Investigating parental monitoring, school and family influences on adolescent alcohol use

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Introduction

Adolescence is a dynamic developmental period, during which young people develop behaviours and habits that affect their health and social outcomes. Teenage drinking in particular has become a major public health concern, with under-18s consuming more alcohol than in previous generations, seduced by a new range of alcoholic drinks designed for the brand-savvy youth consumer. A recent UK survey indicated that 70 per cent of 13-14 year olds and 89 per cent of 15-16 year olds had, had an alcoholic drink; the most common age for a first drink was 12 to 13 years old, usually when with an adult and celebrating a special occasion (Bremner et al., 2011). Adolescent alcohol use has been associated with delinquency and violence (Peleg-Oren et al., 2009; Felson, Teasdale & Burchfield, 2008; Ellickson, Tucker & Klein, 2003); early sexual debut and risky sexual behaviour (Fergusson & Lynskey, 1996; Cavazos-Rehg et al., 2010) and poor academic performance (Balsa, Giuliano, & French, 2011; Peleg-Oren et al., 2009; Barry, Chaney & Chaney, 2011).

Within the social context navigated by these adolescents attempts to identify the behavioural determinants of teenage alcohol use, has stimulated much interest. A thorough understanding of adolescent substance use must consider the complex interplay among adolescents, their families, and their social environments (Cleveland, Feinberg & Greenberg, 2010). The family is a key influence on children's and young people's behaviour (Sondhi & Turner, 2011); however, interventions at the level of the family that aim to reduce adolescent behaviour have weak effects overall (Smit et al., 2008). As young people get older, primary influences tend to move from the parents to the peer group and other societal factors (Armsden, and Greenberg, 1987). Several seminal studies have demonstrated that disengagement from pro-social entities (such as school) and either simultaneous or subsequent engagement with anti-social entities (e.g. delinquent or substance-using friends) are critical contributors to adolescent alcohol use (Henry, Oetting, & Slater, 2009). None the less, parental and family factors still hold huge sway over how much influence these other factors have, and at which stages they will start to predominate (Velleman, 2009). Understanding how these interactions play out between family, peer and school processes, requires further investigation.

Parental monitoring

For parents of teenagers, negotiating adolescence is a notoriously difficult task requiring the development of parenting practices such as 'parental monitoring.' Parental monitoring refers to a parents' knowledge of their child's whereabouts, activities and associations or social connections (see Patock-Peckham et al., 2011, Ledoux et al., 2002; Stattin & Kerr, 2000; Soenens et al., 2006; Borawski et al., 2003). Evidence drawn from an extensive body of literature connects low levels of parental monitoring to a wide range of antisocial and risk behaviours (e.g. Ary et al., 1999). Of particular relevance to this study, low parental monitoring has been associated with: teenage alcohol use (Fosco et al., 2012; Pokhrel et al., 2008; Velleman, 2009; Bahr, Hoffman & Yang, 2005, Bremner et al., 2011; Barnes & Farrell, 1992; Nash, McQueen & Bray, 2005; De Haan & Boljevac, 2009); initial levels of alcohol misuse and rates of increase in alcohol misuse (Barnes et al., 2000; Barnes et al., 2006; Ryan, Jorm & Lubman, 2010); lifetime alcohol use (Habib et al., 2010); frequent drinking (Bremner et al., 2011; Marsden et al., 2005); excessive, risky, binge or problematic drinking (Bremner et al., 2011; Piko & Kovács, 2010; Habib et al., 2010; Arata, Stafford & Tims, 2003; Gossrau-Breen, Kuntsche & Gmel, 2010).

Few studies have identified attempted to identify patterns of parental monitoring. Tobler & Komro (2010) identified four trajectories of monitoring (and communication) (in a sample of 2621, 6th-8th graders): high (76.4%), medium (9.1%), decreasing (6%) and inconsistent (8.5%). Relative to those with high monitoring/communication, youth in the decreasing and inconsistent trajectories were at significantly greater risk for past year and past month alcohol use. Cleveland et al. (2005) reported effective parenting (including monitoring the child's activities) protected adolescents from subsequent alcohol use more than five years later, and, these protective effects were strongest among families residing in high-risk neighbourhoods. The effects of parental monitoring may also confer differential risks for sons and daughters. Griffin et al. (2000) found an association between increased parental monitoring and less drinking among boys in a sample of 228 sixth-grade students. Borawski et al. (2003) also reported an association between high parental monitoring and less alcohol use among males; parental monitoring had no effect on female behaviour (692 adolescents in 9th & 10th grades); others (see Ledoux et al., 2002; Fosco et al., 2012) have reported no gender differences. The degree of influence of parental monitoring (or knowledge), in the context of other family variables, has been demonstrated across studies. Griffin et al. (2000) indicated parental monitoring as having the strongest protective effect of any parenting

variable in a study which also investigated parent-child communication and parental involvement. Ledoux et al. (2002) reported other family variables such as the family structure, maternal and parental relationships, showed greatly reduced significance, once parental knowledge was taken into account.

