

# Neighborhood or School? Influences on Alcohol Consumption and Heavy Episodic Drinking Among Urban Adolescents

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**Abstract** Little is known about the relative influences of neighborhood and school on the alcohol socialization process. Survey data from the Young in Oslo Study ( $N = 10,038$ , mean age 17.1 years, 52% girls) were used to investigate the details of such influences, using cross-classified multilevel models. School and neighborhood contexts were equally important for ordinary alcohol use; however, neighborhood influences were mainly explained by individual and family factors, whereas peer-based sociocultural processes played a key role in explaining school effects. Neither context had much impact on heavy episodic drinking. The study suggests that “privileged” youth may be at risk of high alcohol consumption. Parental influences and peer-based sociocultural aspects of the school milieu should be considered in prevention efforts.

**Key words** Neighborhood · School · Alcohol · Alcohol problems · Cross-classified models

## Introduction

Bronfenbrenner and others (Bronfenbrenner and Morris 2006; Dunn et al. 2015) have suggested that it is important to examine the relative impact of different social contexts, such as school and neighborhood, on the development of risk behaviors in adolescence. Multilevel theories claim that different social contexts may influence health, well-being and behavior simultaneously, and that emphasizing a single context, such as neighborhood, may misdirect interventions. Advanced analytical techniques have been developed to address such complex processes, e.g., cross-classified multilevel models (Goldstein 2003). However, research using such methods to take into account different social contexts remains scarce. The aim of this study is to investigate how alcohol consumption and heavy episodic or binge drinking are shaped by influences of both neighborhood and school contexts, while at the same time considering individual, family, and peer influences. The study uses a large sample of adolescents from Oslo, the capital of Norway, one of the Nordic welfare states, with low social and economic inequality (Barth et al. 2014) and a restrictive alcohol policy (Rossow and Storvoll 2014).

## Neighborhood and School Influences

Neighborhoods and schools have no a priori established hierarchical order in the socialization process. Often, adolescents who live in the same neighborhood can attend different schools, and a school may recruit adolescents from many neighborhoods. Adolescent alcohol use is a particularly interesting example of such multilevel influences, as it does not necessarily conform to the typical pattern of potentially health-damaging behavior. Whereas adolescents from disadvantaged neighborhoods and low socioeconomic

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strata are typically at risk of factors such as poor diets, physical inactivity, and smoking (Janssen et al. 2006), such risk factors are not necessarily supported by studies examining alcohol use.

Indeed, several studies conclude that so-called “areas of disadvantage” may have high levels of excessive alcohol consumption and alcohol problems (Stimpson et al. 2007; Cerda et al. 2010). However, a recent review of neighborhood factors and alcohol suggested weak links between neighborhood and ordinary or normative alcohol use (Bryden et al. 2013). A few studies, mainly from the USA, even suggest that neighborhood socioeconomic *advantage* may be linked to higher alcohol consumption. For example, in a US national sample, high socioeconomic status (SES) neighborhoods were associated with increased parental drinking, which was further associated with increased adolescent alcohol use (Chuang et al. 2005). Moreover, a study from New York revealed that wealthy neighborhoods had higher proportions of alcohol users and more frequent drinking than lower income areas (Galea et al. 2007). Another US study, drawing on three adolescent samples in different parts of the country (east coast suburban and northwest suburban), uncovered elevated levels of substance use and externalizing problems in affluent youth (Luthar and Barkin 2012). However, some European studies suggest that such associations may reflect higher proportions of Muslims in areas of disadvantage, as these may have low levels of alcohol use as well as low incomes (Amundsen 2012; Kuipers et al. 2013). Hence, information about religious affiliation should be included in such studies.

The lack of conclusive findings in this research area may be due to the heterogeneity of the alcohol variables used, which range from dichotomous measures of alcohol use (no/yes), frequency of low-level intake, and heavy episodic drinking, to measures of even more pathological alcohol-related behaviors. Importantly, the use of alcohol becomes normative behavior at a certain age in most Western cultures. Hence, there is a need for specificity with regard to the age groups sampled and the phenomenon to be studied, and recent reviews of area-level SES and alcohol use suggest that the preponderance of alcohol consumption in disadvantaged neighborhoods is primarily limited to heavy alcohol use and alcohol problems in adult samples (Karriker-Jaffe 2011). A recent study from New Zealand reflected this complexity; neighborhood disadvantage was associated with a number of alcohol-related measures among younger adolescents (<16 years). However, the reverse pattern was revealed in older adolescents ( $\geq 16$  years). Hence, disadvantaged communities were primarily associated with risky alcohol consumption in age groups where such behaviors were non-normative (Jackson et al. 2016). A recent study from Oslo, Norway, echoed this pattern,

finding a higher proportion of alcohol users and a higher frequency of normative drinking among adolescents in the wealthiest areas of the city. However, the risk of developing alcohol problems was higher in the more disadvantaged parts of the city (Pedersen et al. 2015).

A problem with many studies of neighborhood influences is related to the lack of inclusion of other possible sources of contextual influence—most notably schools. It is well documented that schools have an effect on adolescent alcohol use, both through perceived peer norms, best friends’ use, and the presence of others who use (Salvy et al. 2014). School-sponsored organizational activities outside ordinary school hours may also have an impact (Fujimoto and Valente 2013). Less is known about the relative influence of neighborhoods and schools in this respect. Several studies have compared neighborhood and school contexts with regard to educational results, and here school characteristics seem to be the more important (Brannstrom 2008; Sykes and Musterd 2011). On the other hand, the neighborhood context has usually been considered most important with regard to behavioral problems and delinquency (Sampson et al. 2005; de Beeck et al. 2012). However, until recently, no studies of delinquency directly compared the relative effects of the two contexts using adequate methodology. A recent study from the USA, utilizing such methodology, revealed that the effect of neighborhoods on juvenile delinquency was two to three times larger than that of schools, and characteristics such as SES, residential mobility, and proportion of youth not enrolled in the school system were important dimensions of the neighborhoods investigated. In that study, school context had some effect—although it was clearly smaller—and indicators of “the school milieu” seemed to be most important (Kim 2016). A limitation of that study was that a neighborhood typically sent its adolescents to very few schools—usually between one and three, so school effects may be of greater importance in areas with greater heterogeneity in school transitions.

