	26.1	8.9

Unweighted n; weighted %; Pearson Chi<sup>2</sup> tests; all tests significant with  $p < .001$ .



and verbal aggression in males disappeared when alcohol consumption was controlled for (Model II). In both genders, main effects of both alcohol volume and EHD on verbal aggression were positive and highly significant (Table 4, model II). With the exception of volume and income as well as EHD and marital status in females, no significant interaction terms of drinking with sociodemographic variables were observed. Finally, the interaction between volume and EHD was significant in males, but not in females (Table 4, model III).

Results for physical aggression in males were similar to those for verbal aggression (Table 5). Analyses revealed a significant negative association between physical aggression and education, and lower odds in married compared to unmarried males (Table 5, model I). Moreover, the association between education and physical aggression remained significant when drinking variables were controlled for. The association between marital status and physical aggression, however, disappeared. In females, education was significantly associated with physical aggression and did not change when the alcohol variables were included in the model (Table 5, model II). Strong main effects were found for both drinking variables in males but only for volume in females. None of the interactions between drinking variables and demographic variables were found significant. Finally, the interaction of volume and EHD significantly predicted physical aggression in males (Table 5, model III).

## Discussion

The present study investigated associations between sociodemographic variables, alcohol consumption and alcohol-re-

lated verbal and physical aggression while taking into account age, gender and interaction effects between sociodemographic status and alcohol consumption. The results are mixed but indicate that differences in the risk of experiencing alcohol-related verbal and physical aggression between sociodemographic groups may not only be attributed to differences in drinking behaviour. Second, no evidence was found for social group membership moderating the association between alcohol volume or frequency of heavy drinking and aggression. Finally, frequency of heavy drinking moderated the effect of volume on verbal and physical aggression in males only. At any given volume the risk of experiencing aggression increased with the frequency of heavy drinking.

Our findings partially contradict the two-step model (Robins et al., 1962), which proposed that sociodemographic variables predict alcohol consumption, but are not good predictors of negative social consequences when patterns of drinking are accounted for. Earlier research confirmed the view of Robins and colleagues concluding that the risk for problems at the same average level of drinking is rather evenly distributed across different social classes (Huckle et al., 2010; Selin, 2005). Contrary to this, our findings suggest that particularly lower educated females experienced alcohol-related physical aggression and lower educated males both types of aggression over and above different levels of alcohol consumption and drinking patterns. The evidence for marital status as predictor of aggression after controlling for alcohol consumption was less consistent, and income was, with the exception of physical aggression in males, not associated with aggression.



**Table 4:** Results of logistic regressions on alcohol-related verbal aggression by gender

	Males											
	Females				Males				Males			
	Model I			Model II			Model III			Model I		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Constant	2.29	1.59; 3.29***		0.46	0.31; 0.69***		0.44	0.29; 0.66***		2.01	1.46; 2.77***	
Age	0.88	0.87; 0.90***		0.88	0.87; 0.90***		0.88	0.87; 0.90***		0.90	0.89; 0.92***	
Age <sup>2</sup>	1.07	1.05; 1.10***		1.08	1.06; 1.11***		1.08	1.06; 1.11***		1.04	1.02; 1.06***	
Education	0.94	0.77; 1.14ns		0.84	0.67; 1.04ns		0.90	0.69; 1.18ns		0.79	0.67; 0.93**	
Income	0.96	0.78; 1.17ns		0.81	0.66; 0.99*		0.87	0.67; 1.14ns		1.22	1.02; 1.48*	
Marital status												
Not married	1.0			1.0			1.0			1.0		
Married	0.84	0.74; 0.96*		0.98	0.85; 1.13ns		0.83	0.72; 0.95**		0.78	0.70; 0.87***	
Volume				1.72	1.60; 1.86***		1.76	1.61; 1.92***		1.64	1.52; 1.76***	
EHD				F=40.68***			F=44.05***			F=53.45***		
No				1.0			1.0			1.0		
1 time				1.86	1.61; 2.15***		1.78	1.52; 2.08***		1.51	1.29; 1.76***	
2-4 times				2.40	1.99; 2.90***		2.36	1.97; 2.83***		2.25	1.96; 2.58***	
5 or more times				2.90	2.27; 3.71***		3.14	2.44; 4.04***		3.54	2.84; 4.41***	
Volume by												
Education <sup>1</sup>				1.01	0.75; 1.35ns		1.01	0.75; 1.35ns				
Income <sup>1</sup>				0.65	0.49; 0.84**		0.65	0.49; 0.84**				
Marital status				0.98	0.84; 1.15ns		0.98	0.84; 1.15ns				
UHD by												
Education <sup>1</sup>				0.91	0.69; 1.20ns		0.91	0.69; 1.20ns				
Income <sup>1</sup>				1.27	0.98; 1.65ns		1.27	0.98; 1.65ns				
Marital status				1.29	1.11; 1.49**		1.29	1.11; 1.49**				
Volume by EHD <sup>1</sup>				0.97	0.90; 1.04ns		0.97	0.90; 1.04ns				
Nagelkerke R <sup>2</sup>	0.17			0.25			0.25			0.19		
										0.27		

