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# Heterogeneity in Drinking Practices in England and Wales and Its Association With Violent Behavior: A Latent Class Analysis

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## ABSTRACT

**Background:** Crude single-item consumption metrics, such as “binge drinking” measures, mask the complexity and heterogeneity in young people’s drinking; thus limiting our understanding of young people’s drinking patterns as well as how alcohol drinking is associated with violent outcomes. **Objectives:** The current study employed a range of consumption and contextual indicators to explore heterogeneity in young people’s (16–29 years) drinking practices, giving due consideration to their social nature. It also assessed to what extent heterogeneity in drinking practices was associated with violent outcomes. **Methods:** Employing data from the 2006 Offending Crime and Justice Survey, three measures of alcohol consumption and nine drinking context indicators were utilized within latent class analysis to create typologies of drinking practices among current drinkers in England and Wales ( $n = 2711$ ) and examine their association with violent outcomes. The validity of the typologies was also assessed on age, sex, and socio-economic status. **Results:** Three discernible drinking profiles were identified: “regular social drinkers” (48%), “regular pub binge drinkers” (32%), and “moderate drinkers” (20%). The “regular pub binge drinkers” were found to be more than twice as likely to commit an assault offence (odds ratio = 2.8 95% CI [1.3, 6.2]) when compared to “moderate drinkers” and “regular social drinkers” (odds ratio = 2.2 95% CI [1.4, 3.4]). **Conclusions:** Interventions aimed at reducing alcohol-related violence ought to give due consideration to the social context of drinking as well as levels of consumption.

## KEYWORDS



Alcohol; binge drinking; drinking patterns; latent class analysis; offending crime and justice survey; violence

## Introduction

Due to its association with violent outcomes (Finney, 2004; Felson, Savolainen, Aaltonen, & Moustgaard, 2008; Graham and Homel 2008; Boden, Fergusson, & Horwood, 2013; XXX; XXX), heavy episodic or “binge” drinking remains a concern in the fields of public health and criminal justice. In wider discourse and policy responses, “binge” drinking has focused on younger populations given their frequent and often public displays of drunkenness. However, young drinkers are not a homogeneous group and the concept of “binge drinking” overlooks the complexity and heterogeneity of their alcohol use. Indeed, many scholars have called for a move away from broad classifications such as “binge drinkers” (White, 1987; Carey, 2001; Gmel, Klingemann, Muller, & Brenner, 2001) and single indicator measurement of problematic alcohol use (Rehm et al., 2004; Reboussin, Song, Shresha, Lohman, & Wolfson, 2006; Bräker, Göbel, Scheithauer, & Soellner, 2015), as these can mask distinct types of drinkers and potentially differential risks of harm.

Many biological, psychological, and social factors shape drinking practices. From a social perspective, drinking patterns are necessarily context dependent, shaped by characteristics of the drinking location and the company with whom drinking takes place (Wells, Graham, Speechley, & Koval, 2005). Although other factors such as marital status, education, and race may also influence drinking patterns, homophilic selection of peers usually results in similar drinking styles and preferences for drinking locations, as purported by the assortative drinking theory (Gruenewald, 2007). Individuals may also assort together in different drinking venues on the basis of heavy drinking and aggressive behaviors, and do so commonly in more “permissive” venues (Leonard, Quigley, & Collins, 2002; Quigley, Leonard, & Collins, 2003).

Incorporating the context into the identification of subpopulations of drinkers is therefore central to developing a more nuanced understanding of young people’s drinking behavior and offers opportunities for more

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effective targeting of public health and crime prevention interventions. Subpopulations with characteristic drinking practices or “customs” may further exist, based on gender,<sup>1</sup> age,<sup>2</sup> and socio-economic status,<sup>3</sup> which may be differentially associated with adverse outcomes.

In public health and epidemiology, latent class analysis (LCA) is considered useful in trying to “understand the risk from, and determinants of, varying patterns of drinking” (Jackson et al., 2014, p. 137). LCA categorizes individuals, not based on theoretical assumptions, but rather explores patterns of drinking-related indicators empirically to examine the underlying structure among cases (i.e., latent taxonomic structure) (Uebersax, 2009). Thus, when considering recreational drinking practices, resulting groups can thus be characterized as expressive and distinctive drinking behavioral profiles (Bräker et al., 2015). Three studies have used DSM criteria to classify alcohol users and found between three and four classes that are broadly similar across different geographical contexts (McBride, Teesson, Baillie, & Slade, 2011; Casey, Adamson, & Stringer, 2013; Castaldelli-Maia et al., 2014).

Although many studies have sought to identify alcohol consumption typologies in order to examine drinking trajectories and improve the targeting of health interventions, there remains variation in variable selection, the number and nature of typologies identified, and their interpretation. A recent narrative synthesis of studies of drinking typologies in young people identified one or two non- or low-using groups and up to a further four categories of drinkers distinguished as social and hedonistic drinkers or heavy and harmful consumers (Davoren et al., 2015). Many LCA approaches have neglected the social context of drinking nor utilized the identified typologies to predict subsequent harmful outcomes, including violent behavior. While Bräker et al. (2015) advocate the consideration of environmental factors as promoting or preventing specific use patterns, including peer and contextual factors, these can be utilized in LCA to explore the dynamic interplay between the drinking behavior and the social context of the drinking. This leads to a greater understanding and more nuanced perspective of young people’s drinking patterns.

