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The dynamic risk of heavy episodic drinking on interpersonal assault in young adolescence and early adulthood

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Abstract

This study examines the extent to which variation in violent behaviour can be explained by variation in drinking patterns in late adolescence and early adulthood using panel data of regular drinkers aged between 16 and 29 in England and Wales. Multi-level models explore individuals' propensity to commit assault controlling for their drinking behaviour. Results suggest that males and younger people are more likely to commit assault offences and that around 60% of the variation in assault is between people; the remainder being within people between observations. Heavy episodic drinking is a significant predictor of assault in all models. Collectively, the findings point to a periodic association between drinking patterns and violent outcomes, supporting evidence of other forms of contemporaneous association.

Introduction

The destructive impact of alcohol consumption and associated violence has been the focus of public, political and academic concern for several decades (see for example Strategy Unit 2004; HM Government 2012; Fagan 1990; Sumner and Parker 1995; Parker 2005; Measham 2006; Room and Rossow 2001; Järvinen and Room 2007 and WHO 2006). Whilst the prevalence of alcohol use has been decreasing in younger school aged children (11-15 years) in the UK, the amount of alcohol consumed amongst drinkers (those who have drunk in the last week) has not (Fuller 2013). Older UK pupils (aged 15-16) report both more frequent heavy episodic drinking and more frequent episodes of drunkenness and experience higher levels of alcohol-related harm - including violence - than most of their European counterparts (Hibell et al. 2012). Similarly, trend data for Great Britain from 1988 to 2006 showed an overall increase in the proportion of young adults (aged 16-24) drinking in excess of recommended weekly limits for men and women (Smith and Foxcroft 2009). Furthermore, other reviewers identified that young people's alcohol consumption was increasingly concentrated on high volume single drinking occasions (commonly referred to as 'heavy episodic' or 'binge drinking'; see Sumner and Parker 1995; Measham 1996; Järvinen and Room 2007). This is of particular concern as it is heavy episodic drinking patterns, that appear to be associated with interpersonal assault (see Finney 2004; XXXX

2011; Leonard 2005; Matthews and Richardson 2005; Room and Rossow 2001; Shepherd 1994). It thus seems that young people who drink heavily are more likely to be involved in violent incidents and the evidence base overwhelmingly suggests that acute alcohol consumption is a contributory factor for violence (see Felson et al. 2008; Leonard 2005).

Several theories have been forwarded to explain variation in alcohol-related violent offending. Some focus exclusively on individual characteristics and the impact of alcohol on cognitive functioning and behaviour, whilst others focus on the wider environment investigating the relationships between individuals and their economic and social surroundings (see Fagan 1990). Many studies of violence focus on the event level of analysis (studying the role of alcohol in violent events) aiming to discover situational determinants, perhaps as a counterpoise for the many individual-level studies that aim to identify underlying 'traits' or 'dispositions' but then go on to assume these are causally related to diverse instances of criminal behaviour (Horney 2006:6).

Some such individual-level studies have suggested that heavy drinking and violent behaviour may both form part of a wider syndrome of antisocial behaviour that may persist over time (see Farrington 1995; 2003; Piquero et al. 2007) or that both behaviours may be symptomatic of a general lack of self-control (*cf.* Gottfredson and Hirschi 1990). "This view implies that life events after childhood are of little, if any, explanatory importance" (Horney et al. 1995:655) and denies substantial changes in offending over the life-course, such as those found by Sampson and Laub (1993) (Horney et al. 1995). Whilst this reasoning is plausible, it is equally plausible that alcohol consumption also has a specific influence on outcomes in adolescence and early adulthood, in addition to the common influence of problem behaviour (Duncan et al. 1997).

As Horney (2006) observes crime, including violence, is 'situationally clustered' meaning that it is more likely in some situations than others. Furthermore, the assumption that levels of self-control or personality traits are static over the lifecourse, as advocated in the general theory of crime (*cf.* Gottfredson and Hirschi 1990) and in Moffit's (1993) original developmental taxonomy of life-course persistent and adolescent limited offenders, is disputed by other scholars (see Sampson and Laub 1992; Laub and Sampson 2003; Horney 2006) who believe such approaches cannot explain the considerable heterogeneity in the (dis)continuity of delinquent behaviour. They suggest that behaviour can be modified as individuals develop according to "local life circumstances" (Horney et al. 1995), thus emphasising the role of proximal (close in time to the event) risk factors, including alcohol consumption, and their role in increasing or decreasing the likelihood of behavioural outcomes. Such an interactional and developmental perspective suggests there are times at which people drink more and are more likely to engage in criminal or violent behaviour; emphasising the fact that violent events are nested within individuals and thus the need to study variation within individuals' over time (longitudinally).

The transition between childhood and young adulthood is one in which both heavy drinking and (violent) offending can feature and indeed longitudinal studies consistently demonstrate strong associations between antisocial behaviour and heavy drinking during adolescence and early adulthood (Farrington 2003; Huang et al. 2001; Loeber et al 2003). According to Room (2007), the first experience with alcohol typically falls within the period of adolescence and young adulthood (around age 13-25). This is an age range that also corresponds to the period in which drinking to intoxication and (violent) offending is most common. Criminal careers, including violent behavioural trajectories, often commence in teenage years, peak in early adulthood and tail off in the twenties; this is known as the 'age-crime curve' (see Siennick and Osgood 2008). As Sumner and Parker (1995) observe, this trajectory of offending approximately maps onto that of drinking which often starts at a similar time in the life course and co-occurs in young people.

