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Article

Does Class Proportion of Students with Non-Western Origin in High Schools Affect Drinking Habits Among Ethnic Danish Students?

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Abstract

Aim: the objective was to test the hypothesis that a higher proportion of students with non-Western origin in high school classes is associated with lower and less frequent alcohol consumption among ethnic Danish students.
Method: data on country of origin was obtained from the Danish Civil Registration System, while information on drinking habits were derived from the Danish National Youth Study 2014. Multilevel zero-inflated binominal regression was used to assess the association between class proportion of students with non-Western origin and odds of non-drinking and mean weekly alcohol consumption, while multilevel logistic regression was used to assess the association with frequent binge drinking.
Results: a higher proportion of students with non-Western origin in class was associated with higher odds of non-drinking among ethnic Danish student in the same class. For example, ethnic Danish boys in classes with more than 15% of the students of non-Western origin had 77% higher odds of being non-drinkers, compared to ethnic Danish boys in classes where 0–5% had non-Western origin (OR: 1.77, 95% CI; 1.42–2.20). Among ethnic Danish students that did consume alcohol, class proportion of students with non-Western origin was not associated with weekly alcohol consumption, while a higher proportion of students with non-Western origin in class was associated with lower odds of frequent binge drinking.
Conclusion: the downward drinking trend among adolescents in Western countries may be partly explained by the higher proportion of youth with non-Western origin, influencing the prevalence of drinking and frequency of binge drinking among adolescents in the ethnic majority population.

INTRODUCTION

Alcohol use is estimated to be the leading risk factor for death among 15- to 24-year-olds worldwide (Mokdad *et al*., 2016) and is associated with an increased risk of more than 60 alcohol-related diseases (Rehm *et al*., 2010). Since 2000 there has been a marked reduction in the amount and frequency of alcohol consumption among adolescents in most Western countries (Looze *et al*., 2015; Pape *et al*., 2018). Adolescents in Denmark binge drink more frequently than adolescents in any other country (Kraus *et al*., 2016); however a small reduction in adolescence consumption has taken place. The

percentage of 16- to 24-year-olds that every month drank more than five alcoholic drinks at the same occasion (binge drinking) was 54% among girls and 64% among boys in 2010, which decreased to 47% among girls and 54% among boys in 2017 (Christensen *et al*., 2011; Jensen *et al*., 2018). The cross-national downward drinking trend indicates that some of the causal mechanisms have been operating across borders and thus go beyond changes in national alcohol policies and preventive initiatives (Pape *et al*., 2018). One suggested explanation is that the higher proportion of youth from non-drinking or less drinking ethnic minorities (hereafter referred to as 'drier' alcohol cultures) in Western countries may have influenced alcohol consumption among adolescents in the ethnic majority population (Pape *et al*., 2018).