Within the United Kingdom, there has been limited attention directed to the exploration of alcohol consumption patterns using LCA. Smith & Selvin (2008) investigated drinking patterns based on measures of alcohol use, related dependence and problems, and their association with mental health outcomes. Six classes were identified. Percy and Iwaniec (2007) found five classes to differentiate between groups of risky users. However, these findings were based on data collected in the 1980s, and only included those 16 years of age (i.e., below the legal purchase age; Percy and Iwaniec, 2007).

While LCA is growing in popularity in criminology, it has not been employed to identify recreational drinking practices so that their association with violent behavioral outcomes can be explored. This is surprising given that research routinely points to an association between heavy episodic or “binge” drinking patterns and violence (Room and Rossow, 2001; Finney, 2004; xxx; xxx; Matthews and Richardson, 2005; Felson et al., 2008). It is widely purported that alcohol intoxication acts as a contributory cause of violence alongside other factors (Graham, 1980; Fagan, 1990; Sumner and Parker, 1995; Leonard, 2005). For example, evidence suggests that it is the nature of drinking combined with the specific drinking context that makes violent outcomes more probable (e.g., crowded or poorly managed nightclubs; Leonard et al., 2002; Bellis, Hughes, & Anderson, 2007; Graham and Homel, 2008). Alcohol thus contributes to violence in some people under particular circumstances. Consequently, it remains important to understand how different types of drinking practices are associated with different outcomes, so as to target suitable intervention and develop effective policy to reduce alcohol-related harm (Jackson et al., 2014; Davoren et al., 2015). Moreover, it is useful for the field to make a more detailed distinction between different patterns of alcohol use among young people, and to relate these to alcohol-related outcomes such as violence.

Siciliano, Mezzasalma, Lorenzoni, Pieroni, & Molinaro (2013) examined drinking patterns using an integrated metric of well-established alcohol consumption indicators resulting from a principal component analysis (PCA) in an Italian sample. They found three distinct drinking patterns to be associated with alcohol-related aggression. However, PCA is unlikely to have been the appropriate statistical technique in this instance, as their variables were ordinal. LCA would thus have been a more appropriate method with which to model their data. Additionally, the study’s findings were not validated on the basis of key demographics (assess measurement invariance) and their outcome measure of *alcohol-related* assault could have been conflated with the drinking behavior measures used to predict it. Also, as the authors themselves acknowledge, the requirement for respondents to attribute their fighting to their drinking may also produce underestimates about the co-occurrence of violence and drinking.

The current study utilized a range of consumption and contextual indicators from a general population sample of 16–29 year olds from England and Wales to: (1) identify typologies of drinking to describe heterogeneity in drinking practices among young people; (2) assess the validity of the typologies based on sex, age, and socio-economic status; and (3) to examine the relationship between drinking typologies and violent assault outcomes.

## Methods

### Data

The Offending Crime and Justice Survey provides nationally representative data for those living in households in England and Wales on alcohol consumption and violent behavior. The most recent (2006) wave was utilized in the current study, which comprised a multi-stage stratified random sample of individuals aged 10–29 years. (Home Office, NatCen and BMRB, 2008). Households based on postcode districts were the primary sampling units, stratified by police force area, region, and district (based on population density and occupational profile; Phelps et al., 2007). The survey was delivered via computer assisted self-interviewing (CASI) to encourage honest self-reports, resulting in a response rate of 67%. Further details on the survey design and administration can be found elsewhere (Phelps et al., 2007).

Drinking patterns, contexts of drinking, and violent behavior were examined among regular drinkers (defined as those who drank at least once per month) aged 16 to 29 years ( $n = 2711$ , 52% female; 57% aged 16–20; and 43% aged 21–29).<sup>4</sup> A pragmatic decision was taken to exclude non- and very low frequent drinkers from the analyses as survey questions (e.g., binge drinking frequency) were not asked of non- or infrequent drinkers. Adopting this approach also allowed specific comparisons among regular drinkers and avoided inflated regression coefficients; as an abstainer would not have been drinking during any (violent) event.

The data were weighted to correct for differences in the probability of selection, non-response, and to match the profile of the reference population, before applying the ranking ratio method to produce a weight based on age, sex, and region. (See Phelps et al., 2007 for further detail on weighting.)

### Measures

Twelve survey measures were utilized to capture drinking patterns (details in [Appendix I](#)). Nine were binary contextual measures referring to drinking companions and locations in which the respondent usually consumed alcohol.<sup>5</sup> The remaining three were binary measures of consumption, derived by collapsing ordinal variables. This was done to aid interpretation and avoid problems of sparse data in the LCA. The three consumption measures captured whether respondents were; weekly drinkers, had felt drunk at least once a month (both indicators for the last 12 months), and were binge drinkers (frequency of drinking more than six/eight units in one day for females and males, respectively, in the last month).