Findings elsewhere suggest that alcohol impacts on within individual variation in antisocial behaviour, including violent behaviour (see Farrington 1995; Hussong et al. 2004) and short-term changes in alcohol consumption have been identified as having proximal influence on the likelihood of violent behaviour (Horney et al. 1995), even when controlling for anti-social personality (Falls-Stewart et al. 2003). Such findings support, at least in part, the theory that alcohol intoxication facilitates violence via its psychopharmacologic effects on cognitive processing or expectancies associated with intoxication (Falls-Stewart et al. 2003). Whilst Loeber et al. (2003) found no evidence of a linear dose-response relationship between alcohol consumption and violence severity in their review of longitudinal studies, change in alcohol consumption was a strong predictor of changes in violence: "these results confirm earlier research showing a dynamic, and often very proximal, confluence between alcohol consumption and violence" (Loeber et al. 2003:123). Similarly, Hussong et al. (2004) who studied individual differences in desistance from antisocial behaviour during young adulthood found that during periods in which young people drink more, they were also more likely to behave violently. Hussong et al.'s (2004) findings suggest that alcohol abuse can act both as a 'snare' for time-specific elevations in antisocial behaviour relative to an individual's own developmental trajectory, as well as a 'launching factor' operating as a distal effect to slow an individual's pattern of crime desistance relative to the population trajectory norm (Hussong et al. 2004). However, Huang et al. (2001) found that the positive cross-sectional correlation between alcohol and aggression decreased in strength with age from mid to late adolescence, thus suggesting that "reducing one behaviour will probably not have a long-term impact on the other" but that "early prevention efforts aimed at shared risk factors may reduce both contemporaneously" (Huang et al. 2001:64).

Drinking practices are gendered: the fact that males are more likely to be involved in alcohol-related violence may be due to gender differences in socialisation strategies and the cultural reinforcement of both aggressive and drinking behaviour associated with 'masculinity' (Shafer 1984 cited in Huang et al. 2001; Blitstein et al. 2005). Whilst multiple masculinities exist, dominant (hegemonic) masculine values are likely to shape drinking

practices at the population level (for example ideals of appear tough and being able to 'handle one's ale') and may shape resulting drunken behaviour and also serve to legitimise violence. Some authors also suggest that males and females express aggression differently; with girls being more likely to internalise problems (Keenan & Shaw 1997 cited in Blitstein et al. 2005) and suppress aggressive behaviour (Heimer 1996 cited in Blitstein et al. 2005). Males and females may also engage in alcohol use for different reasons (Lex 1991; Liu & Kaplan 1996 cited in Blitstein et al. 2005). Notwithstanding that males are not a homogenous group and there is inevitably variation between males in socialisation experience (for example, by social class), it is thus reasonable to propose that associations between violent behaviour and alcohol consumption may vary by sex.

Some studies have explored the extent to which gender moderates the effects of the predictors of violence with mixed results. Swahn and Donovan (2004) include in their model an interaction term for gender and heavy episodic drinking, which was not found to be significant. Blitstein et al. (2005) found that gender modified the association between drinking and *later* violence but in a slightly unexpected way: whilst baseline alcohol use was associated with violent behaviour, heavy episodic drinking was not associated with violence 18 months later amongst males, whereas heavy episodic drinking suppressed the rate of violence 18 months later in females. Duncan et al. (1997) found the development of alcohol use during adolescence was related to higher levels of alcohol use and aggressive behaviour in young adulthood for males only. Finally, Huang et al. (2001) did not find that sex moderated the reciprocal effect of aggression and alcohol use identified in their study; so "although males and females may differ in their levels of alcohol use and interpersonal aggression, the relationships between the two behaviours did not differ by sex" (Huang et al. 2001: 79). Given incongruent findings in studies to date, it remains unclear as to whether the influence of drinking on violent outcomes is similar for males and females. It also remains unknown at which point (both in terms of drinking frequency and stage in their development) a young female's drinking affects their propensity for violent behaviour and whether this is at the same point as for young males or not.

Whilst many studies have identified an association between acute intoxication or heavy episodic drinking using cross sectional analyses (see for example Matthews and Richardson 2005; Finney 2004; Shepherd 1994; Room and Rossow 2001), there is comparatively little research focused on longitudinal dimension of this relationship amongst UK youth; as most is centred on US samples of young people (see, Blitstein et al. 2005; Swahn and Donovan 2004; White et al. 1993; Huang et al. 2001). Whilst trajectories of offending behaviour have been the subject of much investigation, as has the causal direction of the alcohol-violence relationship, estimating the extent to which variation in violent behaviour is associated with variability in alcohol consumption within individuals (as opposed to between people) has received relatively little attention. To do this, it is necessary to assess the proportion of variance in violence attributable to individual change over time or between individuals and the relative risk of individual drinking patterns.

The psychopharmacological effects of alcohol on aggressive behaviour are not the focus of the current paper, nor do the authors aim to establish a causal relationship. Rather, the aims are: (1) to use longitudinal data to build on existing evidence of concurrent behavioural associations between alcohol drinking and violent behaviour amongst English and Welsh youth identified in many cross sectional studies; and (2) to explore the proportions of variation in violence attributable to change *between* individuals and *within* individuals in England and Wales over the period of late adolescence and early adulthood, as well as the relative contributions of their drinking patterns.

To achieve these aims, it is necessary to account for the dynamic risk of drinking patterns and violent behaviour over the life course and assess the relative risk of heavy episodic drinking on different occasions on the probability of violent behaviour. In this developmental framework, age forms a key covariate of interest as (a) the relative risk of heavy episodic drinking may vary according to the age at which it is performed and (b) given that previous studies have identified ages within this developmental period to be associated with elevated risk of both heavy alcohol consumption and violent offending. Furthermore, given mixed findings to date on the extent on the role that gender plays, the relative risk of violence given heavy episodic drinking by gender will also be examined. This study specifically addresses the following research questions:

> *Are alcohol consumption patterns temporally associated with violent behaviour in young people*?
>
> *Does concurrent alcohol consumption increase the risk of violent offending?*
>
> *What is the relative risk of heavy episodic drinking frequency on violent outcomes?*
>
> *Does this differ for males and females?*

We hypothesise that:

> (1) at times when young people are drinking more they are more likely to behave violently;
>
> (2) the more frequently young people drink to excess the more likely they are to commit a violent offence; and
>
> (3) being male is likely to be associated with a greater risk of committing an assault offence, regardless of frequency of heavy episodic drinking or age at which this is performed.