In the past decade, immigration from non-Western countries to Western countries, including Denmark, has increased resulting in a higher proportion of immigrants and descendants from 'drier' alcohol cultures in the population. In Denmark, the proportion of immigrants and descendants has gradually increased the past 40 years, and in 2000 7% of the 15- to 25-year-olds in Denmark had a non-Western origin, while this number was 11% in 2019 (Statistics Denmark, 2020). Immigrants and descendants in Denmark are mainly from non-Western countries, including Turkey (13%), Syria (8%) and Iraq (7%) (Statistics Denmark, 2018). Immigrants and descendants from non-Western countries tend to have a lower alcohol consumption and drink less frequently than the majority population in the receiving countries (Denscombe, 1995; van Tubergen and Poortman, 2010). The difference varies depending on immigration generation and alcohol consumption levels in country of origin and in the receiving country; however, alcohol use has been found to be more influenced by alcohol prevalence in country of origin than in the receiving country (Barsties *et al*., 2017). Assuming an extent of social interaction between youth in receiving countries and immigrants and descendants, drinking norms and behaviors may be subjected to an acculturation process (Berry, 2001). Acculturation refers to the process of culture change and adaption that occurs when individuals with different cultures come into contact, which changes the original cultural patterns of either or both groups (Gibson, 2001; Rothe *et al*., 2010). Thus, youth in the receiving countries may, to some extent, adapt to the 'drier' alcohol culture introduced by non-Western immigrants and descendants, while non-Western immigrants and descendants likewise may adapt to the 'wetter' alcohol culture in the receiving countries. This may be due to a change in the number of social activities involving alcohol and the social acceptance of drinking. Existing literature on immigrants' and descendants' influence on ethnic majority youths' drinking habits is scarce and inconclusive. A Swedish time series analysis found no association between changes in demographic composition of Swedish youth and aggregated changes in non-drinking (Svensson and Andersson, 2016). However, existing studies generally suggest that a high proportion of ethnic minorities and/or Muslim students in school is associated with a low probability to drink, to drink heavily and to frequently consume alcohol, among students from the ethnic majority and minorities (Wechsler and Kuo, 2003; Amundsen *et al*., 2005; van Tubergen and Poortman, 2010; Svensson, 2010) or exclusively among ethnic minority students (Monshouwer *et al*., 2007). Most of the existing literature is based on study populations below or at 16 years of age (Amundsen *et al*., 2005; Svensson, 2010; Svensson and Andersson, 2016) where at least 17% of the students are characterized as ethnic minorities (Amundsen *et al*., 2005; Monshouwer *et al*., 2007; Svensson, 2010; van Tubergen and Poortman, 2010). However peers' influence on adolescents behavior changes over the course of adolescence (Steinberg and Monahan, 2007), as does the importance of alcohol in socialization, e.g. a dramatic change in consumption is observed in Denmark around age 16 years, in the transition from primary school to high school (Brink, 2008; Nielsen *et al*., 2010; Frederiksen *et al*., 2012); thus age may impact the degree of alcohol-related acculturation between peers. Further, it is likely that the ethnic composition in a society impacts the likelihood and degree of interaction between individuals with different cultures and thus the acculturation process. Therefore further research among older adolescents are needed to address whether the higher proportion of youth from non-drinking or less drinking ethnic minorities may have influenced alcohol consumption among adolescents in the ethnic majority population.

Danish adolescents finish their basic schooling at the age of 15 or 16 years, and ~89% of the graduates will later complete an upper secondary education, of whom the majority (about 70%) completes high school (Ministry of Education, 2018). Danish high school is a fulltime 3- or 2-year general upper secondary education program that prepares young people for higher education (Ministry of Children and Education, 2020). Students are placed in a class, based on their choice of subjects, and receive most of their teaching within this class, and students are therefore assumed to primary interact with classmates. To the best of our knowledge, no studies have previously addressed the effect of class composition of students with non-Western origin, within high schools nor in a large representative sample.

The objective of this study was to test the hypothesis that a higher proportion of students with non-Western origin in high school classes is associated with lower alcohol consumption among ethnic Danish students, compared to ethnic Danish students in classes with fewer students with non-Western origin.

METHODS

Study population

The study population is derived from the Danish National Youth Study 2014, a national survey focusing on health, health behavior and wellbeing among students in secondary education. The Danish National Youth Study 2014 includes students from high schools ($n = 119$) and vocational schools ($n = 10$). For the present study, we solely included high school students. The students completed self-administrated electronic questionnaires in their class, during a lesson of 45 min. Data were collected from September 2014 to December 2014 at high schools. It was clearly stated that participation in the study was voluntary and that responses would be treated confidentially. Participating students gave consent that their data could be used for research. The study was approved by the Danish Data Protection Agency in 2014 (J. No. 2013–54-0526). In total, 119 of the 137 general high schools in Denmark participated (response proportion 87%), 3214 classes (response proportion 96%) and 70,674 students (response proportion 85%). Participants were slightly more likely than nonparticipants to be of Danish origin, to be girls and to have parents with higher educational levels and higher income. The participation rates were high at all levels (school, class, student), and the study population is assumed to be representative of students in Danish high schools.

Further information about the Danish National Youth Study can be found elsewhere (Pisinger *et al*., 2020).