Demographic characteristics included age, sex, and socio-economic status. Age was dichotomized into those aged 16 to 20 years and those aged 21–29. A binary measure of socio-economic status (SES) indicated whether (or not) the respondent perceived that their household was managing well on their income.<sup>6</sup>

Assault outcomes were captured using a dichotomous measure of whether or not the respondent had committed an assault in the last year (regardless of whether or not the other party incurred an injury). Respondents were asked if they had used force or violence on anyone on purpose in the last year, for example, by scratching, hitting, kicking, or throwing things, and whether they believed it had injured the other party in some way. This definition of physical violence was chosen based on previous research that suggests assault is the most common form of violence perpetrated by young people (especially those aged 18–24), in which excessive alcohol consumption often features (Room and Rossow, 2001; WHO, 2006; Cherpitel, Yu, Bond, Room, & Guilherme, 2012; ONS, 2015a).

### Analysis

LCA was performed using the 12 binary consumption and contextual measures and model specification was conducted incrementally. The final model was selected based on the Lo–Mendell–Rubin likelihood ratio test, Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), a sample size adjusted BIC, a measure of entropy, and interpretability of the classes. Models were estimated using the default full-information maximum likelihood (FIML) under a missing at random assumption<sup>7</sup> and used a number of starting values and optimizations (500/20) to avoid convergence to local maxima. Residuals were inspected to assess problems of local independence using the cut-off value of 3.84 as suggested by Vermunt and Magidson (2000). To avoid problems with local independence (residual correlation), two pairs of items were collapsed; an approach previously adopted by Sufin et al. (2009). A measure of “at home drinking” derived from measures of drinking in their own home as well as in the homes' of others. A measure of drinking “with family” was derived from measures of drinking with parents as well as doing so with brothers or sisters.

Distinctions in the structure of the measurement model were compared across groups (measurement invariance) using indicators of age group, sex, and socio-economic status. A multi-group analysis was run for each demographic variable.<sup>8</sup> The assumption of measurement invariance was then formally tested by comparing models in which item-response probabilities were first constrained to be equal across sub-groups (restricted (measurement invariant) model) and then allowed to vary

**Table 1.** Model fit statistics for LCA 2–5 class solutions.

Number of classes	2	3	4	5
Log-likelihood	−17483.29	−17222.696	−17112.426	−17034.542
Number of parameters in model	25	38	51	64
Bayesian Information Criterion (BIC)	35164.207	34745.785	34628.01	34575.008
Adjusted Bayesian Information Criterion (ABIC)	35084.774	34625.047	34465.967	34371.660
Akaike Information Criterion (AIC)	35016.58	34521.392	34326.852	34197.083
2 <sup>*</sup> log-likelihood reduction compared to previous model	−18825.107	−17483.29	−17222.696	−17112.426
Lo–Mendell–Rubin likelihood ratio test	0	0.0019	0.0804	0.3604
Entropy (level of miscalculation)	0.733	0.718	0.655	0.689
Condition number <sup>*</sup>	0.806E <sup>−02</sup>	0.565E <sup>−02</sup>	0.273E <sup>−03</sup>	0.196E <sup>−03</sup>

\*Ratio of the largest eigenvalue to the smallest eigenvalue for the Fisher information matrix. Values less than 10E−09 indicate problems with model identification.

freely (unrestricted model) (Collins and Lanza, 2010). Where measurement invariance was deemed to hold, the prevalence of classes across demographic indicators was also assessed (prevalence equivalence).

Finally, LCA with a dichotomous distal observed assault outcome variable was performed using logistic regression, controlling for (antecedent) covariates age, sex, and SES in order to examine the association between the derived latent classes and assault outcomes using the one-step analysis approach.<sup>9</sup> Once again the fit statistics outlined above were inspected and odds ratios (and 95% confidence intervals (CI)) were compared between groups (Long, 1997; Hosmer and Lemeshow, 2000). Interactions between demographic characteristics and latent classes on violent outcomes were conducted separately. All models were fitted using MPLus (version 7.4) software.

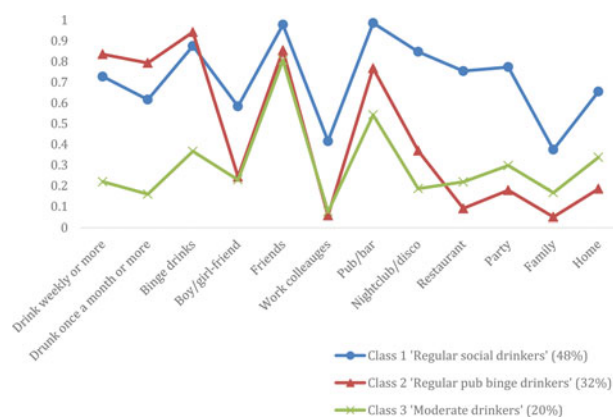
## Results

Almost two thirds (65.3%) of the sample drank twice or more per week. Approximately one in five (21.2%) never binge drank, however, the majority did; with 69% doing so up to 10 times a month and a further 9.8% doing so more regularly. Just under half (45.4%) felt drunk<sup>10</sup> between one and three times per month, with the remainder doing so either once every few months or less (39.4%) or once a week or more (15.2%). Pubs and bars were the most common venue for drinking (82.5%). Friends were the most common companions for drinking (90.3%), followed by boy- or girlfriends (40.3%) and parents (38.4%). Over one in ten (11.5%) had perpetrated an assault offence in the last year.