The paper presents three nested repeated measures models exploring the relative contribution of heavy episodic drinking to the likelihood of assault as well as highlighting the variation accounted for within and between individual's propensity to commit assault controlling for their drinking behaviour and subsequently presents the final model

separately for males and females. The results are then discussed with reference to prior findings of a contemporaneous association between heavy episodic drinking and violence (XXXX 2011) and existing evidence that at times when young people are drinking more they are more likely to behaviour violently.

Data and Methods

The survey

The UK Home Office's Offending Crime and Justice Survey (OCJS) was selected for this study. The OCJS is a self-report survey of young people aged 10-29 in England and Wales, which asks about their drinking as well as offending behaviour. The survey was administered using (audio-) computer assisted interviewing (CASI)[i] to encourage honest self-reports of offending and drug use (see Phelps et al. 2007 for further details on the administration of the survey). The OCJS was designed as a four-year rotating panel survey (2003-2006); that is, each year, part of the previous year's sample is re-interviewed in the same manner and is augmented by a fresh sample to ensure a representative sample of young people in each sweep. For more detail on the sampling strategy and survey design please refer to Phelps et al. (2007).

The sample

The sample design (similar in design to other national household surveys, such as the Crime Survey for England and Wales) captures those individuals resident in households. Thus particular populations such as homeless people, more serious offenders who are incarcerated in prison or institutes for young offenders, or those with clinically identified drug and alcohol problems that may be in hospital or care are absent from the data. These populations, however, may exhibit distinct (and possibly more serious) drinking and offending profiles and studying a non-clinical and non-custodial sample is beneficial as it allows for assessment of general population behaviour and provides information on 'normative' behaviour and can thus help identify those at risk of violent offending in the general population.

A subset of the panel sample (those who responded and were regular drinkers[ii] in the final sweep and at least on one other occasion) was employed here to run repeated measures models investigating the impact of drinking behaviour on violent behaviour over the period of late adolescence and early adulthood. Data from three sweeps (2004, 2005 and 2006) were used in the models presented here. Panel response rates for each of the three sweeps were between 82 and 85 per cent. For these models a subset of those panel respondents that had responded in 2006 and at least on one prior occasion and for whom heavy episodic drinking measures were captured was used. Given the low numbers of regular drinkers under age 16, the models run here examine the impact of drinking patterns on violent behaviour will focus specifically on those aged 16 to 29 in 2006 (N=2415)[iii]. Data from the 2003 sweep could not be utilised in the current study, as the heavy episodic drinking

questions were not introduced until the second sweep of the survey. There were 77 cases which had one or more missing values for the response and/or explanatory variables used in the final model of the analysis.[iv] To optimise comparability, these cases were removed from all models.

Measures

Heavy episodic drinking is defined in the UK by drinking more than twice the daily UK Government recommended daily unit allowance (six/eight units (48g/64g)[v] of alcohol for females and males respectively) on one day; (DH 1995). This measure is used as a proxy for 'binge' or heavy episodic drinking in other national government surveys such as the General Lifestyle Survey, which informs the Alcohol Harm Reduction Strategy for England and National Alcohol Strategy. In line with this, the frequency of drinking more than six/eight units in one day (for females and males respectively) in the last month was used in the OCJS. Procedures were taken to ensure participants' understanding of this question by giving them a list of drink types to choose from which the respective number of units could then be calculated (see Maxwell et al. 2007)[vi].

A measure of the frequency of heavy episodic drinking was important. The heavy episodic drinking variable available in the standard OJCS dataset is constructed on a six-point ordinal scale form 'less than once every couple of months' to 'most days'. However, this variable includes categories with low frequencies, which will cause problems when modelling, and so this variable has been collapsed into three categories for the purposes of this study:

1) *those that do not engage in heavy episodic drinking* representing those who drank modestly but never exceeded twice the recommended daily allowance.
2) *those that engage in heavy episodic drinking at a low frequency* (once to ten times a month) comprising over two thirds of those who drank once a month or more and perhaps representing those who exceeded twice the recommended daily limits up to / around twice a week and perhaps constituting a group of 'weekend' drinkers.
3) *those that engage in heavy episodic drinking more frequently* (eleven times a month or more); comprising a minority of drinkers (8.3%) who's heavy drinking occurs more than this (i.e. on more days of the week).

As heavy episodic drinking frequency was asked only of those that drank at least once a month or more, the findings presented here exclude abstainers and infrequent drinkers.

To capture violent behaviour this study focuses specifically on interpersonal assault, which is the most common form of physical violence perpetrated by young people (WHO, 2006; McVeigh et al. 2005). The violent behaviour measure will be whether the respondent had committed an assault in the last year (regardless of whether or not the other party incurred an injury). [vii]

There is a discrepancy in the timescales to which the heavy episodic drinking and assault measure refer: the former asks about drinking frequency in the last month and the latter

asking about occurrences in the last year. This is less problematic than it might be as we are essentially asking people about their recent behaviour. Although there will be some developmental variation, a person's drinking behaviour in the last month will be a strong predictor of their drinking behaviour over the last year. To the extent that there is unmeasured variation this will tend to reduce the extent of any association.

A bigger limitation of the data is that it does not identify whether heavy episodic drinking occurred in an assault episode (concomitantly). So the hypothesis that heavy episodic drinking and violent behaviours occur concurrently cannot be verified using these measures; this limits any claims that can be made as to the immediate causal role of heavy episodic drinking in assault outcomes.

As with most secondary data the OCJS does not capture gender. In order to proxy for gender, the available dichotomous sex variable (male/female) was employed as an explanatory variable. This approach has been adopted elsewhere (see e.g, Ostergaard 2007, Measham 2002) and facilitates an examination of the distinctions between male and female drinking patterns and associated behavioural outcomes, given that experiences of drinking are likely to be different for males and females (Hutton et al. 2013, Ostergaard 2007) as it the probability of violent outcomes (Finney 2004, Fagan 1990, McVeigh 2005, Matthews and Richardson 2005).