Class proportion of students with non-Western origin

Country of origin was retrieved through the Danish Civil Registration System and defined in accordance with Statistics Denmark's definition: when both parents were known, the country of origin was

defined as the country of birth of the mother. When only one parent was known, the country of origin was defined as the country of birth of that parent, and if this was Denmark, the country of citizenship was used. When no parents were known, the country of origin was defined from the student's own information: country of origin was in these cases assumed equal to country of birth if the student was an immigrant, while country of origin was assumed equal to country of citizenship for descendants (Statistics Denmark, 2019). In accordance with Statistics Denmark's classification, Western countries were classified as all 28 EU countries, Andorra, Australia, Canada, Iceland, Liechtenstein, Monaco, New Zealand, Norway, San Marino, Switzerland, the United States and the Vatican State, while all other countries were classified as non-Western (Statistics Denmark, 2019). The percentage of students within each class with non-Western origin was calculated. Hereafter each student was assigned a variable with one of four categories (0–5%, >5–10%, >10–15% or >15%) indicating the percentage of students with non-Western origin in the class.

Ethnic Danish students

Students were defined as ethnic Danish if at least one of their parents were a Danish citizen and born in Denmark.

Drinking habits

Drinking habits were described in three dimensions: (1) non-drinking, (2) weekly alcohol consumption and (3) frequent binge drinking. *Non-drinkers* were defined as those who answered that they never drank alcohol on weekdays nor at weekends. Participants that did drink were asked how many alcoholic drinks (12 g of pure alcohol) they normally drank each day in a typical week. A *weekly alcohol consumption* score was calculated for students that did drink, using the sum of alcoholic drinks consumed on each of the weekdays. Further, participants that did drink were asked how many times within the past 30 days they had consumed at least five alcoholic drinks on one occasion (binge drinking). *Frequent binge drinking* was defined (among drinkers) as binge drinking four or more times within the last 30 days. This cutoff point was chosen to distinguish students with a more extreme binge drinking patterns from the average drinking culture among Danish adolescents and is in accordance with previous Danish studies of alcohol habits among adolescents (Kuntsche *et al*., 2004; Bendtsen *et al*., 2015; Pisinger *et al*., 2017).

Covariates

Potential confounders were identified according to existing literature and the directed acyclic graph methodology (Greenland *et al*., 1999) and included sex, age, parental education, parental income, degree of urbanization and type of school (Appendix 1). Information on sex, age and type of school (2-year or 3-year high school) was self-reported, while information on parental education (defined by the parents' highest achieved educational level) was derived through the Danish Population Education Register (Jensen and Rasmussen, 2011). Parental educational level was categorized into three groups: basic schooling (elementary school), short education (high school or vocational training) and tertiary education (short, medium and long tertiary education). Data on parental income was assessed through the Income Statistics Register, which contains information on the income of everyone residing in Denmark who are liable to pay Danish taxes (Baadsgaard and Quitzau, 2011). Parental income was categorized into three groups (25% highest income, 50% middle income and 25% lowest income). Degree of urbanization, in the municipality of the school, was assessed in accordance with European statistics definition: densely populated areas (at least 50% of the population lived in urban centers), intermediate density areas (at least 50% of the population lived in urban clusters and less than 50% of the population lived in urban centers) and thinly populated areas (at least 50% of the population lived in rural centers) (European Commission, 2019). Information on students' religious affiliation and practice was obtained through the survey.

Exclusions

Observations with missing personal identifications number were excluded, as these observations could not be linked to national registers ($n = 3621$). Participants with missing information on weekly alcohol consumption were excluded ($n = 732$). Participants in high school classes with less than five respondents ($n = 17$), with missing information on parental income or parental educational level ($n = 313$), and participants younger than 15 years or older than 25 years were excluded ($n = 61$). Further, students with unknown country of origin ($n = 9$), non-Western origin ($n = 4968$) and Western non-Danish origin ($n = 650$) were excluded. This left 60,303 students in analyses of non-drinkers and weekly alcohol consumption and 56,406 in analyses of frequent binge drinking among drinkers.