Few studies have investigated the simultaneous influence of neighborhood and school on smoking, alcohol, or illegal substance use with adequate methodology. A recent study utilizing cross-classified multilevel modeling of adolescent smoking revealed that ordinary two-level multilevel analyses produced misleading results, overestimating the role of neighborhoods. Including schools in a cross-classified multilevel model reduced the fraction of variance attributable to neighborhoods from 5.2% to 0.5%, whereas that at the school level (6.1%) was not greatly influenced by the inclusion of the neighborhood level (Dunn et al. 2015). A recent study from Stockholm, Sweden, concluded that school characteristics were more important than those of neighborhoods for alcohol socialization. In that study, schools with the highest parental educational level also had

the highest level of alcohol consumption. However, the variance explained by school-level characteristics was low, for which one explanation may be the young age of those in the sample (15–16 years) and half of the participants did not drink alcohol at all (Carlson and Almquist 2016).

What kind of factors at the school level may account for increased alcohol consumption? Previous research suggests that the sociocultural milieu, and rituals and traditions anchored in the students themselves may be important. High-status groups in school networks may have norms favorable to alcohol, and these networks have a large impact on the drinking patterns at a school (Teunissen et al. 2012). In a similar vein, high-status “Greek letter organizations” are important in socialization to excessive alcohol use in many US colleges (Scott-Sheldon et al. 2016).

A recent study from Norway investigated the importance of a tradition linked to the high school graduation celebration (Fjaer et al. 2016). Participants go under the untranslatable name of *russ*, which stems from an academic initiation ritual long used at European universities (Sande 2002). Students buy old buses that are refurbished to function as “rolling nightclubs” in the final three weeks of celebration. The tradition is particularly important in the Oslo area and at schools where high-SES students are recruited. In Norway, people from high-SES backgrounds generally have the highest alcohol consumption (Nordfjaern and Brunborg 2015). Hence, knowledge about the influence of parental SES and data on the degree of engagement in this celebration—individually and at the school level—should be taken into account when investigating how the school milieu may influence alcohol use among students.

To summarize, adolescents in affluent neighborhoods may develop higher levels of alcohol consumption than those in disadvantaged areas, while adolescents from disadvantaged areas may be at greater risk of alcohol problems. Little research has been done on the relative importance of neighborhoods and schools in these processes. The present study investigates the importance of these two contexts while controlling for individual and family factors. In particular, the importance of peer-based sociocultural factors at the schools is emphasized. Moreover, two different alcohol measures are used—one related to frequency of alcohol use as a marker of normative behavior, and one related to excessive alcohol use, possibly indicating more problematic use.

### Other Sources of Influence

To identify the relative impact of neighborhood and school contexts in the alcohol socialization process, one must also include variables measuring other well-established influences in the models. First, a large number of studies have demonstrated the importance of parental drinking in the

alcohol socialization process (for a review, see: Ryan et al. 2010). A recent population-based longitudinal study from Norway revealed that parental alcohol consumption patterns measured in mid-adolescence were strong and highly specific predictors of drinking patterns when those in the sample were approaching their 30s (Pedersen and von Soest 2013). Second, it is well known that non-Western immigrants in Norway, and Muslims in particular, have a low level of alcohol consumption (Amundsen 2012) and that high levels of religious involvement are generally associated with reduced alcohol use (Brown et al. 2001). Third, peers also have strong influences on adolescent drinking (Kuntsche et al. 2004). At a certain age, adolescents choose drinkers as friends more often than they choose non-drinkers, and a majority of adolescents then regard alcohol use as an attractive, high-status activity (Osgood et al. 2013). In a similar vein, late adolescent alcohol abstainers often perceive themselves as lonely and as having weak social networks, and they often come from low-SES families (Pedersen and Kolstad 2000). Thus, the study includes data on parental influences, religious affiliation, and peer influences.

## The Current Study

The current study is part of a broader project investigating the alcohol socialization process in adolescence. This article focuses on the relative importance of neighborhood and school influences respectively, using a methodology that enables us to evaluate possible effects from both these contexts simultaneously (cross-classified multilevel methods). In particular, the present study aims to simultaneously assess the importance of neighborhood and school in the alcohol socialization process, while controlling for individual, family, and peer characteristics (Aim number 1). Moreover, it will be assessed whether possible variations may be ascribed to the sociodemographic characteristics of the neighborhood and school (Aim number 2). Finally, the study aims to identify sociocultural aspects of the school milieu that may be important (Aim number 3).

## Methods

### Context, Participants, and Procedure

The study was conducted in the capital of Norway, Oslo, which has 670,000 inhabitants. Generally the welfare level is high in Norway, but there are considerable socioeconomic differences between parts of the city (Toft and Ljunggren 2016). The Norwegian alcohol policy is restrictive, with high prices, a state monopoly on selling wine and

spirits, and a formal age limit of 18 years for purchasing beer and wine and 21 years for spirits. Nevertheless, most adolescents can obtain alcohol before that age, with minor legal consequences for breaking the law (Rossow and Stordvoll 2014).

Data were used from the *Young in Oslo 2015 Study*, a survey of students in secondary school about their living conditions. All high schools in Oslo with students in grades 11–13 were invited to participate. Thirty of 33 invited schools participated, covering all of the city's 22 public schools and eight of the 11 private schools. A school-based electronic questionnaire was administered under the supervision of teachers, with assessments of family background, religious belief, relationship with peers, leisure activities, and substance use. The response rate was 72%. The sample covers 62% of the population of 16–18-year-old adolescents in Oslo. All parents and students were informed about the purpose of the study in advance and told that participation was voluntary. All ethical aspects were approved by the Norwegian Centre for Research Data.

The analyses in this article are based on a sample of 10,038 students residing in Oslo. The average age was 17.1 years ( $SD = 0.9$ ) and 52% of the respondents were girls.