Latent class models were run incrementally up to 5 classes, with the three-class solution providing a best fit for the data based on the log-likelihood values, Bayesian Information Criteria (BIC) (where a lower value indicates a better fit), and the Vuong–Lo–Mendell–Rubin likelihood ratio test results (see Table 1) as well as parsimony and theoretical interpretability of the classes. Adding additional parameters (i.e., more classes) into the model will continue to lower the BIC, however, in

the values obtained here the decline in the BIC tails off in the four and five class models. This suggests the additional fourth and fifth classes are not reducing the BIC significantly. This is supported by the insignificant *p* values obtained from the Vuong–Lo–Mendell–Rubin likelihood ratio tests. This test assesses whether or not adding an additional class to the previous model offers a significant improvement to the model and its fit to the data: here adding a fourth or fifth class would seem not to.

To aid interpretability of the classes response probabilities are visualized in Figure 1. Figure 1 highlights the distinctions between the three classes: namely, differing levels of consumption and drunkenness as well as drinking contexts. The first two classes were characterized by high levels of drinking frequency, binge drinking, and drunkenness. However, these two classes differed in their usual drinking companions and venues: the first tended to drink in a wide range of settings, whereas the second predominantly drank in pubs or bars. The former was also characterized by drinking with a wider range of people, including friends and are thus referred to as “regular social drinkers.” Whereas the latter were not as diverse in the range of people with whom they drank; drinking predominantly with friends and are thus referred to as “regular pub binge drinkers.” In sum, regular social drinkers drank frequently in a wider range of settings with a wider range of people. This class also comprised the



**Figure 1.** Response probabilities for three-class solution.



majority of the sample (48%). Regular pub binge drinkers tended to also drink frequently but mostly with friends in pubs or bars rather than in other settings (it comprised 32% of the sample). The third class (20%) was characterized by lower levels of consumption, binge drinking, and drunkenness and mirrored the preference for drinking with friends and in pubs or bars, as among the regular pub binge drinkers. Overall, moderation for most consumption measures appeared to characterize this class and those classified as such are thus thought to comprise a group of “moderate drinkers.”

When assessing the fit of the three class model, it is noteworthy that adding a third class to a two-class model allowed a moderate drinking group to be identified. However, the addition of a fourth class did not offer tangible benefits in interpretation, as two classes were broadly similar. Doing so, seemingly split the second class based on modest differences in item response probabilities (with the most pronounced differences between these being whether or not they also drank at nightclubs or parties). Item-response probabilities for the two and four class solutions are detailed in [Appendix II](#).

Measurement invariance was assessed for sex, age, and socio-economic status. Independent models were run for each binary grouping separately and a three-class solution was deemed a reasonable fit the data in each instance (results available on request). Allowing differences in item thresholds across grouping variables and comparing results to models in which they were constrained to be equal, measurement equivalence was then formally tested.

In relation to sex, while the ABIC and AIC favored the free model, the BIC value suggested a fixed model provided a better fit to the data.<sup>11</sup> In relation to socio-economic status, the AIC favored the free model, whereas both the BIC and ABIC favored the fixed model.<sup>12</sup> Fit criteria are only one decision-making tool and it is up to the investigator to judge whether differences are conceptually important or not (Collins and Lanza, 2010). In light of the inconclusive fit statistics, and having examined the magnitude and overall pattern of any differences (in which the interpretation of the three classes is essentially identical across the sex and SES groups), measurement invariance was imposed for the sake of parsimony and to aid interpretation.

Fit statistics in relation to age group favored a free model.<sup>13</sup> On inspection of the response probabilities (available in [Appendix III](#) for both the fixed and free model), some items appeared to be operating differently between the age groups; older persons were more likely to drink in pubs whereas younger people were more likely to do so at parties and at each other's homes. A Wald test confirmed this for all three items ( $p < 0.005$ ). This was, however, only evident among “moderate drinkers,”

suggesting partial measurement invariance in this class. The substantive interpretation of the classes remained consistent. Measurement invariance was further assessed using a trichotomized age categorization (16–17, 18–22, and 23–29 years) in addition to excluding respondents under the legal purchase age (i.e., <18 years). These further analyses revealed that much of the measurement invariance was due to different drinking practices among those under the legal age. Indeed, the BIC favored a constrained model (28303.278 compared to 28342.3 for free model) when comparing age groups 18–22 and 23–29. However, focusing on those only of legal purchasing age by excluding those under the age of 18 would result in losing 686 cases and a significant proportion of assault outcomes, reducing the power to conduct regression analyses. The full sample is thus retained in the analyses that follow and age retained as a covariate influencing class membership.