OR odds ratio; CI confidence interval; <sup>1</sup> test based on the residual interaction term; \* p < .05; \*\* p < .01; \*\*\* p < .001; ns not significant.

**Table 5:** Results of logistic regressions on alcohol-related physical aggression by gender

	Females						Males					
	Model I			Model II			Model III			Model I		
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Constant	1.36	0.57; 3.23ns	0.28	0.12; 0.69*	0.26	0.10; 0.66**	6.18	3.88; 9.84***	1.52	0.88; 2.64ns	2.29	1.32; 3.98**
Age	0.80	0.76; 0.85***	0.80	0.76; 0.85***	0.80	0.76; 0.85***	0.79	0.77; 0.81***	0.77	0.74; 0.79***	0.76	0.74; 0.79***
Age <sup>2a)</sup>	1.21	1.14; 1.28***	1.22	1.14; 1.29***	1.22	1.15; 1.29***	1.20	1.16; 1.24***	1.25	1.21; 1.29***	1.26	1.22; 1.30***
Education	0.51	0.27; 0.95*	0.43	0.23; 0.83*	0.91	0.44; 1.91ns	0.58	0.41; 0.81**	0.42	0.30; 0.58***	0.41	0.27; 0.63***
Income	1.32	0.68; 2.58ns	1.16	0.59; 2.27ns	1.31	0.56; 3.08ns	1.50	0.98; 2.30ns	1.19	0.77; 1.84ns	1.28	0.70; 2.34ns
Marital status												
Not married	1.0		1.0		1.0		1.0		1.0		1.0	
Married	0.79	0.52; 1.21ns	0.90	0.60; 1.35ns	0.79	0.53; 1.19ns	0.80	0.65; 0.98*	0.89	0.74; 1.07ns	0.99	0.78; 1.26ns
Volume			1.78	1.45; 2.20***	1.54	1.23; 1.91***			1.83	1.61; 2.08***	1.44	1.23; 1.68***
EHD			F=2.06ns		F=2.35ns			F=8.68***			F=11.04***	
No			1.0		1.0			1.0			1.0	
1 time			1.39	0.94; 2.06ns	1.52	1.01; 2.28*			1.30	0.96; 1.76ns	1.76	1.20; 2.57**
2-4 times			1.72	1.11; 2.66*	1.82	1.15; 2.90*			1.72	1.38; 2.16***	2.39	1.74; 3.28***
5 or more times			1.82	0.90; 3.65ns	1.64	0.71; 3.79ns			2.16	1.49; 3.13***	2.05	1.30; 3.22**
Volume by												
Education <sup>1</sup>			0.49	0.22; 1.08ns					0.77	0.47; 1.27ns		
Income <sup>1</sup>			0.53	0.22; 1.26ns					0.90	0.49; 1.64ns		
Marital status			0.99	0.66; 1.49ns					0.88	0.68; 1.14ns		
EHD by												
Education <sup>1</sup>			0.72	0.32; 1.64ns					1.24	0.78; 1.97ns		
Income <sup>1</sup>			1.52	0.63; 3.69ns					1.02	0.59; 1.76ns		
Marital status			1.18	0.83; 1.67ns					0.98	0.76; 1.27ns		
Volume by EHD <sup>1</sup>			1.08	0.87; 1.33ns					1.25	1.11; 1.40***		
Nagelkerke R <sup>2</sup>	0.14		0.19		0.19		0.23		0.30		0.30	