Age has been re-specified here to start from zero at age 16, to aid interpretation of the resulting coefficients: age coefficients thus pertain to one year's increase in age starting from the age of 16 and up to the age of 29. An age-squared term is also specified to assess the likely shape of the violent behavioural trajectory. The mean age of respondents was 19.9 (Standard deviation 3.15).

A measure of social class (SEC code[viii]) was available in the OCJS dataset but was not employed in current analyses as earlier cross sectional analyses of the 2006 sweep found that the association of this variable and assault to be non-significant. Individual level risk factors such as sex, age and frequency heavy episodic drinking were significant in the cross-sectional analyses and so are examined in further detail here.

Methods

In initial exploratory analyses (see XXXX 2011) logistic regression models were run to examine the impact of heavy episodic drinking in the current and previous sweeps on committing an assault in the 2006 sweep. Those models were informative but did not account for the longitudinal design. The models presented here use a multi-level repeated measures framework, which accounts for the nesting of observations over time within individuals.

As Snijders (2012) describes, time constant and time varying covariates - such as heavy episodic drinking frequency and age in this study – can be incorporated in a multi-level

repeated measures framework. Such a framework also allows for a consideration of either a random intercept in which a different starting levels (at time 1) for each individual is allowed and/or a random slopes model to allow a different rate of change for each individual (across time). The models can thus separate out within-person and between-persons variance and the proportion of variability attributable to each. In the binomial logistic multi-level models presented here, a random slope and intercept are being specified to account for variation in the starting level and rate of change in the outcome between individuals.

Data preparation was performed in SPSS version 16 and the repeated measures models were fitted using MLwiN version 2.21. Three nested repeated measures models were run to examine the contribution of heavy episodic drinking in predicting the likelihood of assault as well as examining the variation accounted for within and between individual's propensity to commit assault. The final model was then run separately for males and females to explore whether differing processes may be operating between the sexes. In all of these models, age is controlled for as is sweep year given the multiple overlapping cohorts study design (that is, people can be of different ages in different years). This minimises possible cofounding by period effects. An age squared term is introduced into the models to assess whether shape of the predicted trajectory of the outcome is curvilinear. An interaction effect between age and heavy episodic drinking is also added to test whether there might be change in the effects of alcohol on violent behaviour as individuals get older. Risk of violent behaviour more generally is inherently controlled for in the model specification here as the outcome variable measuring violence pertains to violence in any of the three sweeps under study – that is, it is allowed to vary by time.

Findings

Of the total 2338 included individuals aged 16-29 in the current study, 46.2% were male and the average age was 20 (standard deviation of 3.15). Of these individuals, at their earliest record in the survey, just under a quarter (23%) never engaged in heavy episodic drinking, over two thirds (68.7%) did so at the lower frequency (once to ten times a month) and 8.3% were classified as those that drank heavily in one drinking episode at the higher frequency of eleven times a month or more. Almost twice as many males were classified as engaging in heavy episodic drinking at the higher frequency (eleven times a month or more; 11.3%) compared to females (5.7%). 13.6% of the sample had committed an assault offence with almost twice as many males having done so compared to females (18.1% and 9.8% respectively). The relationship between heavy episodic drinking frequency and having committed an assault offence is displayed in Table 1 below. The association between the two variables is significant (χ^2= 44.101, df=2, p<.001) with the proportion of those committing an assault offence increasing in line with increased heavy episodic drinking frequency categories.

TABLE 1 ABOUT HERE

A series of binomial repeated measures models were run to examine the effects of heavy episodic drinking on violent behaviour controlling for age and sex as well as time (sweep year; which will be fitted as a categorical covariate given the non-linear change in assault over time apparent from exploratory analyses (available on request)). Table 2 illustrates the resulting coefficients for each of these stages, which will be documented and narrated in turn.

Initially a binomial null model[ix,x] was run to predict the outcome (assault) from the constant and sweep year (see Model 1, Table 2). The variance partition coefficient[xi] was 0.61 for this model[xii], suggesting that 61% of variation in risk of assault is between people, the remainder between occasions. Coefficients from this model suggest that the overall contribution of sweep year is significant and thus worth controlling for when considering multiple overlapping cohorts. It will therefore be retained in subsequent models.[xiii]

TABLE 2 ABOUT HERE

Age and sex were added to the model as fixed effect explanatory variables (Model 2, Table 2), leading to a slight reduction in the variance partition coefficient; having accounted for age and gender variation, 57% of unexplained variation in risk of assault is between people, the remainder between occasions. Both age and sex were found to be significant predictors, with males being more likely to commit assault and with age being negatively related to the risk of committing an assault.

The model was further developed to examine the impact of heavy episodic drinking frequency on assault through the addition of dummy variables in the fixed part of the model (Model 3, Table 2). This highlighted a significant effect of heavy episodic drinking, with the probability of assault increasing in size with increased heavy episodic drinking frequency. Again the variance partition coefficient reduced slightly; in this model 55% of unexplained variation in risk of assault is between people, with the remainder being between occasions. Males, people at the younger end of the age range and those that drink heavily in single episodes, especially the most frequent heavy episodic drinkers are more likely to commit assault.

The fourth model (Model 4, Table 2) included an age and heavy episodic drinking interaction term to examine whether the impact of heavy episodic drinking was moderated by age. The variance partition coefficient in this model was similar to that of Model 3 (0.56) and, only one of the interaction effects was found to be non-significant..

To more accurately interpret the impact of age on the rate of change in violent behaviour an age-squared term was entered into the module (Model 5, Table 2). The variance partition coefficient in this model was 0.56 and the age squared term was significant and in a positive direction, thus modifying the negative age term slightly; age, sex and heavy episodic drinking all remained significant covariates in the model.[xiv]

The models reported above include sex as a fixed effect. However, it is reasonable to consider the possibility that the relationships between the explanatory and response variables may be different for males and females. We therefore also ran the models separately for men and women.