Statistical methods

Statistical analyses and data processing were performed using STATA 15. To account for correlation between students nested within schools, multilevel analyses were applied. Multilevel zero-inflated negative binominal regression was used to assess the association between class proportion of students with non-Western origin and odds ratio of non-drinking and relative difference in mean weekly alcohol consumption. Weekly alcohol consumption was non-normally distributed with excessive zeros, and thus the Vuong test showed that a zero-inflated negative binominal model was preferable to a standard negative binominal regression model (Moghimbeigi *et al*., 2008). Multilevel logistic regression modelling was used to assess the association between class proportion of students with non-Western origin and frequent binge drinking among drinkers. Analyses were stratified by sex, as boys have been found to have a higher alcohol consumption than girls (Kuntsche *et al*., 2004; Bendtsen *et al*., 2015), and social factors may affect boys' and girls' drinking habits differently (Schulte *et al*., 2009). All analyses were adjusted for age, parental education, parental income, degree of urbanization and type of school. Further, a sensitivity analysis was performed to test the robustness of findings. In densely populated areas, there will usually be more high schools to choose from, and thus selection mechanisms may be stronger than in less populated areas. To assess if the association between class proportion of students with non-Western origin and ethnic Danish students' alcohol habits differs depending on degree of urbanization, we stratified analyses based on population density.

RESULTS

Study population characteristics

The study population consisted of 23,416 boys and 36,887 girls, with an average age of 18 years (Table 1). The majority of the study population had at least one parent with tertiary education (boys, 68%; girls, 60%), lived in an intermediate density area (boys, 42%; girls, 41%) and attended a 3-year high school (boys, 93%; girls, 93%). There were 7% of the boys and 6% of the girls that did

Table 1. Baseline characteristics of ethnic Danish high school students in the Danish National Youth Study 2014 according to drinking habits and sex. Values are frequency (%) unless otherwise specified

	Total		Non-drinkers		Mean weekly alcohol consumption (drinks per week) among drinkers		Frequent binge drinkers among drinkers	
	Boys 23,416	Girls 36,887	Boys 1561	Girls 2118	Boys 14.6	Girls 10.3	Boys 8623	Girls 9441
Age, mean (interquartile range)	18 (17–19)	18 (17–19)	18 (17–19)	18 (17–19)	-	-	18 (17–19)	18 (17–19)
Parents highest education completed								
Basic schooling	543 (2)	1229 (3)	65 (4)	97 (5)	15.7	12.0	152 (2)	289 (3)
Short education	6899 (29)	13,355 (36)	520 (33)	757 (36)	15.5	10.8	2404 (28)	3247 (34)
Tertiary education	15,974 (68)	22,303 (60)	976 (63)	1265 (60)	14.2	9.9	6067 (70)	5905 (63)
Family income								
Low	4784 (20)	8254 (22)	407 (26)	571 (27)	14.9	10.9	1647 (19)	2136 (23)
Medium	11,623 (50)	19,358 (52)	773 (50)	1138 (54)	14.6	10.3	4152 (48)	4667 (49)
High	7009 (30)	9275 (25)	381 (24)	410 (19)	14.4	10.0	2824 (33)	2638 (28)
Degree of urbanization								
Densely populated area	6525 (28)	9476 (26)	409 (26)	549 (26)	14.9	10.5	2754 (32)	2944 (31)
Intermediate density area	9855 (42)	15,206 (41)	647 (41)	832 (39)	15.0	10.3	3716 (43)	3885 (41)
Thinly populated area	7036 (30)	12,205 (33)	505 (32)	738 (35)	13.8	10.2	2153 (25)	2612 (28)
Type of school								
3-year high school	21,682 (93)	34,199 (93)	1383 (89)	1889 (89)	14.4	10.1	8052 (93)	8752 (93)
2-year high school	1734 (7)	2688 (7)	178 (11)	230 (11)	17.7	12.7	571 (7)	689 (7)
Year								
First year of high school	8541 (36)	13,532 (37)	675 (43)	953 (45)	14.5	10.5	3051 (35)	3488 (37)
Second year of high school	8199 (35)	12,827 (35)	537 (34)	677 (32)	14.9	10.6	2994 (35)	3369 (36)
Third year of high school	6676 (29)	10,528 (29)	349 (22)	489 (23)	14.4	9.8	2578 (30)	2584 (27)
Religion								
Muslim	128 (1)	143 (<1)	63 (4)	104 (5)	25.7	8.4	24 (<1)	6 (<1)
Practicing Muslim	67 (<1)	82 (<1)	47 (3)	73 (3)	44.0	5.7	10 (<1)	<5 (<1)
Christian	9,092 (39)	21,282 (58)	594 (38)	1131 (53)	13.8	10.1	3132 (36)	5044 (53)
Practicing Christian	1192 (5)	2521 (7)	174 (11)	344 (16)	11.9	8.5	286 (3)	396 (4)
Buddhist, Jews and other	143 (1)	262 (1)	9 (1)	23 (1)	13.8	10.1	64 (1)	83 (1)
Practicing Buddhist, Jews and others	29 (<1)	41 (<1)	<5 (<1)	6 (<1)	11.9	8.5	18 (<1)	10 (<1)

not drink. Non-drinkers were more likely to attend a 2-year high school, be first year students and be practicing Muslims or practicing Christians as compared to the total of the study population.