The direction of the association between parental monitoring and child alcohol use is not always specified or investigated in the extant literature, primarily due to the use of cross-sectional data. As the data for this study was collected over time, we can investigate the temporal ordering of the association between these factors, and thus try and unpick the causal relationships, or the extent to which one factor influences the other. In addition to the idea that low parental monitoring leads to higher adolescent alcohol use, it may be hypothesised that adolescents who use alcohol heavily may elicit increased levels of monitoring from their parents (i.e. reverse causation). Once adolescents begin 'normative' drinking in social settings without their parents, they may modify their behaviour around their parents asserting greater autonomy and encouraging their parents to permit greater independence in order to facilitate peer socialisation. Despite an explicit call from the creators of the standard parental monitoring scales to assess these youth-driven processes, few studies have used longitudinal data to do so (Kerr, Stattin & Burk, 2010) The Belfast Youth Development Study, having collected data on parental monitoring and alcohol use across the early adolescent years is eminently suited to clarifying the direction of association and clarify the extent to which these causal or reverse causal mechanisms hold true.

Child disclosure

Adolescence typically portents a shift away from parental reliance to greater autonomy, or a move from asymmetric to more symmetric relationships in which parents relax control (e.g. Keijsers et al., 2009) and adolescents gradually disclose less information in order to reduce parents' authority and gain more autonomy (Finkenauer, Engels, & Meeus, 2002). Although, initially operationalised as the 'tracking and surveillance of children's behaviour,' Stattin & Kerr's (2000) definition of parental monitoring was extended to assess not only the parent's knowledge but also the source of their knowledge (see Kerr & Stattin, 2000). This reinterpretation of 'parental monitoring' stems from their study of approximately seven hundred, 14 year olds which reported parental knowledge came mainly from child disclosure about their unsupervised activities outside the home whereby child disclosure was the source of knowledge that was most closely linked to broad and narrow measures of delinquency. More recently, Kerr, Stattin, & Burk (2010) revisited this hypothesis using

longitudinal data, which also indicating youth disclosure was a significant predictor of parental knowledge and neither measure of parents monitoring efforts-control or solicitation were significant predictors. Soenens et al. (2006) argue, although studies such as those by Kerr and colleagues, indicate parental knowledge has more do to with adolescents' self-disclosure than with parents active monitoring, this may be due to self-disclosure being influenced by parents' rearing style. In their investigation, characteristics such as high responsiveness, high behavioural control and low psychological control were associated with self-disclosure among students (Soenens et al., 2006). In addition, SEM analyses revealed parenting is both indirectly (through self-disclosure) and directly associated with perceived parental knowledge but not directly related to problem behaviour (including alcohol use) or affiliation with peers engaging in problem behaviour. Gender differences are also apparent. A study by Waizenhofer, Buchanan & Jackson-Newsom (2004), indicated mothers knew more about adolescents' activities than did fathers and were more likely than fathers to gain information by active supervision or voluntary disclosure from the adolescent. Fathers were more likely than mothers to receive information via their spouses/partners. Overall, these studies suggest that adolescents contribute actively to parental monitoring by managing strategically the information they disclose.

Parental solicitation

Studies on parental monitoring suggest parents solicit more information from girls than boys (according to the children, not the parents) (Stattin & Kerr, 2000). While a number of studies have investigated the role of solicitation in teenage alcohol use (e.g. Jimenez-Iglesias et al., 2013), to our knowledge, no evidence of an association between parental solicitation and teenage drinking has been reported. Results from a longitudinal study of adolescent alcohol use and parental source of knowledge, indicated parents active efforts to (control their youths or to) gain information through solicitation do not appear to have an effect in reducing their children's drinking behaviour (Stavrinides, Georgiou & Demetriou, 2010). The extant literature indicates children will reduce maladaptive behaviours when they are free to share their thoughts with their parents in a free and uncontrolling manner (Stattin & Kerr, 2000).