The resultant latent classes were found to distinguish between the probability of assault outcomes (see [Table 2](#)). The probabilities for each class were 0.09, 0.17, and 0.07, respectively, for “regular social drinkers,” “regular pub binge drinkers,” and “moderate drinkers.”

When controlling simultaneously for sex, age group, and socio-economic status, females were significantly less likely to belong to “regular pub drinkers” when compared to both “moderate drinkers” and “regular social drinkers” (see [Table 3](#)). Those struggling on their income were less likely to be “regular social drinkers” when compared to “moderate drinkers” and more likely to be “regular pub drinkers” than “regular social drinkers” (see [Table 3](#)). “Regular pub drinkers had significantly higher odds of perpetrating an assault when compared to “moderate drinkers” (OR 2.83 (95% CI [1.30, 6.17]) and “regular social drinkers” (odds ratio = 2.2 95% CI [1.4, 3.4]).

Interaction analyses showed that sex and age group were not found to moderate the association between latent class and violence. However, a significant interaction was found between latent class and socio-economic status ( $p = 0.04$ ; see [Table 3](#)) demonstrating that the association between “regular social drinker” status and violence (compared to moderate drinkers) was stronger in those of low socio-economic status (OR 1.47, 95% CI [0.86, 2.51] vs. moderate drinkers (OR 0.43, 95% CI [0.15, 1.20]). No interactions were observed when using the “regular social drinkers” as the reference group.

## Discussion

This study examined drinking practices during the period of late adolescence and early adulthood (16–29 years), drawing on theory that suggests drinking practices are shaped by a dynamic interplay between consumption,

**Table 2.** LCA-D results on a probability scale,  $n = 2688$ .

	Class 1 "Regular social drinkers"	Class 2 "Regular pub binge drinkers"	Class 3 "Moderate drinkers"
<i>Drinking pattern</i>			
Drink weekly or more	0.73	0.84	0.22
Drunk once a month or more	0.62	0.80	0.15
Binge drinks	0.88	0.94	0.37
<i>Drinking company</i>			
Boy/girl-friend	0.58	0.24	0.23
Friends	0.98	0.86	0.80
Family	0.37	0.05	0.16
Work colleagues	0.41	0.06	0.07
<i>Drinking location</i>			
Pub/bar	0.99	0.76	0.55
Nightclub/disco	0.85	0.37	0.19
Restaurant	0.76	0.08	0.22
Party	0.77	0.18	0.29
Home	0.65	0.19	0.33
Assault	0.09	0.17	0.07
<i>Fit statistics</i>			
Akaike (AIC)	36362.55		
Bayesian (BIC)	36604.66		
Sample-size adjusted BIC	36474.39		
Entropy	0.72		
Condition number *	0.607E <sup>-02</sup>		

\*Ratio of the largest eigenvalue to the smallest eigenvalue for the Fisher information matrix. Values less than 10E-09 indicate problems with model identification.

peer interaction, and drinking location. This is the first study of its kind to investigate the heterogeneity in young people's drinking, which is associated with violence.

Results distinguished three classes of young adult drinkers. One class comprised a group of "moderate drinkers" with a low risk of perpetrating assault offences; consistent with evidence showing that there is less risk of harm when levels and regularity of drinking are low (xxx; xxx). The distinction between the remaining two classes was discernible in the variety of drinking locations and companions. One of these was characterized by drinking frequently and predominantly with friends in pubs ("regular pub binge drinkers"), whereas the other class also drank frequently but across a wider range of settings with a wider range of people ("regular social drinkers"). The former was associated with a higher probability of violent behavior in the form of assault offences, intuitively pointing to the assortative nature of drinking and establishments and potentially high levels of alcohol consumed in the pub setting, which can be particularly problematic (Leonard et al., 2002; Bellis et al., 2007; Graham and

Homel, 2008). The finding that "regular social drinkers" had a lower propensity for violence suggests a protective effect of drinking less frequently and doing so with your partner, work mates, or at family gatherings. This supports the notion that drinking behavior is tailored and moderated to the setting in which alcohol is consumed (as initially purported by MacAndrew and Egerton, 1969).

Results also somewhat concur with findings from clinical studies assessing alcohol-use disorder across a variety of countries whereby three to four classes are commonly discerned on a severity gradient from a "modest" to an "extreme" drinking class (see McBride et al., 2011; Casey et al., 2013; Castaldelli-Maia et al., 2014). Casey et al. (2013) also identify their "severe class" as hazardous to both themselves and the wider public, based on injuries and their criminal histories.