When run on male respondents only, the resulting models suggest that heavy episodic drinking remains a significant predictor of assault, increasing monotonically with the frequency of heavy episodic drinking (see Model 3 and 4, Table 3). Age also remains significant in a negative direction with a significant positive age squared coefficient (Model 4, Table 3). The variance partition coefficient reduced from 0.61 in Model 1, to 0.59 in Model 2 and then to 0.57 for model 3, which is similar to that of Model 4 (0.56) and to those in the comparable models for both genders (see above).

TABLE 3 ABOUT HERE

On examining only female respondents, findings suggest that heavy episodic drinking is once more a significant predictor of assault outcomes (see Models 3 and 4, Table 4). However, compared to the male only model, the effects of low level heavy episodic drinking frequency are less pronounced. Nonetheless, as with males, the risk of an assault outcome increases with increased heavy episodic drinking frequency and age is a significant predictor also, with older respondents being less likely to commit an assault offence. Once again a small positive effect of the age-squared term was present (Model 4, Table 4).

TABLE 4 ABOUT HERE

Post-estimation of the predicted probabilities for males and females, as shown in Figure 1, clearly display a general trend of declining risk of committing and assault offence with age with males being more probable than females of doing so between the ages of 16 and 29. However, what is also apparent is the narrowing gap in risk between the genders as age increases, with the probabilities - conditional on heavy episodic drinking - almost converging by age 29.[xv]

FIGURE 1 ABOUT HERE

Predicted probabilities by heavy episodic drinking category are displayed in Figure 2. These suggest that the likelihood of committing an assault decreases as age increases for all three categories. The high frequency heavy episodic drinking group mostly display elevated risk at all ages compared to the other groups; however, they also display the greatest reduction in risk by age.[xvi]

FIGURE 2 ABOUT HERE

The mean predicted probabilities calculated for males by heavy episodic drinking group (see Table 4) suggest that the probability of committing an assault approximately doubles for each pairwise increase in the heavy episodic drinking frequency variable: those who do not binge drink have a 1 in 20 chance of committing an assault offence, whereas those who binge drink at the low frequency have a 1 in 10 chance and those who binge drink at the high frequency have a 1 in 5 chance. The same trend can be seen amongst females, but the probability is estimated at approximately half that of males for each given category of heavy episodic drinking frequency: a 1 in 10 chance of committing and assault offence is seen amongst females performing heavy episodic drinking at the high frequency and this risk reduces with reduced heavy episodic drinking frequency (for example, to a 1 in 20 chance for those performing heavy episodic drinking at the lower frequency).

TABLE 5 ABOUT HERE

Discussion

Although it is not possible to determine causality in the current study, all three of our hypotheses were partially supported. The headline result reported above suggests the risk of committing an assault offence increases monotonically with increased heavy episodic drinking frequency (for both genders) and confirms findings from an earlier study using logistic regression models (XXXX 2011). This finding resembles that identified in a meta-analysis by Lipsey et al. (1997) and also the finding that increases in alcohol consumption are associated with a monotonic increased risk of injury, as established by Taylor et al. (2010).

The study also adds to the longitudinal evidence base on UK general population samples an estimation of the inherent variation in violence that is attributable to individual development: the variance partition coefficients (VPCs) suggest that around 60% of the variation in assault is between young people and the remainder (around 40%) is between occasions within young people. This finding suggests that when considering the violence alcohol relationship a developmental framework is of indeed of value. Findings suggest: (1) that males, compared to females, show an elevated risk of violence conditional on their drinking but that this almost converges by age 29 and (2) the risk of violent outcomes is positively associated with heavy episodic drinking frequency, but that the probability for females is estimated at about half that of males for each given category of heavy episodic drinking frequency. The current study also identifies that it is those that have recently engaged in heavy episodic drinking that are associated with a higher likelihood of committing an assault offence. Thus increases/decreases in the probability of committing assault over time are seemingly dependent on proximal levels of drinking, as identified in other studies (see Loeber et al. 2003 for a review). Indeed, predicted probabilities suggest a general reduction in the likelihood of committing an assault offence as age increases for those classified as low frequency heavy episodic drinkers or those that do not drink heavily. However, the high frequency heavy episodic drinking group mostly display elevated risk at all ages compared to the other groups, yet are also the group that display the greatest absolute decline in risk over time.

Whilst a contemporaneous association does not imply causation - there remains a possibility that both drinking and violent behaviour are symptomatic of a wider syndrome of anti-social behaviour which fluctuates over the life course (*cf.* Farrington 2003) - it suggests heavy episodic drinking can be considered akin to a time-specific risk factor for elevations in violent behaviour similar to that reported by Hussong et al. (2004) in relation to substance misuse and anti-social behaviour.

Age and gender are identified as significant predictors of assault suggesting that males and younger people (within this age group) are more likely to commit assault offences, as established in many other studies. The positive age-squared term modifies the negative effect of age in both the combined and single gender models so that the impact of age decreases the older the young person gets. This resonates with established findings concerning violent offending trajectories and criminal careers (see Siennick and Osgood 2008).

Results obtained here further suggest that the effect of low frequency heavy episodic drinking on the probability of violence appears to be greater for males than females. Although (conditional on heavy episodic drinking) the predicted probabilities for males and females converge as age increases, which might be related to different progressions through socialisation processes and the preferences for stabilising influences such as long-term

relationships. However, these possibilities are speculations in the current context and would need further study.

Limitations of the current study

Alongside measurement issues associated with secondary data, established concerns surrounding self-reports (see Thornberry and Krohn 2000; Smith and McVie 2003 and Pudney 2006 for issues concerning the OCJS in particular), and the underreporting of alcohol use using survey measures and associated underestimation of alcohol-related harms (Goddard 2001; Bellis et al. 2009), there remain concerns associated with missing data and attrition. Overall, attrition rates were relatively low and panel response rates ranged between 82 and 85%. However, retention rates were lowest amongst those aged 18 and over.

The focus in this paper was on the role of age, gender and drinking on violent behaviour and the proportion of variation in violent behaviour accountable within and between individuals given their drinking patterns. Young people's behaviour and lives are complex and not all factors influencing their behaviour can be accounted for in the statistical models presented here. Many other social factors are known to influence changes in offending over the life course. Here we were not focused upon the varied social experience of young people conditional on their socio-economic status or class, not least because of the insignificant findings in earlier cross-sectional analyses. However, further analyses accounting for relative social (dis)advantage and gendered interactions conditional on this would, however, make for an interesting extension to this research.