Parental control

The theoretical perspective of social control theory (Gottfredson & Hirschi, 1990) argues that a lack of parental monitoring and control plays a pivotal role in determining adolescents' involvement in deviant behaviour and substance use due to weakened ties with family,

school and other aspects of society that serve to diminish one's propensity for deviant behaviour. . According to this perspective, parental monitoring efforts can be effective in reducing opportunities for young people's association with deviant peers and risk taking (e.g. Dishion & McMahon, 1998). Lax parental control has been associated with increased drinking (Foxcroft & Lowe, 1991) and problematic alcohol use (McKay et al., 2010) among adolescents. van der Vorst et al., (2006), reported strict parental control was related to lower engagement in alcohol use among adolescents. Others have reported evidence of a possible curvilinear relationship between control and adolescent drinking. Stice, Barrera & Chassin (1993), found a negative linear relationship between parental control, parental support and adolescent alcohol use and both control and support were prospectively related to adolescent alcohol use. The authors concluded adolescents who receive either extreme of parental support or control are at risk for problem behaviours.

Parental attachment

One factor that would seem likely to influence the relationship between monitoring and alcohol use is parental attachment (Barnes et al., 2000). Problematic parent-child interactions may disrupt parents' attempts to monitor and control their children, and they may also be less open and honest in their activities. This disruption in attachment itself may lead to harmful alcohol use, above and beyond the risk conferred by different patterns of monitoring attributable to poor attachment. Family bonding or attachment appears to protect against alcohol use (Velleman, 2009; Anderson & Henry, 1994; Sokol-Katz, Dunham & Zimmerman, 1997). van der Vorst et al. (2006) found an association (cross-sectional) between parental attachment and early development of adolescent alcohol use (11-14 year olds). The study used 3 waves of data (baseline, 6 months, 12 months) and longitudinal analyses using SEM suggested a good attachment relationship between parent and child does not prevent adolescents from drinking. In terms of moderating effects, parental attachment did not moderate the association between parental control and an early development of alcohol use.

In this study, we have information on overall levels of parental monitoring of child activity, and information on the three methods of gaining monitoring information mentioned above. We propose to explore how each of these methods of monitoring

Peer influences

The influence of peer or peer alcohol use on teenage drinking has been widely reported (Dickens et al., 2012; Capaldi et al., 2009; Shortt et al., 2007; Simons-Morton, 2004, Dishion & Owen, 2002; Borsari & Carey, 2001; Barnes et al., 2006; Donovan et al., 2004; Trucco, Colder & Wieczork, 2011, Stoolmiller et al., 2012; Windle, 2000; Rai et al., 2003; Rawana & Ames, 2012; Andrews et al., 2002; Henry, Oetting & Slater, 2009). Evidence suggests young people are more likely to drink, drink frequently and drink to excess if they spend more than two evenings a week with friends (Bremner et al., 2011) or have friends who drink (Goodman et al., 2011; Bremner et al., 2011). Once again, gender differences are apparent. Friends' drinking has been more strongly related to alcohol use in girls, compared to boys, and in adolescents with opposite-sex friends, compared to adolescents with only same-sex friends (Dick et al., 2007). Peer relationships have been reported to have greater effects on drinking behaviour in female than in male adolescents (Yeh, Chiang & Huang, 2006; Simons-Morton et al., 2001). Gaughan (2006), investigating best friend dyads, reported adolescents in same-sex best friendships influenced one another mutually, boys in mixed-sex best friendships had an influence over their female friends' drinking patterns while girls did not have any effect on their male friends drinking behaviour. Others suggest having norm breaking friends is predictive of alcohol use among girls and young boys (Branstrom, Sjostrom & Andreasson, 2007). Perceived peer group drinking has also been demonstrated as a significant individual level predictor of drinking initiation (Stock et al., 2011) and increases in use (Capaldi et al., 2009).

In keeping with the general literature on development, adolescents appear to become increasingly socialised by their peers, often at the expense of parents' efforts (Latendresse et al., 2008). However, Velleman (2009) argues the family can continue to be a moderating influence throughout adolescence and even young adulthood. A number of studies have examined interactions between family and peer influences demonstrating these moderating effects (e.g. Nash, McQueen & Bray, 2005). Families which are characterised by low levels of parental monitoring and exposure to substance using peers may serve as a marker of increased vulnerability (Velleman, Templeton & Copello, 2005; Duncan et al., 1998**;** Dishion & Owen, 2002; Kuntsche & Jordan, 2006) playing a pivotal role in the onset and development of young people's alcohol use. Furthermore, parental monitoring is reportedly a protective factor for the selection of substance using friends (Cohen, Richardson & LaBree, 1994). Nash, McQueen & Bray (2005) demonstrated peer influence (use of alcohol by same age peers and friends, friends' approval of drinking) had a stronger effect on subsequent