This is the first study to examine the moderating factors in the relationship between drinking patterns and violence using LCA. The disproportionate harm caused by drinking patterns to low socio-economic groups (Hart,

**Table 3.** Association between latent class membership and assault outcome,  $n = 2688$ .

	Regular pub binge drinkers <sup>a</sup> OR (95% CI)**	Regular social drinkers <sup>a</sup> OR (95% CI)**	Regular pub binge drinkers <sup>b</sup> OR (95% CI)**
Sex (Female)	0.54 (0.34–0.85)	1.26 (0.83–1.92)	0.43 (0.28–0.64)
Age (20–29)	1.29 (0.68–2.44)	1.42 (0.95–2.11)	0.91 (0.59–1.40)
SES (Struggling on income)	0.74 (0.44–1.24)	0.44 (0.31–0.62)	1.67 (1.10–2.55)
Assault	2.83 (1.30–6.17)	1.31 (0.61–2.79)	2.16 (1.39–3.37)
<i>Interactions</i>			
	<i>p</i> value	<i>p</i> value	<i>p</i> value
Age	0.80	0.88	0.71
Sex	0.82	0.69	0.57
SES	0.11	0.04	0.73

<sup>a</sup>Compared with reference class; moderate drinkers.

<sup>b</sup>Compared with reference class; regular social drinkers.

\*\*Odds ratios with 95% confidence limits that do not include 1 can be considered to reflect a significant group difference.

2015) is important to investigate from a health equity perspective and can be used to inform the development of preventative approaches. The significant interaction effect, pointing to an amplified risk of violent outcomes for those of low socio-economic status belonging to the “regular social drinkers,” warrants further qualitative and quantitative investigation.

Females were found to be more likely to be “regular social” and “moderate” drinkers whereas males were more likely to be “regular pub binge drinkers.” These findings suggest that men assort to drink together in pubs, whereas females drink in a wider range of venues and with a wider range of people. Given that females have larger, more diverse, social networks than males (Ajrouch, Blandon, & Antonucci, 2005), this may operate as a protective factor. The higher prevalence of intoxication and alcohol-related assaults among males (ONS, 2013, 2015a, 2015b) poses particular risks to the prevention of violence and management of licensed premises and nightlife settings (Wells et al., 2014).

Those not managing on their household income were found to be less likely to be “regular social drinkers” (see moderate drinkers). This may point to the financial costs of regular heavy drinking, particularly as these groups are more price sensitive (Barbor, 2010). The fewer drinking occasions may play a role in the fewer occasions of violence when compared to other more regular drinkers in pub settings, pointing to the importance of both the frequency and quantity of alcohol consumption in the pathway to violent outcomes.

The fact that measurement invariance did not hold across age group (due to differences in underage drinking patterns) points to the sensitivity in variation in drinking practices over the life course and the potential for age differences in social network structure to reflect differing roles and responsibilities according to life stage. This, as well as the sample’s limited ability to further disaggregate age groups in regression analyses, gives weight to studying alcohol-related violence from a developmental perspective (as developed elsewhere; xxx and xxx) as well as considering those of legal drinking/purchase age and under as a distinct population group. Excluding those under the legal drinking/purchase age would have resulted in sparseness in assault outcomes to model using these data, it thus remains a possibility that the current findings are driven to some extent by those below the legal drinking/purchase age. The cross-sectional nature of this study, as well as the inability to identify concomitant occurrences of alcohol consumption and violent behavior using the available measures, precluded any conclusions about causation between the drinking practices and assault outcomes.

Residual confounding may be possible if other factors, beyond consumption, peers, and drinking locations contributed to the association between alcohol and violence. These might include volume of alcohol consumed as well as individual characteristics (e.g., attitudes, relationships, education, ethnicity) and local environmental triggers such as late trading hours and the clustering of types of premises. Future studies would benefit by including these factors in an LCA approach. It may also be the case that violence forms part of a more general anti-social lifestyle, as advocated by Farrington (1995, 2003), rather than being predicted by drinking practices. Moreover, it was not possible to account for all possible drinking contexts using the available measures (e.g., drinking at football matches) or to identify levels of drinking occurring in each context. The current study is also limited due to the household sampling strategy excluding residents in institutions such as prisons, the low response rate, the reliability of self-reported measures (despite the use of CASI), and the loss of information in collapsing ordinal variables to binary measures (although this was deemed necessary to avoid sparse data). Finally, because contextual measures with a prevalence of less than 20% were omitted from the analysis, the salience of less-frequent drinking conditions (e.g., drinking alone) could not be examined.

Among the merits of this study, however, are its large general population sample of young people in England and Wales and the inclusion of drinking context measures in the LCA to more fully understand the heterogeneity in drinking practices. The findings suggest that attempts to ameliorate alcohol-related violence ought to be context- and peer group-specific rather than just focus on drinking frequency and/or amount consumed. Indeed, given that those favoring drinking heavily in pub settings are disproportionately associated with perpetrating assault, the findings offer support for three of the strategies for preventing alcohol-related harm as outlined by Barbor (2010).<sup>14</sup> Specifically, modifications to alcohol pricing and taxation, pub trading hours (Kypri, Jones, McElduff, & Barker, 2011; Kypri, McElduff, & Miller, 2014; Rossow and Norstrom, 2012; Menéndez, Tusell, & Weatherburn, 2015) and clustering of licensed premises, as well as enforcement of legal requirements on licensed premises (such as not serving drunk patrons) and effective training in responsible service and managing or preventing aggression for bar staff.