Conclusions

The findings here provide further insight into of the dynamic role of alcohol on the risk of violent offending over the stages of young adolescence and early adulthood: the evidence presented builds on the limited evidence of the association between concurrent heavy episodic drinking and violence based on UK samples and adds to this an assessment of the proportion of which is attributable to developmental fluctuations in both alcohol and violent behaviour during young adulthood. This study found that assault offences are more probable the more frequently young people engage in heavy episodic drinking and the results also indicate that differential levels of risk for younger males and females ought to be accounted for when seeking to reduce violence and alcohol-related violence.

The current findings also align themselves with findings from studies elsewhere which highlight that at times when young people are drinking more they are more likely to behaviour violently, suggesting that interventions aimed at reducing drinking in late adolescence are likely to reduce the prevalence of violent assault offences in this age group. Given the temporally proximal relationship between alcohol and violence indicated here, situational crime prevention techniques, which aim to reduce the likelihood of violent incidents in high risk drinking environments, may also help reduce violent incidents in high-risk settings. In addition to this temporal proximity of drinking and violent behaviours, 40%

of the variation in violent behaviour was identified within individuals, thus lending support to those who favour targeted and prompt intervention with young individuals who display high frequency heavy episodic drinking or marked increases in drinking behaviour as they navigate through the transitions between late adolescence and early adulthood[xvii].

The current findings support the use of a developmental framework to understand alcohol related violence. We thus concur with McCambridge and Rowe (2011) who highlight a need to develop a longer term perspective on harm reduction in relation to alcohol consumption, poor health, social outcomes and later alcohol problems, which requires the support of better longer scale longitudinal data relating to alcohol consumption and related harms.

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Table 1: Percentage of those having committed an assault offence by heavy episodic drinking frequency in panel sample and gender.

		No heavy episodic drinking	**Low heavy episodic drinking (once to ten times a month)**	**High heavy episodic drinking (eleven times a month or more)**	**Total**
Male	No assault offence	89.20%	81.70%	69.70%	81.90% (881)
	Assault offence	10.80%	18.30%	30.30%	18.10% (195)
	Total	100.00% (222)	100.00% (732)	100.00% (122)	100.00% (1076)
Female	No assault offence	94.90%	89.30%	80.60%	90.20% (1132)
	Assault offence	5.10%	10.70%	19.40%	9.80%

					(123)
	Total	100.00% (314)	100.00% (869)	100.00% (72)	100.00% (1255)
Total	No assault offence	92.50%	85.80%	73.70%	86.40% (2013)
	Assault offence	7.50%	14.20%	26.30%	13.60% (318)
	Total	100.00% (536)	100.00% (1601)	100.00% (194)	100.00% (2331)

* 7 cases were dropped from this analysis as they did not have responses to both variables in the same sweep.

Table 2 Model coefficients: predicting assault (base no assault offence)

	Model 1	P value	Model 2	P value	Model 3	P value	Model 4	P value	Model 5	P value
Constant	-3.023	**	0.401	n.s	-0.288	n.s	-2.247	**	8.103	**
Sweep 2005	-0.136	n.s	-0.119	n.s	-0.113	n.s	-0.1	n.s	-0.136	n.s
Sweep 2006	-0.864	**	-0.832	**	-0.789	**	-0.795	**	-0.912	**
Age-16			-0.189	**	-0.189	**	-0.094	*	-1.004	**
Male			1.024	**	0.924	**	0.951	**	0.946	**
Heavy episodic drinking low (reference category 'never')					0.953	**	3.221	**	0.989	**
Heavy episodic drinking high (reference category 'never')					1.561	**	4.479	*	1.627	**
Heavy episodic drinking low.Age-16							-0.114	*		
Heavy episodic high.Age-16							-0.146	n.s		
Age squared									0.019	**
Constant/Constant	5.337		4.559		3.95		4.225		4.175	
DIC:	2514.633		2487.159		2496.157		2482.807		2480.195	
Units: caseref	2338		2338		2338		2338		2338	
Units: sweep	4108		4108		4108		4108		4108	

*p ≤ .05; **p ≤ .01, n.s. = non significant

Model 1: overall contribution of sweep **, variance partition coefficient = 0.62; Model 2: overall contribution of sweep **, variance partition coefficient = 0.58; Model 3: overall contribution of sweep **, overall contribution of heavy episodic drinking **, variance partition coefficient = 0.55; Model 4: overall contribution of sweep **, overall contribution of heavy episodic drinking **, overall contribution of interaction *, variance partition coefficient = 0.56; Model 5: overall contribution of sweep **, overall contribution of heavy episodic drinking **, variance partition coefficient = 0.56.

Table 3 Model coefficients: predicting assault (base no assault offence) males

	Model 1	P value	Model 2	P value	Model 3	P value	Model 4	P value
Response	assault		assault		assault		assault	
Constant	-2.415	**	1.525	*	0.926	n.s	3.191	n.s
Sweep 2005	-0.291	n.s	-0.254	n.s	-0.212	n.s	-0.228	n.s
Sweep 2006	-0.953	**	-0.897	**	-0.84	**	-0.881	**
Age-16			-0.194	**	-0.209	**	-0.424	n.s
Heavy episodic drinking low (reference category 'never')					0.989	**	0.999	**
Heavy episodic drinking high (reference category 'never')					1.584	**	1.607	**
Age squared							0.005	n.s
Constant/Constant	5.391		5.006		4.63		4.69	
Level: sweep								
DIC:	1428.444		1416.874		1417.398		1419.09	
Units: caseref	1079		1079		1079		1079	
Units: sweep	1926		1926		1926		1926	