Oslo consists of 15 main districts and 92 subdistricts of residence, officially defined by the Municipality of Oslo. In the electronic survey, students were asked to indicate their main district of residence. Students were then instructed to select their subdistrict of residence from a list of all subdistricts within the chosen main district. Teachers were instructed to help students to identify their subdistricts in cases where they were not able to do so themselves.

Information about the schools that the adolescents attended was also obtained. From each school, an average of 335 students ( $SD = 216$ ) were included in the sample. Because high school students in Oslo are admitted to schools of their choice and selected based on their grades from lower secondary school, the student population in each school included young people from different subdistricts (an average of 59 subdistricts for each school). Thus, there was no clear hierarchical nesting between school and place of residence. Nevertheless, recruitment to high school follows traditional socioeconomic and sociogeographic differences, where students from low-SES and immigrant backgrounds are overrepresented in schools situated in the outer eastern suburbs, while ethnic Norwegian middle- and upper-class students mainly attend the most popular schools in the center of the city or the more affluent western parts of Oslo. On average, 109 respondents ( $SD = 82$ ) reported living in each subdistrict, and the mean number of schools that the students attended in each subdistrict was 19.3. In all, 1774 combinations of school and neighborhood contexts were identified in the sample, which makes the *Young in Oslo Study* well suited for cross-classified multilevel modeling.

## Measures

### *Alcohol use*

Alcohol consumption was measured by the question “Do you drink any form of alcohol?” Response options included: never (0), have only tasted it a few times (1), sometimes, but not as often as monthly (2), quite regularly, approximately one to three times a month (3), and weekly (4). Heavy episodic drinking was assessed by the question: “In the course of the past 6 months, how often have you drunk so much that you felt clearly intoxicated?” Response options ranged from never (0), once (1), twice to four times (2), five to 10 times (3), to more than 10 times (4). For the analyses of heavy episodic drinking, the analysis was restricted to those who were at risk of being drunk, and all respondents who used alcohol at least “sometimes, but not as often as monthly” were included (59.9% of the sample).

### *Socioeconomic background*

Socioeconomic background was measured by a single composite socioeconomic score. It was based on the average scores for three variables, which were all coded on a scale ranging from 0 to 3: (1) the number of parents who had a university degree, (2) the number of books in the home of the respondent (on a six-point scale from 0 to 1000+), and (3) the average score on the four-item Family Affluence Scale II (FAS II) (Currie et al. 2008). FAS II includes items assessing the number of computers and cars in the family, how many times the family went on holiday last year, and whether the respondents had their own room at home.

### *Religion*

We asked about religious belonging, with “Christianity”, “Islam”, “other religion”, and “no religion” as options. A dummy variable was constructed, indicating whether the respondent was Muslim or not. The impact of religion on daily life was assessed with response options ranging from “Religion has no importance in how I live my life” (0) to “Religion is very important” (3) (Cotton et al. 2006).

### *Parental and friends' alcohol use*

Mother's and father's use of alcohol was assessed with a question about the frequency of each parent's drinking frequency, and response options ranged from “Never” (0) to “Daily” (4). Friends' use of alcohol was assessed similarly, with the same response options as for parents' use of alcohol.

### *The high school graduation celebration*

Respondents were asked to indicate how important they considered the high school graduation celebration to be, with response options ranging from “Not important at all” (0) to “Extremely important” (4). A question was also posed about how much money they expected to spend on the celebration, ranging from no money at all to NOK 100,000 ( $\approx$  USD 10,000). A celebration commitment indicator with values from 0 to 4 was constructed by combining these items.

### *Aggregated neighborhood and school characteristics*

Characteristics of the neighborhood and of the student population at each school were assessed by means of an average SES score and the average score on the celebration commitment variable for each school and for each neighborhood. In an initial analysis, the proportion of students from immigrant backgrounds was also included. Because the correlation with the SES variable was very high at the school level ( $r = -0.91$ ) and at the neighborhood level ( $r = -0.93$ ), the proportion of immigrants variable was excluded to avoid multicollinearity. At the subdistrict level, self-reported information from the youth survey was validated with information about various socioeconomic indicators gathered from the municipality’s official register. The correlation between these measures was  $r = 0.86$  ( $p < .001$ ), indicating that the self-reported information is a valid measure at the neighborhood level. Because register-based information was not available at the school level, self-reported measures of students’ socioeconomic backgrounds at both the school and neighborhood levels were used.

### **Statistical Analyses**

First, the proportion of the total variance in alcohol consumption attributable to each of the two levels was estimated, in a nearly empty model controlling only for age and gender. Intraclass correlations (ICCs) were computed to obtain measures of the variance in the dependent variables (individual alcohol measures) accounted for by differences between schools and between neighborhoods. These measures provide an indication of the importance of the school setting and neighborhood, respectively, in shaping young people’s alcohol habits. Separate models were estimated with school and neighborhood measures as level 2 units, respectively. School and neighborhood was then combined in a cross-classified multilevel model, to address the main research question of this study. In all cases, separate analyses were performed with alcohol consumption frequency and heavy episodic drinking frequency as dependent variables. When examining heavy episodic drinking, only

respondents who had used alcohol at least “sometimes, but not as often as monthly” were included ( $n = 6246$ ). All analyses involving heavy episodic drinking were also rerun while including only respondents who reported being monthly or weekly users of alcohol ( $n = 3,525$ ). The general pattern of results for such analyses did not differ substantially from those that also included adolescents using alcohol “sometimes.” Thus, only analyses based on the larger sample are reported in the article.

As the next step, covariates were included stepwise to assess how much of the between-school and between-neighborhood variation in alcohol patterns was accounted for by (a) family characteristics and religion (socioeconomic and immigrant background, religious affiliation and parental use of alcohol); (b) friends’ alcohol use and the individual’s commitment to the high school graduation celebration; and (c) characteristics of the school and neighborhood.

Multilevel linear regressions were conducted using the MIXED command (random intercepts only) with maximum likelihood estimation in Stata 14.2 for Windows. In each model, ICC was calculated as the proportion of variance in the school and neighborhood, respectively, as a percentage of the total variance. This study follows recommendations by Hox (2010) for evaluating the size of ICC values, whereby ICC values of .05, .10, and .15 are considered to be small, medium, and large, respectively.