OR: odds ratio; CI confidence interval; <sup>1</sup>: test based on the residual interaction term; \* p < .05; \*\* p < .01; \*\*\* p < .001; ns not significant.

Our findings of a social gradient of negative consequences independent of average volume and frequency of heavy drinking are in line with studies using morbidity and mortality (Mäkelä & Paljärvi, 2008) or risk-taking behaviour (Livingston, 2015) as outcome. Mäkelä and Paljärvi explained their findings by systematic differences in alcohol-related morbidity and mortality between workers of high and low socioeconomic status (SES): individuals of the high SES group may experience more social support, i.e., they are more often married, may have family or may receive more support from employers in solving alcohol-related problems. Thus, the high SES group may have better resources to avoid negative consequences from drinking such as drinking in safer environments or taking a taxi instead of driving drunk.

Our second research question concerned the moderating effect of social group membership on the association between average volume or frequency of heavy drinking and aggression. This interaction basically tested whether social group membership affected the association between level of average volume or frequency of heavy drinking and aggression differentially. Reasons for this could be genetic or predisposing vulnerability resulting in an increased risk of aggression at any level of consumption. However, our results revealed no systematic variation between drinking and aggression across social group membership, indicating that even in case of genetic differences in aggression, these differences do not systematically vary between social groups as defined in our study.

Third, we found that frequency of heavy drinking moderated the effect of average

volume on verbal and physical aggression among males, indicating that the risk of physical aggression increased with the frequency of heavy drinking. In females, however, the interaction was not significant. Earlier research from Germany reported that frequency of heavy drinking moderated the relation of alcohol volume with alcohol-related negative social consequences in both males and females (Kraus et al., 2009). Cultural differences in drinking style and particularly in female drinking may explain the mixed result in the present study.

Reasons for our significant findings on education and (partially) marital status predicting aggression independent of drinking volume and EHD may be twofold. First, in contrast to earlier research testing the two-step model, verbal and physical aggressions in our study were clearly defined outcomes rather than a summary measure of negative social consequences including aggression. Second, with alcohol-related verbal and physical aggressions being present in 6.2% and 1.5% of the general population, respectively, these consequences may be considered rare phenomena. For analyses involving many variables, large samples – as in the present study – are needed in order to detect significant differences. The lack of power in earlier studies, i.e. wide confidence intervals, may have been responsible for not challenging the hypothesis.

Our results, in finding higher rates particularly of alcohol-related aggression among individuals of lower education, point at social differences beyond differences in drinking habits. There is evidence for sociopsychological and personality factors best predicting negative