*p ≤ .05; **p ≤ .01, n.s. = non significant

Model 1: overall contribution of sweep **, variance partition coefficient= 0.62; Model 2: overall contribution of sweep **, variance partition coefficient= 0.60
Model 3: overall contribution of sweep **, overall contribution of heavy episodic drinking **, variance partition coefficient = 0.58
Model 4: overall contribution of sweep **, overall contribution of heavy episodic drinking **, VPC = 0.59

Table 4 Model coefficients: predicting assault (base no assault offence) females

	Model 1	P value	Model 2	P value	Model 3	P value	Model 4	P value
Response	assault		assault		assault		assault	
Constant	-3.486	**	0.646	n.s	-0.144	n.s	16.87	**
Sweep 2005	0.055	n.s	0.027	n.s	0.006	n.s	-0.055	n.s
Sweep 2006	-0.74	**	-0.78	**	-0.78	**	-1.069	**
Age-16			-0.198	**	-0.193	**	-1.849	**
Heavy episodic drinking low (reference category 'never')					0.874	**	0.947	**
Heavy episodic drinking high (reference category 'never')					1.541	**	1.643	**
Age squared							0.039	**
Constant/Constant	4.414		4.018		3.789		3.862	
Level: sweep								
DIC:	1091.993		1079.954		1084.544		1064.951	
Units: caseref	1259		1259		1259		1259	
Units: sweep	2182		2182		2182		2182	

*p ≤ .05; **p ≤ .01, n.s. = non significant

Model 1: overall contribution of sweep **, variance partition coefficient = 0.57 Model 2: overall contribution of sweep **, variance partition coefficient= 0.55
Model 3: overall contribution of sweep **, overall contribution of heavy episodic drinking **, variance partition coefficient= 0.54
Model 4: overall contribution of sweep **, overall contribution of heavy episodic drinking **, VPC = 0.54

Figure 1 Mean predicted probabilities by age and gender[xviii]

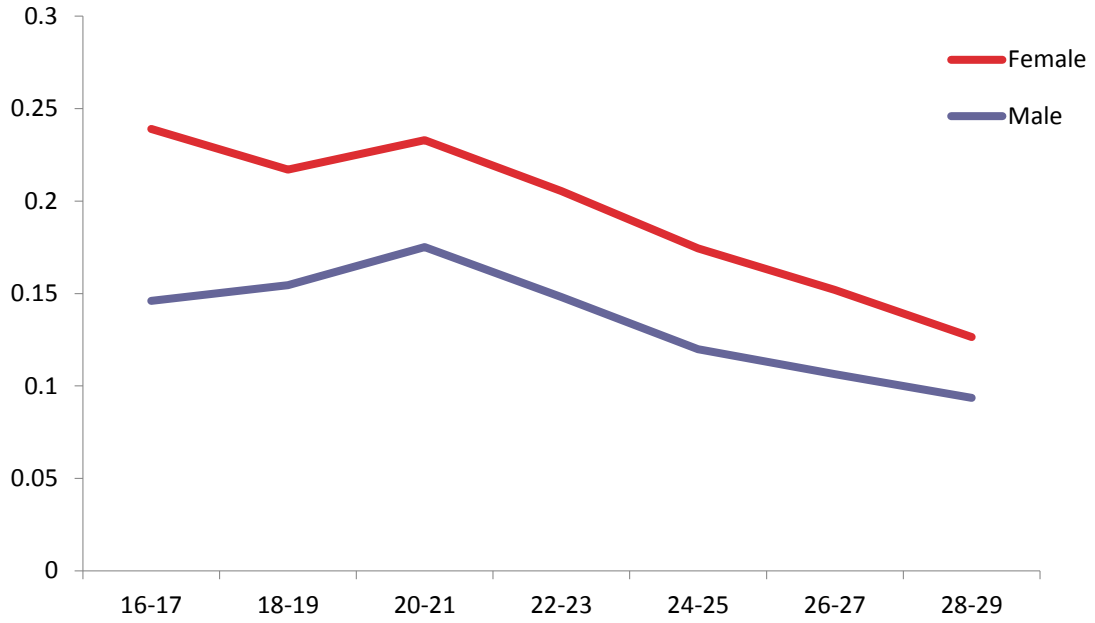

Figure 2 Mean predicted probabilities by age and heavy episodic drinking category[xix]