Questions about alcohol were placed in the middle part of the rather extensive questionnaire, and 6–9% did not report data on their own, their parents’, or their friends’ alcohol habits. The nonresponse rate was even higher for two questions placed in the latter part of the questionnaire, as 15% of the sample did not respond to questions about the high school graduation celebration and 15% had missing responses on the importance of religion in their daily life. The nonresponse rate on background variables was low. To examine potential selective item nonresponse in the latter part of the survey, logistic regression analyses were performed with nonresponses to at least one of the two items as the dependent variable while including all other study variables as predictors. Results showed that female sex ( $OR = 0.59$ ,  $p < .001$ ), higher age ( $OR = 1.05$ ,  $p < .05$ ), ethnic minority background ( $OR = 1.20$ ,  $p = .006$ ), and SES ( $OR = 0.35$ ,  $p < .001$ ), predicted item nonresponse. Similar results were revealed by logistic regression analyses predicting nonresponse to alcohol items.

To avoid bias from missing data arising from item nonresponse in the multivariate analyses, a multiple imputation technique was used with chained equations to manage missing data for all variables included in the study (White et al. 2011). Twenty datasets were generated and imputation was informed by all variables used in the analyses. All analyses were also rerun with missing data managed by means of listwise deletion and a single sample regression



**Table 1** Descriptive statistics for all variables used in the analyses

	Mean	SD	N	Intraclass correlations (ICCs) using cross-classified multilevel models (%)	
				Between schools	Between neighborhoods
Dependent variables					
Alcohol frequency (0–4)	1.82	1.40	9459		
Binge drinking among alcohol users (0–4)	2.34	1.24	5663		
Independent variables					
Gender (girl = 1)	0.53		9863	6.1	0.4
Age	17.08	0.91	10,038	4.1	0.1
Socioeconomic background (0–3)	2.15	0.62	10,038	10.5	11.9
Immigrant background (yes = 1)	0.32		10,038	11.0	17.4
Religious affiliation (Islam = 1)	0.17		10,038	8.4	7.6
Religious belief in God (0–3)	0.84	1.02	8573	9.9	7.1
Parental use of alcohol (0–4)	1.29	1.02	9187	6.5	10.5
Friends' use of alcohol (0–4)	1.54	0.94	9142	5.1	3.6
Celebration commitment (0–4)	1.27	1.14	8497	7.5	3.5

imputation model (Brick and Kalton 1996). Results did not differ substantially across the three different strategies for managing nonresponses, and only results based on multiple imputation are presented.

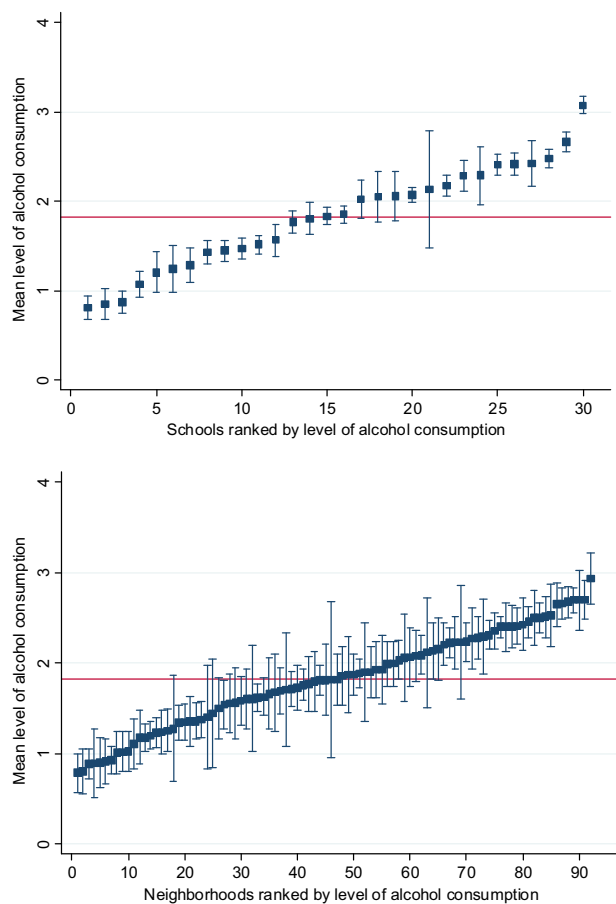
## Results

Table 1 shows descriptive statistics for all variables used in the analyses. The mean score for alcohol frequency indicates that the average response was slightly below “sometimes,” but not as frequent as “monthly.” Moreover, students varied considerably in their frequency of alcohol use, as indicated by a large standard deviation. For binge drinking, the mean score was slightly above “2–4 times” in the previous year.

To examine whether predictor variables could explain between-school and between-neighborhood patterns in alcohol behavior, the degree to which these variables varied between these contexts was estimated. In the two right-hand columns of Table 1, ICCs are reported for the school and neighborhood levels, and are derived from a cross-classified multilevel model with each variable included as a dependent variable in a separate analysis. Results showed substantial neighborhood variations in socioeconomic and immigrant background ( $ICC > 10\%$ ), even when school-level variation was partialled out through cross-classified multilevel analyses. Moreover, religiousness varied considerably between neighborhoods. Between-school variation in socioeconomic and immigrant background and religiousness was also substantial. Results also showed some school and neighborhood variations in friends' use of alcohol and a rather

high degree of neighborhood variation in parental alcohol patterns. Celebration commitment also varied substantially between contexts, with particularly high between-school variance.