adolescent behaviour than family environment. Family environment however influenced adolescents' peer characteristics: positive family environment was related to fewer peers that drank alcohol and less perceived peers' approval of drinking. Wood et al. (2004) reported significant associations between both peer and parental influences and alcohol involvement and showed that parental influences moderated peer influence drinking behaviour such that higher levels of perceived parental involvement were associated with weaker relations between peer influences and alcohol use and problems. Simons-Morton & Chen (2005) reported that although the growth in the number of friends who drink was positively associated with adolescent drinking, parental (involvement and) monitoring (and expectations) over time provided direct protective effects against drinking progression and indirect effects by limiting increases in the number of friends who drink. Bergh, Hagquist & Starrin (2011) found high levels of peer activity were associated with higher frequencies of alcohol use; although the effects of relations with parents were modified by peer activity frequencies, high levels of parental monitoring were significantly associated with lower frequencies of alcohol use, regardless of peer activity frequencies. Trucco, Colder & Wieczorek (2011) in a study of 11-13 year olds, reported high levels of peer delinquency prospectively predicted perceived peer approval and use of alcohol and that peer approval and use of alcohol prospectively predicted initiation of alcohol use. However, there was no support for parental (warmth or) control as moderators of peer influence. Kim & Neff (2010) reported both direct and indirect effects of parental monitoring on adolescent alcohol use; peer influence mediated the relationship between parental monitoring and adolescent alcohol use. Schinke, Fang & Cole (2008) found associations between girls' use of alcohol, who their friends were and their mothers knowledge of their whereabouts and companions. Studies such as Latendresse et al. (2008) have demonstrated that the mediating role of parenting decreases between early and later adolescence.

Attachments or emotional closeness to parents may also be mediated peers. Kelly et al. (2011) found that for girls, the effect of emotional closeness to mothers on alcohol use was mediated by exposure to high-risk peer networks. Overall, peer drinking networks showed stronger direct risk effects than family variables (i.e. emotional closeness, family conflict, parent disapproval of alcohol use). Martino, Ellickson & McCaffrey (2009) reported across a variety of peer contexts (including stable high association with drinking peers, stable low association and increasing association), youth were at lowest risk for developing problematic patterns of heavy drinking when they perceived that their parents maintained strong disapproval of substance use throughout adolescence.

Few studies have investigated whether the parenting experienced by one's friends also affects one's own use. Cleveland et al. (2012) identified 897 friendship groups among 7,439 ninth grade students. Adolescent substance use in 10th grade was significantly related to parenting behaviours of friends' parents, after controlling for adolescents' reports of their own substance use and their own parents' behaviours at the 9th grade level. These associations were particularly strong for parents' knowledge about their children and use of inconsistent discipline strategies. Some, but not all, of the main effects of friends' parents' parenting became non-significant after friends' substance use in ninth grade was included in the model. Nonetheless, the findings suggest that the parenting style in adolescents' friends' homes plays an important role in determining adolescent substance use.

School Influences

The school is the primary institution outside the family within which the development of adolescents can be directed and shaped (Simons-Morton et al., 1999). Gottfredson and Hussong (2011) examined changes in drinking patterns among adolescents as they made the (stressful) transition to high school. Those adolescents who reported less parental involvement were at a higher risk of drinking, highlighting the transition as an important intervention leverage point for those who lack adequate parental support to help them cope with day to day changes. Cleveland, Feinberg & Greenberg (2010) indicated the benefit of belonging to a well-functioning family is more influential for students attending schools characterised by higher-than-average aggregated levels of protection compared to students attending schools of lower-than-average protection. Overall, family-level factors offered less protection for students in relatively high-risk school contexts.

Fletcher (2012) investigated peer influences on adolescent alcohol consumption among students in different grades within the same school-results indicated that a 10 per cent increase in the proportion of classmates who drink increases the likelihood an individual drinks by five percentage points. This paper also provided evidence of peer effects in problem drinking such as binge drinking and drunkenness. Clark & Loheac (2007) examined risky behaviour among American adolescents (collected as part of the Add Health survey, 1994-1996) and reported that even controlling for school fixed effects, risky behaviours were correlated with lagged peer group behaviour. These peer group effects were strongest for alcohol use with young males being more influential than young females. The study

suggested both boys and girls follow boys, as the probability of having had an alcoholic drink in the previous 12 months was, within the school, positively correlated with the percentage of boys in the same school year who drank one year ago. Mrug et al. (2010) investigated the effect of school-level substance use on early adolescent alcohol, tobacco and marijuana use among 452 students attending 49 public middle schools in a single metropolitan area. Only school-level rates of cigarette smoking were associated with individual smoking. However, this study focused on early adolescence and other studies (e.g. Rehm et al., 2005) have found associations between school-level use of alcohol and individual students' use in high school (across adolescence). Rehm et al. (2005) reported both the average and volume of alcohol consumption and patterns of drinking influenced alcohol-related problems at the student level. Lundborg (2006) investigated school-class based peer effects in binge drinking (smoking and illicit drug use) among 12-18 year old students. Positive peer effects were found, and by introducing school/grade fixed effects, the estimated peer effects were identified by variation in peer behaviour across school-classes within schools and grades, implying that estimates were not biased due to endogenous sorting of students across schools.