Among students who consumed alcohol, the mean weekly alcohol consumption was 14.6 drinks among boys and 10.3 drinks among girls. The mean weekly alcohol consumption was marginal higher among boys and girls with lower family income and among 2-year high school students, as compared to the average of boys in the study population. Muslim boys, especially those who were practicing Muslims, had a relatively high mean weekly alcohol consumption—however these groups count very few individuals, as the majority were non-drinkers, and results should be interpreted with caution. Among students who consumed alcohol, there were 40% of the boys and 27% of the girls who binge drank frequently. Frequent binge drinkers were more likely to have a high family income and live in a densely populated area, compared to the total of the study population. Boys who binge drank frequently consumed an average of 22.6 drinks per week and the girls an average of 17.1 drinks per week, while the weekly alcohol consumption was 9.3 drinks among boys and 7.8 drinks among girls who consumed alcohol, but did not binge drink frequently (data not shown). Eight percent ($n = 4968$) of the respondents were of non-Western origin, of these 26% were immigrants and the rest were descendants. They predominantly came from Turkey ($n = 725$), Iraq ($n = 541$) and Lebanon ($n = 423$), 61% characterized themselves as Muslims and 33% as practicing Muslims. The gender distribution was equal to the one among ethnic Danish students in the study population. Among non-Western students, 48% of the boys and 66% of the girls were non-drinkers. Among students that consumed alcohol, the average weekly consumption was 13.1 drinks among boys and 7.6 drinks among girls, and 24% of these boys and 17% of these girls binge drank frequently (data not shown).

Odds ratio of being a non-drinker, relative difference in mean weekly alcohol consumption among drinkers and odds ratio of frequent binge drinking among drinkers, associated with class proportion of students with non-Western origin, among ethnic Danish boys and girls

Odds for ethnic Danish students being non-drinkers were increased with higher class level of students with non-Western origin (Table 2). For example, ethnic Danish boys in classes where more than 15%

Table 2. Multilevel analysis of class composition of students with non-Western origin, non-drinking, weekly alcohol consumption and frequent binge drinking, among ethnic Danish boys and girls in the Danish National Youth Study 2014

	Total of ethnic Danes *n* (%)	Non-drinkers OR (95% CI)		Relative difference in mean weekly alcohol consumption among drinkers (95% CI)		Frequent binge drinking among drinkers OR (95% CI)	
		Boys	Girls	Boys	Girls	Boys	Girls
Class proportion with non-Western origin							
0–5%	33,987 (56)	ref.	ref.	ref.	ref.	ref.	ref.
>5–10%	11,826 (20)	1.12 (0.94–1.33)	1.15 (1.00–1.32)	0.98 (0.95–1.02)	1.04 (1.00–1.07)	0.88 (0.82–0.95)	1.04 (0.97–1.11)
>10–15%	7581 (13)	1.36 (1.13–1.63)	1.24 (1.08–1.41)	0.99 (0.93–1.05)	1.02 (0.98–1.06)	0.82 (0.75–0.90)	0.87 (0.81–0.95)
>15%	6909 (12)	1.77 (1.42–2.20)	1.69 (1.40–2.04)	0.96 (0.90–1.01)	1.03 (0.98–1.07)	0.75 (0.68–0.83)	0.89 (0.81–0.97)

Adjusted for age, parental education, parental income, degree of urbanization and type of school.