consequences of drinking in heavy drinkers (Robins et al., 1962). Research also suggests that alcohol facilitates aggression in individuals showing high levels of predisposition to aggression (Giancola, 2002; Giancola et al., 2002), and increased levels of aggression were found among highly provoked individuals reporting a history of heavy drinking (Parrott, & Giancola, 2006). These findings may be considered in light of differential aggression vulnerability across social groups. Reasons for increased reactivity to provocation may be that coping strategies avoiding aggression and de-escalating aggressive situations may be less developed in these groups or that aggression has been learned as a conflict-solving strategy. Conversely, people with higher education may be more skilled in avoiding critical situations and better trained in strategies of de-escalation. Aggression susceptibility, however, may not be more prevalent among the less educated per se, but may be a response to marginalisation and stigmatisation resulting from labels of “uneducated” (Room, 2005). Thus, the larger number of aggression-susceptible individuals among the lower educated may be a consequence rather than a cause of social group membership. Alternatively, the significant effect of education on aggression independent of drinking may be explained by differences in readiness to report aggression. Norms that stigmatise aggression and associate it with the uneducated may lead to underreporting of aggression in higher educated groups. Differences between social groups in drinking context may also play a role. It has been shown, for instance, that drinking before going out is linked to higher risks

of violent behaviours (Hughes, Anderson, Morleo, & Bellis, 2008).

Although the advantage of our study is the large sample size, the response rate was low and decreased over time, potentially limiting the validity of the results. Frequency of episodic heavy drinking was measured categorically and information on the frequency of experiencing aggression was not available. Future research should avoid categorisation of drinking variables and use measures of aggression severity or frequency. The discrepancy in the reference period of drinking (30 days) and alcohol-related aggression (12 months) may bias the associations. The results may not be accurate for those individuals whose drinking in the last 30 days differed from their drinking in the previous months. Third, social status in our analysis was defined in terms of the highest educational level achieved by the respondents, by income and marital status. Educational level may be considered a more stable trait than marital status or income. Educational level remains stable after young adulthood, while marital status and income change over the life course, and income is a less meaningful measure for those not working. Moreover, as drinking and in particular heavy occasional drinking begins early in life, drinking initiation appears to be influenced by school and academic achievement rather than by later occupational and income attainment. Nevertheless, life course changes were minimised by controlling for age in the regression analyses. Fourth, data on drinking in the present study were confined to measures of general drinking behaviour. Literature, however, suggests an association between aggression and

both general drinking patterns (Parrott & Giancola, 2006) and drinking in the event. Fifth, in aggression research the distinction between aggressor and victim is commonly made. For instance, it is likely that women are victims of domestic violence where the intoxication of the partner is the main factor for reporting alcohol-related aggression. However, transactional processes involved in aggression incidents make it sometimes difficult to disentangle “victim” and “aggressor”: victims sometimes initiate the incident (Murdoch, Pihl, & Ross, 1990) and third parties getting involved in aggressive incidents may consider themselves neither victim nor aggressor (Felson & Tedeschi, 1993). Based on this and our main interest in the link between alcohol and aggression involvement, we used data on alcohol-related aggressive events without this distinction.

In conclusion, our findings challenge the hypothesis of alcohol-related negative consequences such as involvement in aggression incidents being evenly distributed across different social groups when drinking patterns are accounted for. The higher risk for experiencing alcohol-related aggression of individuals belonging to lower social classes or not being mar-

ried independent of their drinking habits seems to be related to group membership. Future research may further investigate the reasons for this social inequality and the different roles education, income and marriage play in males and females.

**Declaration of interest** None.

**Ludwig Kraus, PhD**

IFT Institut für Therapieforschung,  
München, Germany  
Centre for Social Research on Alcohol and  
Drugs (SoRAD)  
Stockholm University  
E-mail: kraus@ift.de

**Kalle Tryggvesson, PhD**

Department of Criminology  
Stockholm University  
E-mail: kalle.tryggvesson@criminology.su.se

**Alexander Pabst, PhD**

Institute of Social Medicine, Occupational Health  
and Public Health (ISAP)  
Medical Faculty, University of Leipzig, Germany  
E-mail: Alexander.Pabst@medizin.uni-leipzig.de

**Robin Room, PhD**

Centre for Social Research on Alcohol and  
Drugs (SoRAD)  
Stockholm University  
Centre for Alcohol Policy Research  
La Trobe University, Melbourne  
E-mail: R.Room@latrobe.edu.au