Internationally, studies have indicated urban-rural divides in alcohol consumption among adolescents. Donath et al. (2011) reported higher life-time and 12 month (previous year) prevalence rates of alcohol use among adolescents in rural areas in Germany; the authors suggested fewer opportunities for engaging in interesting leisure activities than adolescents in cities, as a reason for higher alcohol use rates. Adolescents living and attending school in deprived areas are at increased risk of associating with deviant adolescents (adolescents from malfunctioning families) and, through association with these adolescents, are at increased risk of deviant behaviour such as heavy drinking themselves, regardless of their own family relationships (Bernburg, Thorlindsson, & Sigfusdottir, 2009). Stock et al. (2011) investigated the relationship between school district-level factors and the initiation of alcohol drinking among Danish youth. Adolescents were more likely to initiate alcohol consumption in school districts with higher farming land use and less likely in those with higher proportions of private apartment buildings. Other school district factors were not associated with drinking initiation when they controlled for individual level factors. De Haan & Boljevac (2009) investigated community attitudes and behaviours in the context of adolescent drinking in rural environments. Results indicated adolescent drinkers had higher perceptions (compared to non-drinkers) of peer, parental and overall community drinking as well as lower levels of parental closeness. Adolescent perceptions of peer use were more

accurate than either parents or school officials. Parents were significantly less likely to perceive adolescent alcohol use as a problem than other community adults; school officials were most likely to perceive it as a problem. Overall, school officials' perceptions of adolescent alcohol use were more related to actual adolescent use than were parental perceptions of adolescent use.

Project Aims

This study aims to:

- test different causal hypotheses explaining the longitudinal relationship between parental monitoring and alcohol use trajectories
- test the role of peer- and school-level factors in influencing individual drinking trajectories and monitoring
- investigate how patterns of monitoring dimensions (e.g. parental control and child disclosure) and their association with alcohol use change when considering other factors

To achieve these aims, this study was divided into a number of sections; path analysis investigating how parental monitoring and alcohol use are related; multilevel modelling, investigating how alcohol use, and parental monitoring varies between different schools, and finally; structural equation models to assess the direct and indirect associations between monitoring and other important family characteristics.

Methods

This study used data from the Belfast Youth Development Study, a longitudinal study of substance use during adolescence. Between 2000 and 2011, children attending over 40 schools, colleges and special educational programmes were given questionnaires on a range of personal, social, health and substance use issues. Seven data sweeps took place during this period. Pupils were in their first year of secondary school (around age 11) at the start of the study (academic year 2000/2001), were surveyed annually until 2006/2007 (around age 17) whether they were still attending school, were in a further education college, or no longer in education. They were surveyed again around ten years since they first participated (2011). This report is based on data from the first five years of the study. Where possible, information was linked longitudinally for pupils. The response rate across the sweeps of the study was complex. In year two, several new schools joined that had not been surveyed in year one. Teachers at some schools were participating in industrial action during year four and hence pupils at these schools were not surveyed.

Figure 1: Response rates for the first five years of data collection

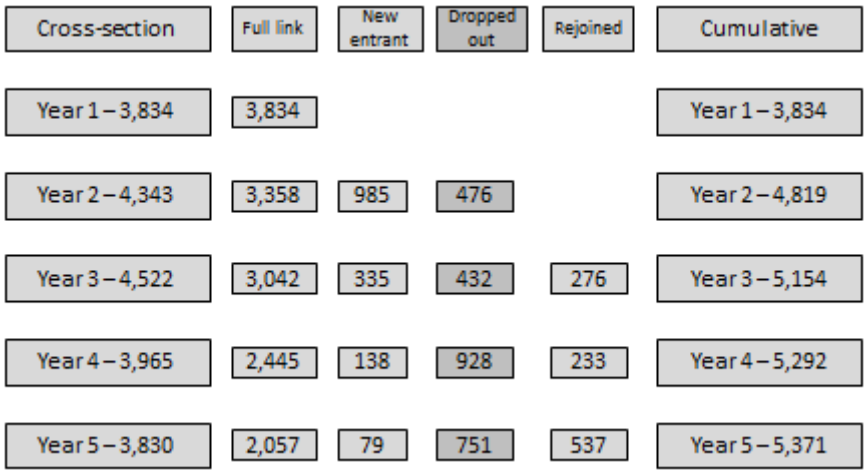


Figure 1 shows the total numbers contacted at each sweep, how many provided data in all years, and how many new entrants, leavers, and rejoiners there were in each year. The right hand side also shows the cumulative number of participants. Across the five years of the study, a total of 5,371 people participated.