Next, multilevel modeling was used with frequency of alcohol consumption as the dependent variable. In the first analysis, neighborhood level was included together with age and gender. The results showed that neighborhood level alone accounted for 15.7% of the variation in students' alcohol use ( $ICC = .157$ ). In a new analysis, school was included as the sole level-2 variable when age and gender were controlled for, showing that schools accounted for 16.7% of all variance in alcohol consumption frequency. Thus, when analyzing each context separately, the neighborhood and school levels accounted for approximately the same amount of variance, with ICC values that are considered large in the methodological literature (Hox 2010). The notion of substantial level-2 variance was also supported by the graphical display of variations in alcohol consumption in Fig. 1a and b, showing considerable variations in alcohol consumption across schools and neighborhoods. For the next step, neighborhood and school levels were included simultaneously using cross-classified multilevel modeling (see Table 2, Model 1). ICC values indicate that the variance explained by both contexts was considerably reduced, to 9.8% at the school level and 8.5% at the neighborhood level, indicating medium sized ICCs. Nevertheless, the analyses showed considerable remaining variation in alcohol use in both contexts. The results thus indicate that adolescents attending the same schools but living in different parts of the city had quite different alcohol consumption patterns, whereas adolescents living in



**Fig. 1** Mean alcohol consumption among high school students (confidence interval  $\pm 1.96$  SE) across 30 schools and 92 neighborhoods in Oslo, Norway

the same neighborhood tended to show different consumption patterns depending on their school affiliation.

In Model 2, family variables and religious affiliation were added to the model. Results showed that all variables were significantly related to alcohol use, with the highest consumption found in families with high SES and those where parents had high alcohol consumption (see Table 2). The lowest consumption was found in immigrant and Muslim families, and among the most religious youth. Moreover, the results showed that almost all neighborhood variation could be explained by these family characteristics, as the ICC was reduced to 1.0% at the neighborhood level, a reduction of 94% from the initial variance accounted for by this context. Even though between-school variation was also reduced substantially when family variables and religious affiliation were included, the difference in alcohol use between schools remained substantially higher, as indicated by the remaining ICC of 4.4%, which is considered a small ICC value.

In Model 3, the additional variables of peers' alcohol consumption and celebration commitment were included.

These variables were also related to alcohol use and explained even more of the remaining between-school variation, reducing the between school ICCs to 2.1%. Hence, school differences in alcohol use to some degree reflect "wet" social networks among peers and individual commitment to the graduation celebration traditions. In contrast, the neighborhood level was not greatly affected by these variables.

The final research question concerned whether the remaining between-school variation was related to characteristics at the school level. Model 4 in Table 2 shows how the average SES at both the school and neighborhood levels were related to alcohol use when all other variables were controlled for. The results showed that high SES at both the school and neighborhood level was related to significantly more frequent alcohol use. Moreover, by introducing SES at the school and neighborhood levels, the between-school variation in alcohol use was reduced to 1.1%. In Model 5, the average commitment to high school celebration at both levels was included. The results show that alcohol use was more prevalent in schools where many students show a strong commitment to this tradition than in schools where the students pay it less attention, and the ICC at the school level was somewhat reduced in the final model. The standardized regression coefficients ( $\beta$ ) in Model 5 indicate that friends' use of alcohol and celebration commitment were the strongest predictors of alcohol use in multivariate analyses.

Next, analyses were conducted examining whether heavy episodic drinking among those who drank alcohol varied at the school and neighborhood levels. For this purpose, a new set of analyses similar to those for alcohol consumption was conducted, with heavy episodic drinking as the dependent variable. Only students who reported drinking alcohol at least "sometimes, but not as often as monthly" were included. First, ordinary multilevel modeling was conducted at the school and neighborhood levels separately, only controlling for age and gender. Results showed that 5.7% of the variation in heavy episodic drinking was accounted for at the neighborhood level, whereas 6.2% was accounted for at the school level. The proportions of variance explained at the school and neighborhood levels were thus small and considerably lower for heavy alcohol use than for frequency of alcohol use. This notion is supported by Fig. 2a and b, showing less school and neighborhood variations in heavy alcohol use compared to frequency of alcohol use. When neighborhood and school levels were included simultaneously, the ICC for neighborhood level was reduced to 2.5%, whereas the ICC for school level declined to 4.7% (see Table 3, Model 1). The ICC for neighborhood level was substantially reduced when controlling for family characteristics as well, while the ICC for the school level was halved. Peers' use of alcohol and individual scores on

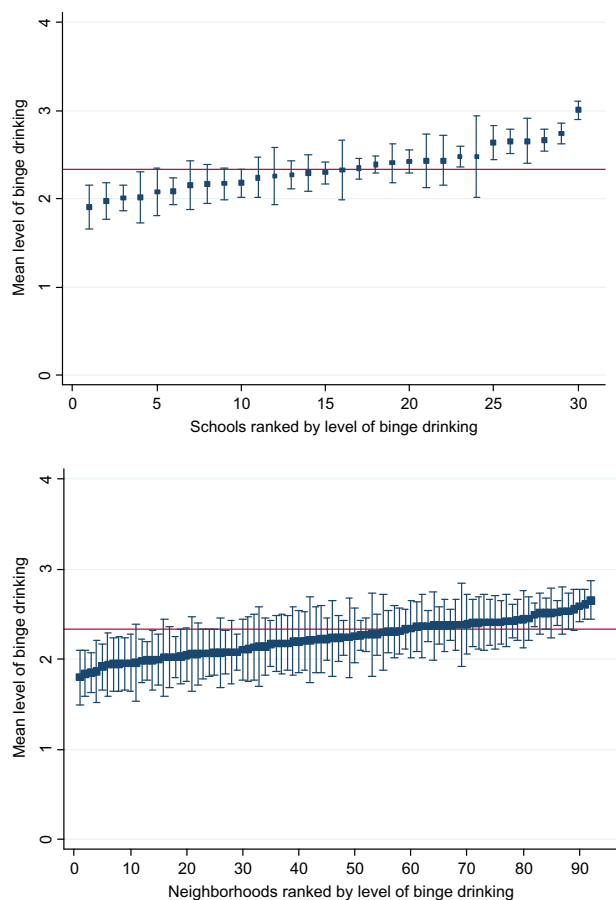
**Table 2** Between-school and between-neighborhood variations