## REFERENCES

- Alvarez, F.J., Fierro, I., & del Rio, C.M. (2006). Alcohol-related social consequences in Castille and Leon, Spain. *Alcoholism, Clinical and Experimental Research*, 30(4), 656–664.
- Bross, I.D.J. (1958). How to use ridit analysis. *Biometrics*, 14(1), 18–38.
- Bye, E.K., & Rossow, I. (2010). The impact of drinking pattern on alcohol-related violence among adolescents: An international comparative analysis. *Drug and Alcohol Review*, 29(2), 131–137.
- Chermack, S.T., & Giancola, P.R. (1997). The relation between alcohol and aggression: An integrated biopsychosocial conceptualization. *Clinical Psychology Review*, 17(6), 621–649.
- Dietze, P.M., Jolley, D.J., Chikritzhs, T.N., Clemens, S., Catalano, P., & Stockwell, T. (2009). Income inequality and alcohol attributable harm in Australia. *BMC Public Health*, 9(1), 70.
- Felson, R.B., & Tedeschi, J.T. (1993). *Aggression and violence: Social interactionist perspectives*. Washington, DC: American Psychological Association.
- Giancola, P.R. (2002). Alcohol-related aggression in men and women: The influence of dispositional aggressivity. *Journal of Studies on Alcohol*, 63(6), 696–708.
- Giancola, P.R., Helton, E.L., Osborne, A.B., Terry, M.K., Fuss, A.M., & Westerfield, J.A. (2002). The effects of alcohol and provocation on aggressive behavior in men and women. *Journal of Studies on Alcohol*, 63(1), 64–73.
- Gmel, G., Klingemann, S., Müller, R., & Brenner, D. (2001). Revising the preventive paradox: The Swiss case. *Addiction*, 96(2), 273–284.
- Gmel, G., Rehm, J., Room, R., & Greenfield, T.K. (2000). Dimensions of alcohol-related social and health consequences in survey research. *Journal of Substance Abuse*, 12(1–2), 113–138.
- Hayes, L.J., & Berry, G. (2002). Sampling variability of the Kunst–Mackenbach relative index of inequality. *Journal of Epidemiology and Community Health*, 56(10), 762–765.
- Huckle, T., You, R. Q., & Casswell, S. (2010). Socio-economic status predicts drinking patterns but not alcohol-related consequences independently. *Addiction*, 105 (7), 1192–1202.
- Hughes, K., Anderson, Z., Morleo, M., & Bellis, M.A. (2008). Alcohol, nightlife and violence: The relative contributions of drinking before and during nights out to negative health and criminal justice outcomes. *Addiction*, 103(1), 60–65.
- Ito, T.A., Miller, N., & Pollock, V.E. (1996). Alcohol and aggression: A meta-analysis on the moderating effects of inhibitory cues, triggering events, and self-focused attention. *Psychological Bulletin*, 120(1), 60–82.
- Karriker-Jaffe, K.J., Roberts, S.C.M., & Bond, J. (2013). Income inequality, alcohol use, and alcohol-related problems. *American Journal of Public Health*, 103(4), 649–656.
- 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 the German Epidemiological Surveys of Substance Abuse. *Alcohol and Alcoholism*, 44(3), 314–320.
- Lance, C.E. (1988). Residual centering, exploratory and confirmatory moderator analysis, and decomposition of effects in path models containing interactions. *Applied Psychological Measurements*, 12, 163–175.
- Lenke, L. (1990). *Alcohol and criminal violence: Time series analysis in a comparative perspective*. Stockholm: Almqvist and Wiksell International.
- Livingston, M. (2014). Socioeconomic differences in alcohol-related risk-taking behaviours. *Drug and Alcohol Review*, 33(6), 588–595.
- Mackenbach, J.P., & Kunst, A.E. (1997). Measuring the magnitude of socio-economic inequalities in health: An overview of available measures illustrated with two examples from Europe. *Social*