### Declaration of interest

The author reports no conflict of interest. The author alone is responsible for the content and writing of the article.



## Notes

1. As, on the whole, males drink more (Fuller, 2015) and are more violent than females (WHO, 2006) and females have larger social networks than males (Ajrouch et al., 2005).
2. Younger males are more violent than older males (WHO, 2006).
3. Those with higher income consume more alcohol (Fuller, 2015).
4. The number of regular drinkers under 16 years old was 430 (29.2% of all those under the age of 16 in the sample) compared to 2394 regular drinkers over 16 (77.8% of all those aged 16 or over in the sample). The small proportion of under 16 drinkers gives reason to be concerned that this group may be categorically different from those in the over 16 year old group.
5. Only contextual measures with a prevalence over 20% were included in the analysis.
6. While neither subjective measures of deprivation or more objective measures such as the English Index of Multiple Deprivation (which in any case was not available for the Welsh respondents in the sample) are ideal in capturing socio-economic status, this available measure in the OCJS relates to individual living conditions rather than to area level deprivation.
7. Individuals were only excluded from the analyses where they were missing information on all variables in the model, but remained included where they were only missing information on some of the items.
8. This differs conceptually from LCA with covariates in that it assumes the subgroups reflect distinct populations: the grouping variable is thus allowed to moderate the effect of the covariates on latent class membership (Collins & Lanza, 2010).
9. The “one-step analysis extracts latent classes and examines the association between latent categorical and observed variables simultaneously via a general latent variable modeling framework” (Feingold, Tiberio, & Capaldi, 2014, p. 2) and so addresses shortcomings of employing a classical 3-step analysis (namely, misclassification in assigning individuals to classes). “Unfortunately, current statistical programs do not conduct a three-step LCA-D [latent class analysis with a distal outcome] with an observed categorical distal outcome” (Feingold et al., 2014, p. 7). However, the approach adopted here is a flexible model-based approach, which enables the class-dependent density functions of distal outcomes with categorical distribution to be derived, so reducing bias in estimates compared to a classify-analyze technique (Lanza, Tan, & Bray, 2013).
10. Only 2079 responded to this question (632 respondents were missing responses to this question; these comprised those who had not felt drunk after drinking in the last 12 months).
11. Free model: BIC = 38562.127 ABIC = 38323.829 AIC = 38119.247 Free model: BIC = 38505.874 ABIC = 38381.959 AIC = 38275.576
12. Free model: BIC = 38045.059 ABIC = 37806.761 AIC = 37602.818 Fixed model: BIC = 37906.914 ABIC = 37782.999 AIC = 37676.949
13. Free model: BIC = 38353.966 ABIC = 38115.668 AIC = 37911.086 Fixed model: BIC = 38511.419 ABIC = 38387.504 AIC = 38281.121

14. Namely; “pricing and taxation,” “regulating the physical available of alcohol,” and “modifying the drinking context.” (The first two of which are thought to be among the most effecting and cost-effective strategies).

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## Appendix I. Original variable wording and response categories

### Drinking frequency

Original wording and categories	Dichotomized into
Thinking about the last 12 months, about how often did you usually have an alcoholic drink?	Whether respondent drank weekly or more or not:
1. Most days	1 = responses 1 and 2
2. Once or twice a week	0 = responses 3 to 6
3. 2 or 3 times a month	
4. Once a month	
5. Once every couple of months	
6. Less often	
7. Don't Know	
8. Don't want to answer	
<i>This question was asked if the respondent had drunk in the last 12 months.</i>	

### Frequency of drunkenness

Original wording and categories	Dichotomized into
Thinking about the last 12 months, about how often have you felt very drunk?	Whether respondent felt very drunk once a month or more or not:
1. Most days	1 = responses 1 to 4
2. Once or twice a week	0 = response 5 and 6
3. Two or three times a month	
4. Once a month	
5. Once every couple of months	
6. Less often	
7. Don't Know	
8. Don't want to answer	
<i>This question was asked if the respondent had drunk in the last 12 months and responded positively to a prior question as to whether they have felt very drunk after drinking in the last 12 months.</i>	

## Frequency of binge drinking

Original wording and categories	Dichotomized into
<p>And how often in the last month have you had [IF sex = Female: 6/IF sex = Male: 8] or more units of alcohol on any one day?</p> <p><i>If you are not sure about what we mean by a unit of alcohol please ask the interviewer for help before moving on.</i></p> <ol style="list-style-type: none"> <li>1. Never in the last month</li> <li>2. Once or twice in the last month</li> <li>3. Three or four times in the last month</li> <li>4. Between 5 and 10 times in the last month</li> <li>5. Between 11 and 20 times in the last month</li> <li>6. More than 20 times in the last month</li> <li>7. Don't Know</li> <li>8. Don't want to answer</li> </ol> <p><i>This question was asked if the respondent had drunk once a month or more over the last 12 months.</i></p>	<p>Whether respondent binge drinks or not.</p> <p>1 = responses 2 to 6</p> <p>0 = response 1</p>

### Where respondents usually drank alcohol

When you do drink alcohol, where do you usually drink?