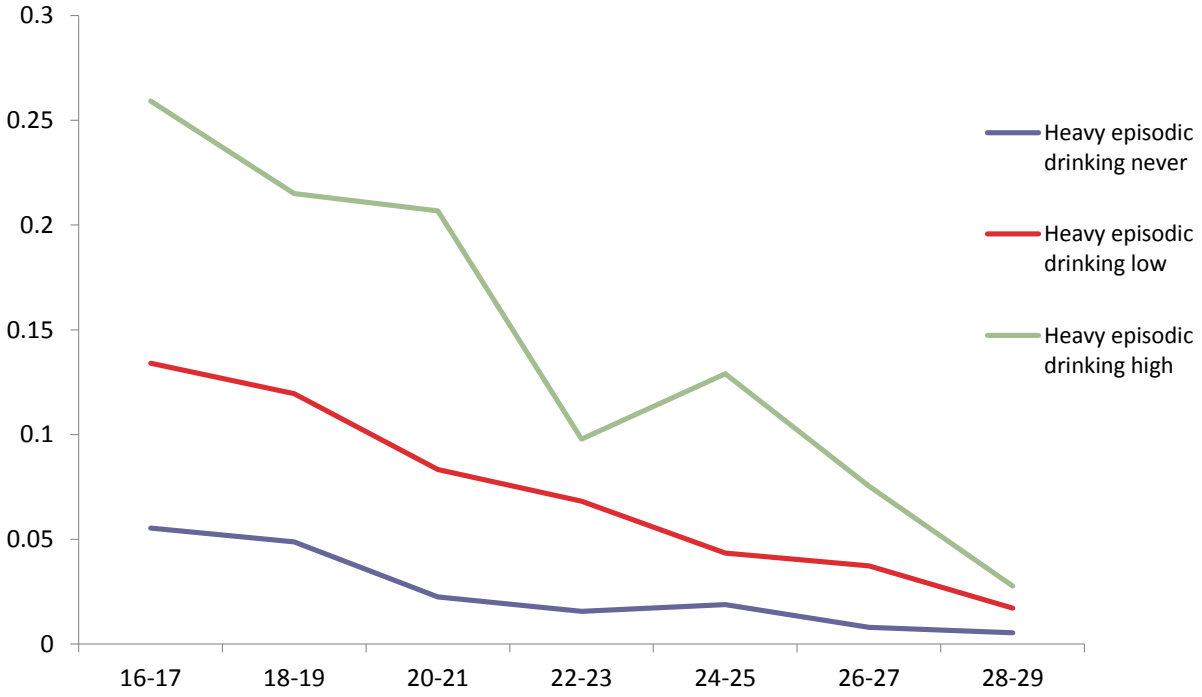

Table 5: Mean predicted probabilities by gender and heavy episodic drinking frequency

Gender	Heavy episodic drinking frequency	Mean	Std. Deviation
Male	No heavy episodic drinking	.0524	.09833
	Low heavy episodic drinking	.1257	.18006
	High heavy episodic drinking	.2126	.23820
	Total	.1230	.18188
Female	No heavy episodic drinking	.0196	.05014
	Low heavy episodic drinking	.0521	.09984
	High heavy episodic drinking	.1162	.18691
	Total	.0488	.10166
Total	No heavy episodic drinking	.0330	.07552
	Low heavy episodic drinking	.0864	.14756
	High heavy episodic drinking	.1764	.22498
	Total	.0836	.14955

[i] Audio-CASI allows respondents to listen to questions and possible answers via headphones before entering their response directly into a computer.

[ii] These are people who reported drinking at least once a month. It was decided to exclude from the subset those who reported drinking less frequently than this (including abstainers) as we wished to make the specific comparison comparing regular drinkers to heavy episodic drinkers, with a control group of regular drinkers who did not binge drink. The inclusion of the effective non-drinkers would have created a heterogeneous control group.

[iii] The number of under 16 year old regular drinkers 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). As we wished to include age as a covariate the small numbers made the models unstable. Furthermore, the small proportion those aged under 16 that were drinkers gives reason to be concerned that that group maybe categorically different from those in the over 16 year old group.

[iv] Analysis of these cases indicated that they were no more likely to come from the heavy drinking group and therefore that this missingness was unrelated to the level of drinking variable used in this study.

[v] A unit is a measurement of alcohol used in the UK to define recommended limits for alcohol consumption. One unit equates to 10 millilitres or 8 grams of pure ethanol; approximately the equivalent amount of alcohol contained in half a pint of beer or lager, a small glass of wine, or in a standard measure of spirits (Department of Health, 1995).

[vi] To aid interpretation of the number of units consumed the following list was made available to respondents:
"1 pint of normal or continental strength beer or lager (e.g. Carling, Fosters, Stella) = 2 units
1 bottle or can of normal or continental strength beer or lager (e.g. Budweiser, Becks, Stella) = 1 unit
1 pint of cider or stout (e.g. Strongbow, Guinness) = 2 units
1 can of strong beer or lager or cider (e.g. Tennant's Super, Special Brew, Diamond White) = 4 units
1 glass of wine = 1.5 units
1 single measure of spirits or liqueur = 1 unit
1 bottle of Alcopop (e.g. Bacardi Breezer, Smirnoff Ice, Hooper's Hooch) = 1.5 units" (Maxwell et al., 2007).

[vii] This definition was chosen to represent physical violence. Whilst this excludes many other forms of violence, such as emotional and sexual abuse, it was chosen based on previous research findings that suggest assault is the most common form of violence perpetrated by young people (especially those aged 18-24), in which excessive alcohol consumption often features.

[viii] http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/soc2010/soc2010-volume-3-ns-sec--rebased-on-soc2010--user-manual/index.html

[ix] Even in the "null" model sweep year was included as a control as we wished to factor out any period effect, to allow for possible fluctuations in violent offending over the three years.

[x] For the multilevel logistic regression models, Monte Carlo Markov Chain (MCMC) estimation was used, implemented via MLwiN (Browne, 2009). MCMC estimation generally leads to better estimates of the model parameters than other methods, such as Penalised Quasi Likelihood (PQL). All models presented in the current paper employ MCMC with 20000 iterations.

[xi] In interval response models this is treated as equivalent to the interclass correlation (sometimes referred to as *Rho*). However in binary response models there is no such equivalence.

[xii] This was calculated using the latent variable approach (see Snijders and Bosker (2012) for a description and Browne et al (2005) for an analytical critique of this and other approaches).

[xiii] It may at first sight seem confusing that we have a random effect of occasion and a fixed effect of sweep year since they appear conflated. However, sweep year gives a period effect which effectively control for the mean level of assault in any one year, still allowing for variation within individuals across time. We avoid the identification problem because we do not control for cohort.

[xiv] Model 5 has the lowest DIC indicating that it was best able to explain the response variable. We cannot formally test for differences between the models using the likelihood ratios as we have used MCMC rather than maximum likelihood to estimate our models.

[xv] The projected probabilities displayed here are not smooth curves as they are conditional on other factors accounted for in the model, such as sweep and drinking.

[xvi] Once more, the probabilities do not yield smooth curves, as they are conditional on gender, age and sweep year as well as heavy episodic drinking frequency.

[xvii] Interventions targeted at known violent offenders with alcohol or substance misuse problems often focus on modifying substance misusing behaviour and impulse control to reduce recidivism (using models predominantly grounded in rational choice theory). However, as no causal ordering can be identified in the current study, nor could alcohol be determined as a feature of violent offending at the time of the offence, such drinking patterns do not necessarily result in violent behaviour and caution must be issued in assuming heavy episodic drinking as a risk factor for violent offending.

[xviii] Confidence intervals are not shown, as standard errors of predictions are not calculated when using MCMC estimation procedures.

[xix] Confidence intervals are not shown, as standard errors of predictions are not calculated when using MCMC estimation procedures.