	Model 1			Model 2			Model 3			Model 4			Model 5		
	<i>B</i>	$\beta$	<i>p</i>	<i>B</i>	$\beta$	<i>p</i>	<i>B</i>	$\beta$	<i>p</i>	<i>B</i>	$\beta$	<i>p</i>	<i>B</i>	$\beta$	<i>p</i>
Fixed effect estimates															
Intercept	-3.405		<.001	-3.847		<.001	-4.190		<.001	-5.079		<.001	-5.081		<.001
Individual level															
Gender (girl = 1)	0.062	0.022	.015	0.110	0.040	<.001	0.152	0.054	<.001	0.151	0.054	<.001	0.153	0.055	<.001
Age (0–3)	0.299	0.239	<.001	0.310	0.247	<.001	0.284	0.227	<.001	0.284	0.227	<.001	0.284	0.027	<.001
Socioeconomic background (0–3)				0.154	0.071	<.001	0.059	0.028	.003	0.047	0.022	.020	0.047	0.022	.019
Immigrant background (yes = 1)				-0.392	-0.133	<.001	-0.290	-0.098	<.001	-0.273	-0.093	<.001	-0.274	-0.093	<.001
Religious affiliation (Islam = 1)				-0.426	-0.113	<.001	-0.334	-0.088	<.001	-0.329	-0.087	<.001	-0.330	-0.088	<.001
Religious belief in God (0–3)				-0.219	-0.161	<.001	-0.174	-0.128	<.001	-0.174	-0.128	<.001	-0.174	-0.128	<.001
Parental use of alcohol (0–4)				0.249	0.184	<.001	0.121	0.089	<.001	0.119	0.088	<.001	0.119	0.088	<.001
Friends' use of alcohol (0–4)							0.384	0.261	<.001	0.383	0.261	<.001	0.383	0.261	<.001
Celebration commitment (0–4)							0.377	0.309	<.001	0.376	0.309	<.001	0.376	0.308	<.001
Neighborhood level															
Mean socioeconomic background										0.139	0.030	.008	0.208	0.045	.011
Mean celebration commitment													-0.081	-0.019	.255
School level															
Mean socioeconomic background										0.301	0.062	<.001	0.219	0.045	.015
Mean celebration commitment													0.106	0.030	.111
Random effect estimates															
Variance															
Neighborhood level	0.150			0.012			0.008			0.006			0.006		
School level	0.130			0.053			0.018			0.009			0.008		
Individual level	1.252			1.156			0.837			0.837			0.837		
Intraclass correlations															
Neighborhood (% of total variance)	8.5			1.0			0.9			0.7			0.7		
School (% of total variance)	9.8			4.4			2.1			1.1			0.9		

Results from cross-classified multilevel analyses of frequency of alcohol use (scale 0–4) among high school students in Oslo.  $N_{\text{individuals}} = 10,038$ ,  $N_{\text{neighborhoods}} = 92$ ,  $N_{\text{schools}} = 30$

*B* unstandardized regression coefficient,  $\beta$  standardized regression coefficient





**Fig. 2** Mean level of heavy episodic drinking among high school students who use alcohol sometimes, monthly or weekly (confidence interval  $\pm 1.96$  SE) across 30 schools and 92 neighborhoods in Oslo, Norway

celebration commitment were also related to heavy episodic drinking, and these variables explained more than half of the remaining between-school variation (Table 3, Model 3). When school-level and neighborhood-level variables are included in the analyses (Models 4 and 5), neither mean socioeconomic background nor general level of celebration commitment were significant predictors of heavy episodic drinking. Similar to the results for frequency of alcohol use, standardized regression coefficients in the final model showed that friends' use of alcohol and celebration commitment were the strongest predictors of heavy episodic drinking.

## Discussion

Both neighborhoods (Karriker-Jaffe et al. 2012) and schools (Salvy et al. 2014) are considered important in the alcohol socialization process. The new contribution of this study is that the potential impacts of both these contexts were

assessed simultaneously. When each context in the models was included separately and with alcohol frequency as dependent variable, both stood out as equally important. In cross-classified models where both contexts were included, their effects were reduced but both continued to have considerable impact. However, when family characteristics (parental SES, parental alcohol use, and immigrant background) and religious affiliation were added, the association with neighborhoods almost completely disappeared. School effects—in the broader meaning of the term—were not explained to the same degree by characteristics such as family and religion. However, more detailed analyses revealed that commitment to the high school celebration tradition and friends' use of alcohol accounted for much of the remaining school effect. Characteristics at the school level, such as a large proportion of the student body being drawn from high socioeconomic backgrounds and the general level of commitment to celebration traditions at the school were also associated with increased alcohol consumption. Thus, neighborhood and school environments seem to influence alcohol socialization through different processes. Whereas school seems to affect alcohol consumption to a larger degree through aspects of peer-based youth culture, neighborhood effects were more closely related to family characteristics.

The important role of youth cultural aspects in the school context may be because adolescents in Oslo after their mid-teens often orient themselves towards new trans-local social networks with roots in their high schools. Parties are often organized through Facebook groups based on school classes or the high school graduation celebration (Fjaer et al. 2016). These processes are shaped in a complex interplay with students' socioeconomic backgrounds and religious affiliations, which are also important in the alcohol socialization process. However, because there are overlaps between schools attended and place of residence, such school-based youth cultures may also be understood as mechanisms that mediate the relationship between neighborhood characteristics and alcohol use.

The importance of neighborhoods and schools for the development of heavy episodic drinking among those who used alcohol was also investigated. In these analyses, neighborhood and school influences were less important than for normative alcohol consumption. The results suggest that neighborhood and school contexts may be of particular importance in shaping alcohol consumption patterns that are deemed acceptable by most adolescents, whereas heavy and high-risk drinking among those who drink may be influenced to a larger degree by individual factors unrelated to school and neighborhood environments.