Study Variables

This study draws on data from years one to five of the study. Demographic, health, socioeconomic, and family characteristics measures were taken from each year where responses were available. The mental health measure used was the strengths and difficulties questionnaire (SDQ). The SDQ is a mental health screener for children and adolescents. The SDQ was asked in years one and four of the study.

The inventory of peer and parental attachment was also included in analysis, this scale includes questions such as "my parents respect my feelings" and "I trust my parents". This 12 item scale was asked on a three point scale in the first year of the study, and a five point scale in later years of the study. Analysis used standardised scores, with a mean of zero and sd of one.

Respondents were asked questions about the number of cars at their household (None, one, two or more), number of family holidays (none, one, two, three or more), parental employment status (None, part-time, full-time for mother and father), whether they had a bedroom to themselves (yes/no), the type of house they lived in (apartment, terraced, semi detached, detached), and eligibility for free school meals (signifying parental receipt of benefits; yes/no). Principal components analyses were used to create affluence measures (1) based on these items for each year. Number of family holidays was dropped, as it loaded onto a separate factor, decision to take holidays appears to be largely independent of socioeconomic position. A single component modelled around 35% of the variance in the affluence indicators (Rho; year 1 0.38; year 2 0.39; year 3 0.35; year 4 0.34; year 5 0.37). In all years, the first component had an eigenvalue between 2.03 (year 4) and 2.31 (year 2). Eigenvalues for all other components fell below one. Analyses used affluence scores computed within each year.

Respondents were asked with whom they lived in each year of the study. Responses were grouped into lives with; both biological parents; a reconstituted family (one biological & one step/foster parent); Single parent; and complex/other (predominantly siblings or grandparents) . Living arrangements in year five of the study were used in analysis. We did not study change in living arrangements specifically, although any parental separation prior to year five will be represented by living arrangements in year five, although not when this occurs. Where living arrangement information was not available in year five, the previous

year's information was used in its place. As this study focussed on the importance of family relationships, people living in complex/other household types were not included in analysis.

Analytical variables

The two main variables of interest in this study are parental monitoring and alcohol use. Each year, participants were asked about how frequently they drank alcohol. Responses for each year were coded; does not drink; rarely drinks, drinks monthly, drinks weekly or more frequently, and missing/no info. Stattin & Kerr's (2000) measures of parental monitoring were asked in each year. Four sets of questions were asked; overall parental monitoring, and three methods of monitoring children's behaviour, child disclosure of information, parental solicitation of information, and parental control of child activity. The monitoring component included questions such as 'do your parents know what you do with your free time' and 'do your parents know who you have as friends during your free time?'. The child disclosure component centred on information offered to parents without being asked; 'Do you talk at home about how you are doing in different subjects at school', and 'do you keep a lot of secrets from your parents about what you do in your free time?'. The parental solicitation component, designed to find out how much parents ask their children about what they do included 'how often do your parents talk with the parents of your friends', and 'how often do your parents start a conversation about things that happened during a normal day at school?'. The parental control component included 'do you need to have your parents' permission to stay out late on a weekday evening', and 'if you have been out late one night do your parents require you to explain what you did and who you were with?'.

Phase 1: Parental Monitoring and Alcohol Use: Causation and path analysis

In order to investigate the causal processes underlying the association between parent-child interaction and child alcohol use, we fitted a series of path analytic models. Path models are a form of Structural Equation Model. In this case, the models assessed the association between parental monitoring and subsequent alcohol use, while also assessing alcohol use and subsequent parental monitoring.

The models were built up as follows: Focussing on year one monitoring, we estimated its association with alcohol use in years two, three, four, and five (i.e. each subsequent year) using a series of ordinal logistic regression models. Year two monitoring was associated with

each subsequent year (years three, four and five) and the same format for year three and four. These regression models were also adjusted for prior alcohol use (i.e. Year five on year four alcohol use, year four on year three etc). The exact same format of time-lagged regression models were used to estimate how alcohol use in each year was associated with subsequent monitoring, after accounting for prior levels of monitoring. These models were then re-estimated after controlling for gender, mental health, affluence, parental attachment and living arrangements. On the basis of these fully adjusted models, the final models presented in the results section below were obtained by estimating only those paths which were significant at $p<0.1$ if a control variable or $P<0.05$ if an analytic variable. Interaction terms between gender and analytic variables were used to assess if the effect of monitoring on alcohol use (or vice versa) varied comparing males and females.