of the students were of non-Western origin had 77% higher odds of being non-drinkers, compared to ethnic Danish boys in classes where 0–5% had non-Western origin (OR: 1.77, 95% CI; 1.42–2.20). Results were similar for ethnic Danish girls; in classes were more than 15% of the students were of non-Western origin, ethnic Danish girls had 69% higher odds of being non-drinkers, compared to ethnic Danish girls in classes where 0–5% of the students were of non-Western origin (OR: 1.69, 95% CI; 1.40–2.04). Mean weekly alcohol consumption among ethnic Danes that did consume alcohol was not associated with class proportion of students with non-Western origin. Conversely, odds for binge drinking frequently, among ethnic Danes that did consume alcohol, was lower with higher levels of students with non-Western origin in class. For example, in classes where more than 15% were of non-Western origin, ethnic Danish boys had 25% lower odds to binge drink frequently, compared to ethnic Danish boys where 0–5% of the students had non-Western origin (OR: 0.75, 95% CI; 0.68–0.83). This association was similar, although weaker, among ethnic Danish girls; Ethnic Danish girls in classes where more than 15% of the students were of non-Western origin had 11% lower odds of being non-drinkers, as compared to ethnic Danish girls in classes where 0–5% of the students had a non-Western origin (OR: 0.89, 95% CI; 0.81–0.97).

Sensitivity analyses

Sensitivity analyses showed that the association between class proportion of students with non-Western origin and drinking habits, among ethnic Danish students, only varied slightly across differently populated areas (Appendix 2).

DISCUSSION

We found that among ethnic Danish students, a higher proportion of students with non-Western origin in class was associated with higher odds of non-drinking. Among ethnic Danish students that did consume alcohol, class proportion of students with non-Western origin was not associated with weekly alcohol consumption, while a higher proportion of students with non-Western origin in class was associated with lower odds of frequent binge drinking. Previous studies generally suggest that a high proportion of ethnic minorities and/or Muslim students in school is associated with lower probability to drink, to drink heavily and frequently consume alcohol, among students from the ethnic majority and minorities (Wechsler and Kuo, 2003; Amundsen *et al*., 2005; van Tubergen and Poortman, 2010; Svensson, 2010). However, this is the first study conducted within a Danish context, and there may be several factors that impede generalization of previous findings to Danish high school students. Firstly, adolescents in Denmark binge drink more frequently than adolescents in any other country (Kraus *et al*., 2016), and alcohol constitutes an assimilated element in the many social activities, constituting the core of Danish high school culture (Beck and Reesen, 2004). Alcohol is a focal point, among Danish youth, when connecting with friends, having fun and forming new social relations (Balvig *et al*., 2005; Frederiksen *et al*., 2012), while not drinking may be associated with social exclusion (Frederiksen *et al*., 2012; Burkal *et al*., 2017). Secondly, existing studies are predominantly conducted in populations where 17–22% of the students are characterized as ethnic minorities (Amundsen *et al*., 2005; Monshouwer *et al*., 2007; Svensson, 2010; van Tubergen and Poortman, 2010), which may limit generalizability to the Danish context, where 8% of the students in the present study are of non-Western origin. It is very likely that the ethnic composition in a society impacts the likelihood and degree of interaction between individuals with different cultures and thus the acculturation process. Thirdly, most studies are based on students below or at 16 years of age (Amundsen *et al*., 2005; Svensson, 2010; Svensson and Andersson, 2016); however age may impact the acculturation process as the importance of peers' influence on adolescents behavior changes over time (Steinberg and Monahan, 2007), and a dramatic change in alcohol consumption is observed in Denmark around age 16 years, in the transition from primary school to high school (Brink, 2008; Nielsen *et al*., 2010). Nevertheless, in accordance with previous studies, our results indicate that ethnic Danish students to some extent adapt to the 'drier' alcohol culture introduced by students of non-Western origin, especially when it comes to abstinences from drinking. Students with non-Western origin may represent an alternative possibility to socialize without alcohol. Further, among students that do drink, the proportion of students from 'drier' alcohol cultures may affect social acceptance of drinking less and drinking less frequent; however, it is puzzling that weekly alcohol consumption, among ethnic Danes, is unaffected by the proportion of students with non-Western origin, while an association is observed for frequent binge drinking.

Gender differences among ethnic Danish students were small on all three alcohol outcomes and indicated a tendency for boys' alcohol habits to be stronger associated with class proportion of non-Western students. Prior research indicates that females in general are more resistant to peer influence than males (after as well as during adolescence) (Steinberg and Monahan, 2007), which may be explanatory for the tendency observed.