By using cross-classified multilevel models, the respective influences of neighborhood and school could be

**Table 3** Between-school and between-neighborhood variations

	Model 1			Model 2			Model 3			Model 4			Model 5		
	<i>B</i>	$\beta$	<i>p</i>	<i>B</i>	$\beta$	<i>p</i>	<i>B</i>	$\beta$	<i>p</i>	<i>B</i>	$\beta$	<i>p</i>	<i>B</i>	$\beta$	<i>p</i>
Fixed effect estimates															
Intercept	-0.777		.016	-1.580		<.001	-3.119		<.001	-3.573		<.001	-3.618		<.001
Individual level															
Gender (girl = 1)	0.008	0.003	.809	-0.018	-0.006	.585	0.039	0.013	.199	0.039	0.013	.195	0.040	0.013	.188
Age (16–22)	0.167	0.127	<.001	0.187	0.143	<.001	0.223	0.169	<.001	0.223	0.169	<.001	0.223	0.169	<.001
Socioeconomic background (0–3)				0.203	0.089	<.001	0.098	0.043	.004	0.085	0.0369	.015	0.084	0.037	.016
Immigrant background (yes = 1)				-0.466	-0.150	<.001	-0.363	-0.117	<.001	-0.348	-0.112	<.001	-0.349	-0.113	<.001
Religious affiliation (Islam = 1)				0.203	0.049	.030	0.123	0.027	.152	0.131	0.029	.128	0.130	0.029	.131
Religious belief in God (0–3)				-0.137	-0.089	<.001	-0.132	-0.088	<.001	-0.132	-0.088	<.001	-0.132	-0.088	<.001
Parental use of alcohol (0–4)				0.156	0.109	<.001	0.072	0.050	<.001	0.070	0.048	<.001	0.070	0.048	<.001
Friends' use of alcohol (0–4)							0.369	0.239	<.001	0.369	0.239	<.001	0.369	0.239	<.001
Celebration commitment (0–4)							0.364	0.280	<.001	0.363	0.280	<.001	0.363	0.280	<.001
Neighborhood level															
Mean socioeconomic background										0.053	0.011	.443	0.132	0.026	.322
Mean celebration commitment													-0.088	-0.019	.203
School level															
Mean socioeconomic background										0.178	0.036	.063	0.147	0.028	.613
Mean celebration commitment													0.042	0.013	.307
Random effect estimates															
Variance															
Neighborhood level	0.038			0.005			0.002			0.002			0.002		
School level	0.073			0.036			0.013			0.010			0.009		
Individual level	1.440			1.440			1.182			1.182			1.182		
Intraclass correlations															
Neighborhood (% of total variance)	2.5			0.3			0.2			0.2			0.2		
School (% of total variance)	4.7			2.4			1.1			0.8			0.8		

Results from cross-classified multilevel analyses of frequency of heavy episodic drinking (0–4) among high school students in Oslo who use alcohol sometimes, monthly, or weekly.  $N_{\text{individuals}} = 6242$ ,  $N_{\text{neighborhoods}} = 92$ ,  $N_{\text{schools}} = 30$

*B* unstandardized regression coefficient,  $\beta$  standardized regression coefficient

disentangled. Investigating only one of these contexts would lead to erroneous conclusions about which context is most important. Although some studies have already utilized this approach to investigating alcohol socialization, it is still underutilized (see: Dunn et al. 2015). This study also highlights the necessity of distinguishing between different types of outcomes in studies of alcohol socialization, as ordinary or normative alcohol use may be predicted by different variables than more deviant patterns of use. One may hypothesize that mixed findings in previous research on the relationship of various influences to alcohol use patterns may be attributable to variations in the type of alcohol outcomes used.

### Neighborhoods and Schools

Previous studies have reported that neighborhoods and schools play different roles in adolescent socialization in different domains. For example, neighborhood influences seem to be of particular importance for the development of delinquency and criminal involvement (Kim 2016). It has been proposed that the influences of neighborhoods are a result of weaker social networks and lack of social control by adults in disadvantaged neighborhoods, in turn leading to a higher risk of delinquency among adolescents in such areas (Sampson 2005; Sampson et al. 2005; Zimmerman 2010). Likewise, “collective efficacy,” defined as the ability of members in a community to control the behavior of individuals, has been suggested as a neighborhood characteristic that may prevent delinquency (Sampson et al. 1997; Fagan and Wright 2012).

A number of studies suggest that neighborhoods may also play a role with regard to both the development of cigarette smoking (Mathur et al. 2013; Kravitz-Wirtz 2016) and the alcohol socialization process (Karriker-Jaffe 2011). However, smoking and alcohol use stand out as disparate phenomena; for daily smoking, neighborhoods with low socioeconomic profiles constitute a high-risk factor (Kravitz-Wirtz 2016). For alcohol socialization, a more complex picture has been revealed; residence in affluent neighborhoods may be associated with higher and more “healthy” alcohol use (e.g., drinking within recommended guidelines) (Karriker-Jaffe 2013). At the same time, research often finds positive associations between neighborhood disadvantage and heavy drinking, adverse alcohol-related consequences, and alcohol dependence (Karriker-Jaffe et al. 2012). Hence, only for the latter outcomes could one hypothesize that findings would echo those of neighborhood studies regarding delinquency, crime, and smoking, where low-SES neighborhoods pose higher risks.

Some studies have suggested that high-SES neighborhoods may be positively associated with “ordinary” or normative alcohol use. However, no studies documenting

this “affluence effect” have utilized methodologies that enabled researchers to compare the relative influences of neighborhood and school. The initial findings in the present study showed neighborhood and school contexts to be equally important for alcohol use. However, after controlling for individual and family characteristics, neighborhood effects almost disappeared, whereas school effects did not. Thus, neighborhood influences on alcohol use seem to be embedded in family, and in individual factors such as religion and parental alcohol use, whereas the broader school context seems to be important for ordinary alcohol socialization, even when accounting for individual and family factors. A new finding from this study is that this to some degree seems to reflect sociocultural traditions anchored in school peer groups.

Study findings also extend previous studies suggesting a positive association between SES and the use of alcohol by adults (Nordfjaern and Brunborg 2015) as well as by their offspring (Pedersen et al. 2015). One of the most striking findings was the positive association—at the individual level and after immigrant background and religiousness were controlled for—between having parents from high-SES backgrounds and alcohol consumption. In addition, the results showed an effect from the general SES levels at the schools; the highest frequency of alcohol use was observed at schools where many students came from high-SES families. In part, this seems to reflect the greater importance of alcohol in the daily lives of high-SES families, and adolescents in such families may gradually be socialized into their parents’ alcohol consumption patterns. Thus, the present study supports previous research suggesting that alcohol may be an anomaly compared with other types of potentially health-damaging behaviors such as smoking, poor diet, and lack of exercise, where low SES is related to increased prevalence (Viner et al. 2012, Quon and McGrath 2014).