This format of modelling was performed looking at the overall monitoring scale, and for each of the three monitoring method scales (solicitation, control, child disclosure). All models were adjusted to account for clustering at the school level.

Phase 2: Parent, Peer and School influences

The next set of models built upon the final models derived from the first stage of analysis. These models investigated between-school variation in alcohol use (and its association with monitoring), and also between-school variation in monitoring (and its association with alcohol use). Given that there is a trend for increasing alcohol use at older ages, variation between schools was assessed in the last year of the study, when presumably most respondents will have begun drinking, thus maximising the difference between the lightest and heaviest drinking individuals, and thus, by extension making it easier to assess differences between lighter and heavier drinking schools. These models included all variables that were identified as associated with alcohol use / monitoring in the first set of models. In addition, the following characteristics of the schools were included; school gender (boys only, girls only, co-educational); catholic vs. state maintained; geographical location (Belfast, Ballymena, Downpatrick); overall level of alcohol use in the school (proportion of weekly drinkers); overall level of parental monitoring in the school (mean monitoring score within school).

Phase 3 – Aspects of Monitoring

Latent profile analyses were used to identify if there were distinct profiles of responses to the four parental monitoring scales, example profiles could be 'very low on all scales'; 'very high on all scales'; 'high disclosure but low control' and so on. The analyses assessed the

response pattern for all respondents, and determined how many patterns of responses, or 'profiles', would best account for the variation between respondents. Models were constructed ranging from two profiles through to ten profiles. These models were compared using the Sample Size Adjusted Bayes Information Criterion (SSBIC) and Entropy fit indices, and the Vuong-Lo-Mendell-Rubin test for comparing models. The SSBIC measure gives a measure of relative fit of the observed responses to those predicted by the models being compared (i.e. how accurately does a two profile model describe the actual range of individual responses, by comparison to a three profile model). The entropy measure indicates how successful the model is in determining which profile a respondent belongs to. Where a model can determine with accuracy which profile all respondents belong to, the value of entropy is close to 1, and this gives an indication that the a model explains the response patterns for individuals well. Where a model performs very poorly in predicting profile membership, the value of entropy is close to zero and this gives us less confidence that the profiles determined by the model are a strong representation of how individuals responded. Entropy values greater than 0.8 are usually considered a sign that the classes specified by the model represent individual's responses well; in other words, lending confidence to the idea that in the general population, people follow certain patterns of behaviour in relation to monitoring levels. Mplus 6 was used for these analyses.

The final stage of analysis looked at the inter-relationship between different elements of the parent child relationship and alcohol use; in particular the relationship between monitoring and parental attachment. Structural equation models were used to assess firstly the relationship between attachment and alcohol use, and also monitoring and alcohol use, secondly, these models assessed the association between attachment and parental monitoring, and thirdly, they assessed the indirect effect of parental attachment on alcohol use, due to its influence on monitoring. The outcome measure for these models was a continuous latent variable indicating propensity to drink frequently, with lower scores indicating very low rates of drinking, and higher scores indicating more frequent drinking. This measure was based on the frequency of drinking measure as used for other models, and the frequency of being drunk. This measure was used in place of either single frequency measure to deal with computational limitations. While Mplus could perform the path analyses detailed above a drinking frequency measure based on categories, the assessment of indirect associations between variables requires continuously distributed outcome measures. The latent variable based on these two measures was left skewed; most respondents scored quite highly (i.e. drinking somewhat regularly) with less respondents

with very low(drinking very infrequently) or very high scores (getting drunk very frequently). The left skew demonstrated that it was much more common to drink less than it was to get drunk very frequently. Residual diagnostics for regression of this measure of predictors showed that the residuals followed a normal distribution; as such, this variable adhered to the assumptions underpinning the Structural Equation Model approach and provided an appropriate alternative outcome measure to the four category drinking frequency outcome.

These models assessed the associations between year four monitoring score, year four attachment score, and alcohol use based year five frequency of drinking and frequency of drunkenness. The models then accounted for prior drinking (using year four drinking and drunkenness frequency measures), and then further accounted for the confounding variables as specified above.

Results

Table 1 shows the distribution of individual attributes and family characteristics that were used in analysis. In total, there were 4,775 included in analysis.