STRENGTHS AND LIMITATIONS

This is the first study to assess the hypothesis that a higher proportion of immigrant youth from non-drinking, or less drinking cultures, may influence alcohol consumption among adolescents in receiving countries, within a large national sample. The size of our sample, 60,962 students from 3195 classes and 119 high schools across Denmark, increases generalizability of the results and ensures high statistical power. Further the use of register-based information on country of origin reduces misclassification of exposure. Additionally, this is the first study assessing the proportion of students with non-Western origin on class level (instead of school proportion), which we consider more appropriate as students are assumed to have most of their social interaction within the class. Further this is the first study assessing the association among older adolescents.

The study population did not include students attending higher technical examination, higher commercial examination and vocational schools or young people outside the educational system, and the sample may thus not be representative of all Danish adolescents (Pisinger *et al*., 2020). However, the sample is considered representative for students in general high schools (Pisinger *et al*., 2020), which constituted the majority (~70%) of Danish pupils graduating from primary school (Ministry of Education, 2018). Some limitations of our study need to be considered. First, due to the cross-sectional study design, casual inference drawn from results may be limited. Individuals tend to join groups of peers with similar habits, e.g. Muslim students, in a study of adolescents of Norwegian and Muslim immigrant background, stated that they preferred to socialize with students with similar background, to avoid drinking pressure (Schultz, 2007). In densely populated areas, there will usually be several high schools to choose between, and thus students may seek to join highs schools, with a 'student profile' they consider similar to their own beliefs and behaviors. However, the sensitivity analysis showed that the association between class proportion of students with non-Western origin and drinking habits, among ethnic Danes, only varied marginally across differently populated areas (Appendix 2). This may further indicate that personality factors, identified as an unadjusted confounder (Appendix 1), may only marginally affect results.

Even though self-reported data on alcohol consumption have generally demonstrated reasonable levels of reliability and validity (Del Boca and Darkes, 2003; Lintonen *et al*., 2004), it may be affected by recall bias. Self-reported measures of alcohol consumption at nightlife venues reported 1–2 days after being observed by peer-based researchers showed that participants (aged 18–25 years) accurately estimated their own consumption, when consuming eight or fewer alcoholic drinks on one occasion (Northcote and Livingston, 2011). In contrast, participants underestimated their own consumption by increasing amounts, when consuming more than eight drinks on one occasion (Northcote and Livingston, 2011). However, potential misclassification is unlikely to differentiate based on proportion of students with non-Western origin in class and thus is unlikely to affect the presented results. Due to the relatively small proportion of individuals with non-Western origin, we were not able to differentiate meaningfully between country of origin and religious affiliation. Even though these factors may be related to alcohol habits, they are not considered to confound the association of interest.

In conclusion, the downward drinking trend among adolescents in Western countries may be partly explained by the higher proportion of youth from non-drinking or less drinking cultures, influencing the likelihood of alcohol consumption and frequency of binge drinking among adolescents in the ethnic majority population. In future studies, longitudinal time series analyses and more direct measures of acculturation should be applied. Further, the mechanisms linking class composition and drinking habits should be unfold and potential difference between boys and girls explored.

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CONFLICT OF INTEREST STATEMENT

None declared.