In the USA, Suniya Luthar and coworkers (Luthar et al. 2013, Lyman and Luthar 2014) have done valuable research in identifying vulnerability factors in affluent parts of the population. They suggest that parents in such milieus may be “lulled into a sense of security given the physical safety of their neighborhoods.” Furthermore, they may have a tendency to “inappropriately bail their children out of all offenses, minor and major” (Luthar and Barkin 2012: 444–445). One may hypothesize that such a parenting ideology may play a role in the Nordic welfare state context as well, and that parents in such areas as well as their offspring should be targeted in prevention programs.

### School-Based Sociocultural Factors

All schools are different, and in an early study, Welsh et al. (1999) argued that schools have their own “personalities,” in

much the same manner as individuals. Psychosocial problems among the students may partly be the result of such a “school personality” or “school climate.” Empirical studies using such a framework with regard to alcohol socialization have pointed to the general adjustment of the student body at a school (Henry et al. 2009). Hence, sociocultural processes with roots in the peer groups are hypothesized to have impacts on behavioral problems more generally as well as on the alcohol socialization process.

Other studies suggest that the peer-based traditions and rituals that facilitate alcohol socialization may be particularly important. Adolescents are usually under social control in their parental homes, and they are typically not allowed to visit bars and pubs where alcohol is served because of age restrictions. Sometimes, unsupervised and alternative party places are developed, such as in parks, beaches, or in squats and raves in the UK (Chatterton and Hollands 2003), or in the *booze barracks* in the Netherlands (Hoof et al. 2012). However, studies suggest that peer-based arenas with reduced social control may also develop at the borders of the high school or university systems. In the USA, Greek involvement is important (Borsari et al. 2007). Leaders in the Greek system are often heavy drinkers and more likely than others see alcohol as a vehicle for friendship and social activity (Cashin et al. 1998). In the Norwegian context, preparations for the high school graduation celebration add structure to much of the social life at some schools (Fjaer et al. 2016). The present study provided new evidence with regard to the importance of such influences. After control for other variables, a significant relationship remained between the individual degree of commitment to this tradition and level of alcohol use. Moreover, the level of alcohol consumption was higher in schools where commitment to the tradition was high. These patterns were intertwined with the SES-based student composition of the school, as the statistical effect of SES at the school was reduced after controlling for the school level of commitment to the tradition. Thus, the tradition may function as a mechanism to increase class-based differences in alcohol socialization.

Hence, both individual and context-based engagement in this tradition are key elements in alcohol socialization in the Norwegian high school system. In other countries, other peer-based sociocultural traditions and rituals may play a similar role.

### Strengths and Limitations

This study has several strengths, such as utilizing a population-based sample with a large sample size, and a rather high response rate. The use of advanced statistical analyses to disentangle influences at school and neighborhood levels is an additional strength. However, there are

limitations. First, the cross-sectional nature of the data does not provide information about the temporal order or long-term trajectories of predictors and outcomes in this study. Longitudinal data, where individuals are followed from lower secondary schools into the high school system would have enabled us to come closer to the causal processes involved. Second, peers seem to be important in the alcohol socialization process. However, it was not possible to identify whether the friends of participants were anchored in neighborhood networks, in school contexts, or in other arenas (e.g., leisure, sport, or religious organizations). Third, the study was conducted in a medium-sized city in a Nordic welfare state. It remains to be seen whether the results can be generalized across geographical areas and to other cities and countries. Previous studies also suggest that different parts of cities may have different risk profiles in relation to the relative importance of legal (alcohol, cigarettes) and illegal substances (cannabis, amphetamines) and of possible patterns of poly-drug use (Pedersen and Bakken 2016). The sole focus on alcohol use in this study provides limited information about more complex patterns of use in school and neighborhood contexts. Thus, replications in other social and cultural contexts are needed. If possible, future research should combine an emphasis on school and neighborhood effects with a longitudinal design.

### Conclusion

School influences are important in the alcohol socialization process. A combination of a high-SES student body and peer-based sociocultural traditions and rituals explain many of these school-level influences. In contrast, family influences—including immigrant background, religion, and parental alcohol use—seemed to be the major source of neighborhood effects on alcohol use. Methodologically, this study demonstrates how cross-classified multilevel models enable us to obtain estimates of the relative importance of the neighborhood and the school context.

So far, school-based alcohol interventions have yielded mixed results (Martineau et al. 2013). However, interventions relying on measures such as personalized feedback, moderation strategies, expectancy challenges, and identification of risky situations may be promising (Scott-Sheldon et al. 2016). Based on the present study, one should hypothesize that interventions aiming at peer-based processes in schools may prove successful, even if they are obviously complex to target. The study provides additional evidence for the previously suggested link between affluence and alcohol use, not found for other potentially health-damaging factors such as smoking, unhealthy nutrition, and lack of exercise. As suggested by Luthar and Barkin, among privileged youth, it is also important to identify factors that are

linked to maladjustment, and prominent among these risk factors are parents' false feelings of security and ambivalent attitudes toward alcohol use (Luthar and Barkin 2012). Thus, the possible adverse short- and long-term consequences of alcohol use by high-SES adolescents should be carefully monitored, and targeted in prevention programs.

**Authors' Contributions** W.P. conceived the study, participated in its design and coordination and led the drafting of the manuscript. A.B. led the data collection, participated in the design, performed the statistical analysis, participated in the interpretation of the results and helped to draft the manuscript. T.v.S. participated in the design, suggested appropriate statistical techniques, participated in the interpretation of the results and helped to draft the manuscript. All authors read and approved the final manuscript.

**Data Sharing Declaration** The data that support the findings of this study are available from Norwegian Social Research, Oslo and Akershus University College of Applied Sciences, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available.

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### Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no competing interests.

**Ethical Approval** All ethical aspects of the study were approved by the Norwegian Centre for Research Data.

**Informed Consent** All parents and students were informed about the purpose of the study in advance and told that participation was voluntary. Informed consent was obtained from all individual participants included in the study.

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