- Science and Medicine*, 44(6), 757–771.
- Mäkelä, P., Keskimäki, I., & Koskinen, S. (2003). What underlies the high alcohol related mortality of the disadvantaged: High morbidity or poor survival? *Journal of Epidemiology and Community Health*, 57(12), 981–986.
- Mäkelä, P., & Paljärvi, T. (2008). Do consequences of a given pattern of drinking vary by socioeconomic status? A mortality and hospitalisation follow-up for alcohol-related causes of the Finnish Drinking Habits Surveys. *Journal of Epidemiology and Community Health*, 62(8), 728–733.
- Murdoch, D., Pihl, R. O., & Ross, D. (1990). Alcohol and crimes of violence: Present issues. *International Journal of the Addictions*, 25(9), 1065–1081.
- Norström, T., & Pape, H. (2010). Alcohol, suppressed anger and violence. *Addiction*, 105(9), 1580–1586.
- Parrott, D. J., & Giancola, P. R. (2006). The effect of past-year heavy drinking on alcohol-related aggression. *Journal of Studies on Alcohol*, 67(1), 122–130.
- Probst, C., Roerecke, M., Behrendt, S., & Rehm, J. (2014). Socioeconomic differences in alcohol-attributable mortality compared with all-cause mortality: A systematic review and meta-analysis. *International Journal of Epidemiology*, 43(4), 1314–1327.
- Ramstedt, M., Axelsson Sohlber, T., Engdahl, B., & Svensson, J. (2009). *Tal om alkohol 2008: En statistisk årsrapport från Monitor-projektet* [A statistical annual report from the Monitor project] (54). Stockholm: SoRAD, Centrum för socialvetenskaplig alkohol- och drogforskning, Stockholms Universitet.
- Rehm, J., Ashley, M. J., Room, R., Single, E., Bondy, S., Ferrence, R., & Giesbrecht, N. (1996). On the emerging paradigm of drinking patterns and their social and health consequences. *Addiction*, 91(11), 1615–1621.
- Rehm, J., & Gmel, G. (1999). Patterns of alcohol consumption and social consequences. Results from an 8-year follow-up study in Switzerland. *Addiction*, 94(6), 899–912.
- Rehm, J., Room, R., Graham, K., Monteiro, M., Gmel, G., & Sempos, C. T. (2003). The relationship of average volume of alcohol consumption and patterns of drinking to burden of disease: An overview. *Addiction*, 98(9), 1209–1228.
- Robins, I. N., Bates, W. M., & O'Neal, P. (1962). Adult drinking patterns of former problem children. In D. J. Pittman & C. R. Snyder (Eds.), *Society, culture and drinking patterns* (pp. 395–412). New York: Wiley.
- Room, R. (2005). Stigma, social inequality and alcohol and drug use. *Drug and Alcohol Review*, 24(2), 143–155.
- Rossow, I. (1996). Alcohol-related violence: The impact of drinking pattern and drinking context. *Addiction*, 91, 1651–1661.
- Royston, P. (2005). Multiple imputation of missing values: Update of ice. *Stata Journal*, 5, 527–536.
- Scott, K. D., Schafer, J., & Greenfield, T. K. (1999). The role of alcohol in physical assault perpetration and victimization. *Journal of Studies on Alcohol*, 60, 528–536.
- Selin, K. (2005). Predicting alcohol-related harm by sociodemographic background: High prevalence versus high risk. *Contemporary Drug Problems*, 32, 547–588.
- Wells, S., Giesbrecht, N., Ialomiteanu, A., & Graham, K. (2011). The association of drinking pattern with aggression involving alcohol and with verbal versus physical aggression. *Contemporary Drug Problems*, 38 (Summer), 259–279.
- Wells, S., & Graham, K. (2003). Aggression involving alcohol: Relationship to drinking patterns and social context. *Addiction*, 98(1), 33–42.
- Wells, S., Graham, K., & West, P. (2000). Alcohol-related aggression in the general population. *Journal of Studies on Alcohol*, 61(4), 626–632.