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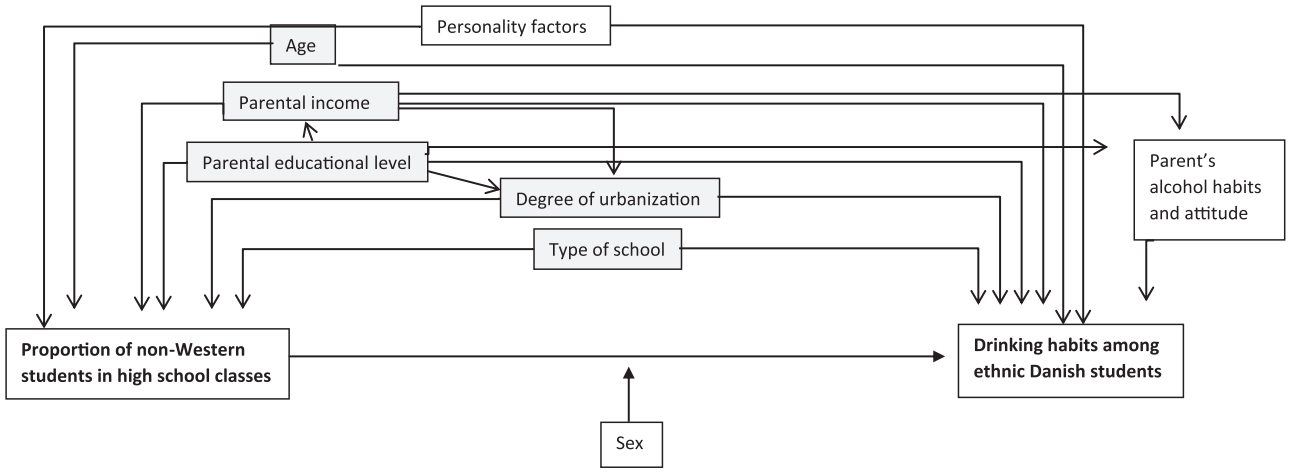
Appendix 1.
Directed acyclic graph of assumed relations between proportion of non-Western students in high school classes and drinking habits among ethnic Danish students



Confounders adjusted for in the analysis are marked by light grey

Appendix 2.
Multilevel analysis of class composition of students with non-Western origin, non-drinking, weekly alcohol consumption and frequent binge drinking among ethnic Danish boys and girls in differently populated areas

	Total of ethnic Danes *n*(%)	Non-drinkers OR (95% CI)		Relative difference in mean weekly alcohol consumption among drinkers (95% CI)		Frequent binge drinking among drinkers OR (95% CI)	
Class proportion with non-Western origin		Boys	Girls	Boys	Girls	Boys	Girls
Densely populated area							
0–5%	7522 (47)	ref.	ref.	ref.	ref.	ref.	ref.
>5–10%	2985 (19)	1.07 (0.63–1.81)	1.07 (0.77–1.49)	0.95 (0.88–1.02)	0.99 (0.93–1.06)	0.83 (0.72–0.95)	1.00 (0.88–1.14)
>10–15%	1956 (12)	1.53 (1.00–2.34)	1.31 (0.96–1.80)	0.98 (0.87–1.10)	0.96 (0.89–1.04)	0.69 (0.57–0.82)	0.75 (0.64–0.88)
>15%	3538 (22)	1.55 (0.95–2.53)	1.73 (1.20–2.48)	0.97 (0.90–1.05)	1.01 (0.93–1.10)	0.71 (0.60–0.84)	0.79 (0.69–0.92)
Intermediate density area							
0–5%	13,812 (55)	ref.	ref.	ref.	ref.	ref.	ref.
>5–10%	5408 (22)	1.19 (0.96–1.49)	1.15 (0.94–1.39)	0.99 (0.93–1.05)	1.04 (0.99–1.10)	0.88 (0.79–0.98)	1.06 (0.96–1.17)
>10–15%	3442 (14)	1.16 (0.88–1.54)	1.14 (0.90–1.44)	1.01 (0.92–1.10)	1.03 (0.98–1.09)	0.88 (0.78–1.01)	0.90 (0.80–1.02)
>15%	2399 (10)	1.80 (1.38–2.34)	1.50 (1.15–1.96)	0.96 (0.87–1.05)	1.00 (0.94–1.07)	0.79 (0.67–0.93)	0.86 (0.74–1.00)
Thinly populated area							
0–5%	12,653 (66)	ref.	ref.	ref.	ref.	ref.	ref.
>5–10%	3433 (18)	1.06 (0.82–1.38)	1.17 (0.92–1.50)	1.01 (0.94–1.09)	1.06 (1.00–1.12)	0.93 (0.81–1.07)	1.02 (0.90–1.15)
>10–15%	2183 (11)	1.52 (1.13–2.03)	1.31 (1.10–1.56)	0.98 (80.87–1.09)	1.04 (0.97–1.12)	0.86 (0.72–1.03)	0.96 (0.83–1.11)
>15%	972 (5)	2.19 (1.59–3.02)	1.96 (1.34–2.86)	0.90 (0.72–1.13)	1.10 (1.01–1.20)	0.76 (0.58–0.99)	1.14 (0.92–1.40)

Adjusted for age, parental education, parental income and type of school.