*You can choose more than one answer if you want to.*

1. Pub or bar
2. Night club or disco
3. Restaurant
4. Party
5. Youth club / community club
6. Your own home (including garden)
7. Someone else's home (including garden)
8. On the street, in a park, or other outdoor area
9. Somewhere else
10. Don't Know
11. Don't want to answer

*Responses 6 and 7 merged in analysis*

*This question was asked if the respondent had had an alcohol drink in the past 12 months.*

### Who respondents usually drink with

And thinking about when you drink alcohol, who are you usually with?

*You can choose more than one answer if you want to.*

1. Parents (including step, foster, or adoptive)
2. Husband / wife / partner
3. Girlfriend / boyfriend
4. Friends
5. Brothers or sisters (including step, foster, or adoptive)
6. Other relatives
7. On your own
8. Work colleagues
9. Someone else
10. Don't Know
11. Don't want to answer

*This question was asked if the respondent had had an alcohol drink in the past 12 months.*

**Appendix II. Two to four class LCA model item response probabilities**

	2 class solution		3 class solution			4 class solution			
	Class 1 (51%)	Class 2 (49%)	Class 1 (48%)	Class 2 (32%)	Class 3 (20%)	Class 1 (31%)	Class 2 (21%)	Class 3 (22%)	Class 4 (26%)
Drink weekly or more	0.724	0.579	0.727	0.835	0.219	0.856	0.817	0.188	0.670
Drunk once a month or more	0.619	0.588	0.616	0.793	0.159	0.759	0.760	0.194	0.540
Binge drinks	0.865	0.706	0.875	0.942	0.366	1.000	0.860	0.394	0.809
Boy/girl-friend	0.571	0.229	0.583	0.243	0.228	0.472	0.173	0.253	0.625
Friends	0.977	0.827	0.978	0.854	0.806	0.955	0.773	0.846	0.991
Work colleagues	0.406	0.053	0.415	0.056	0.074	0.195	0.034	0.088	0.551
Pub/bar	0.986	0.658	0.986	0.767	0.542	0.956	0.671	0.577	0.995
Nightclub/disco	0.84	0.270	0.847	0.369	0.186	0.732	0.219	0.242	0.885
Restaurant	0.732	0.130	0.754	0.09	0.218	0.480	0.005	0.264	0.862
Party	0.757	0.212	0.773	0.178	0.297	0.542	0.045	0.351	0.887
Family	0.365	0.091	0.374	0.049	0.166	0.196	0.007	0.188	0.479
Home	0.635	0.244	0.655	0.185	0.337	0.424	0.12	0.362	0.783

**Appendix III. Three class LCA by age group: Item response probabilities for free and fixed models**

	Fixed model						Free model					
	Class 1 (Young)	Class 1 (Old)	Class 2 (Young)	Class 2 (Old)	Class 3 (Young)	Class 3 (Old)	Class 1 (Young)	Class 1 (Old)	Class 2 (Young)	Class 2 (Old)	Class 3 (Young)	Class 3 (Old)
Drink weekly or more	0.727	0.727	0.835	0.835	0.219	0.219	0.694	0.75	0.835	0.877	0.211	0.219
Drunk once a month or more	0.616	0.616	0.793	0.793	0.159	0.159	0.632	0.603	0.825	0.746	0.289	0.076
Binge drinks	0.875	0.875	0.942	0.942	0.366	0.366	0.857	0.886	0.869	1	0.425	0.353
Boy/girl-friend	0.583	0.583	0.243	0.243	0.228	0.228	0.592	0.576	0.214	0.258	0.235	0.234
Friends	0.978	0.978	0.854	0.854	0.806	0.806	0.981	0.971	0.853	0.844	0.844	0.793
Work colleagues	0.415	0.415	0.056	0.056	0.074	0.074	0.319	0.502	0.066	0.053	0.025	0.13
Pub/bar	0.986	0.986	0.767	0.767	0.542	0.542	0.969	1	0.799	0.776	0.335	0.723
Nightclub/disco	0.847	0.847	0.369	0.369	0.186	0.186	0.853	0.842	0.404	0.35	0.194	0.163
Restaurant	0.754	0.754	0.09	0.09	0.218	0.218	0.718	0.786	0.03	0.161	0.143	0.273
Party	0.773	0.773	0.178	0.178	0.297	0.297	0.827	0.744	0.228	0.092	0.448	0.138
Family	0.374	0.374	0.049	0.049	0.166	0.166	0.328	0.417	0.071	0.03	0.093	0.243
Home	0.655	0.655	0.185	0.185	0.337	0.337	0.679	0.637	0.184	0.167	0.449	0.225