There was a reasonably even split between boys (2,257) and girls (2,518) in the sample. Around 6% of the cohort showed some signs of mental health problems, this proportion was similar at both time points when it was asked (approx. age 11 and 14). Almost three quarters of the cohort lived with both biological parents, 19% lived with one parent only, and around 9% lived with a parent plus step-parent, parent's partner, foster parents etc. The living arrangement variable was based on living arrangements at the end of the study period (around age 16), as such it would capture change in family structure before this time point. We did not analyse when family structure changed. Where no information was available from the year five survey, the previous year's data was used instead. As the focus of the study was on the effect of parental monitoring, 464 individuals were excluded as they did not live with parents. As analysis also looked at between-school variation, a further 132 respondents that did not attend mainstream schools were also removed from analysis. All remaining individuals were analysed, even where they did not provide responses in all waves of the study.

Parental attachment was assessed on a different scale in year one compared to years three and four. For this reason, scales were standardised to have a mean of zero and standard deviation of one within each year, so that the statistical measures for the effect of attachment would be comparable across years.

Table 1: Individual and family characteristics for 4,775 respondents

Variable	Frequency (% of total)	
Gender		
Male	2,257 (47.3)	
Female	2,518 (52.7)	
Mental Health		
Year 1 – SDQ		
Normal	3,116 (65.3)	
Abnormal	310 (6.5)	
Missing	1,349 (28.3)	
Year 4 – SDQ		
Normal	3,485 (72.9)	
Abnormal	309 (6.5)	
Missing	981 (20.5)	
Living Arrangements		
Biological parents	3,442 (72.1)	
Reconstituted family	428 (9.0)	
Single parent	905 (19.0)	
Parental Attachment	**Mean (s.d.)**	**Number of responses**
Year 1	16.9 (3.99)	3,391
Year 3	61.9 (20.6)	4,267
Year 4	62.7 (21.5)	3,752
Affluence		
Year 1	3.6 (1.39)	3,349
Year 2	3.5 (1.44)	3,841
Year 3	3.5 (1.43)	4,088
Year 4	3.4 (1.45)	3,763
Year 5	3.4 (1.45)	3,634
Total		4,775

Table 2 shows the rates of alcohol use across the five years of the study. In the early years of the study, very few respondents drank frequently, although a large proportion reported having tried alcohol. In later years, a greater proportion of the cohort reported drinking alcohol every week or more often; from years one to five, the respective proportions drinking weekly were 4%, 11%, 21%, 27% and 34%.

Table 2: Frequency of alcohol use across five years for 4,775 respondents

Alcohol use	Male	Female	Total
Year 1			
None	493 (22)	547 (22)	1,040 (22)
Rarely	1,103 (49)	874 (35)	1,977 (41)
Monthly	92 (4)	63 (3)	155 (3)
Weekly or more	135 (6)	45 (2)	180 (4)
Missing	434 (19)	989 (39)	1,423 (30)
Year 2			
None	607 (27)	764 (30)	1,371 (29)
Rarely	749 (33)	809 (32)	1,558 (33)
Monthly	224 (10)	265 (11)	489 (10)
Weekly or more	270 (12)	267 (11)	537 (11)
Missing	407 (18)	413 (16)	820 (17)
Year 3			
None	505 (22)	513 (20)	1,018 (21)
Rarely	707 (31)	863 (34)	1,570 (33)
Monthly	352 (16)	392 (16)	744 (16)
Weekly or more	471 (21)	521 (21)	992 (21)
Missing	222 (10)	229 (9)	451 (9)
Year 4			
None	155 (8)	147 (6)	322 (7)
Rarely	545 (24)	606 (24)	1,151 (24)
Monthly	362 (16)	404 (16)	766 (16)
Weekly or more	552 (24)	745 (30)	1,297 (27)
Missing	623 (28)	616 (24)	1,239 (26)
Year 5			
None	121 (5)	120 (5)	241 (5)
Rarely	370 (16)	415 (16)	785 (16)
Monthly	365 (16)	419 (16)	784 (16)
Weekly or more	736 (33)	875 (35)	1,611 (34)
Missing	665 (29)	689 (27)	1,354 (28)
Total	2,257	2,518	4,775

Table 3: Correlation coefficients for Parental Monitoring scale across five years

	Year 1	Year 2	Year 3	Year 4	Year 5
Year 1	~~~				
Year 2	0.29	~~~			
Year 3	0.15	0.26	~~~		
Year 4	0.00	0.10	0.04	~~~	
Year 5	0.02	0.09	0.04	0.25	~~~

Table 4: Correlation coefficients for Parental Control across five years

	Year 1	Year 2	Year 3	Year 4	Year 5
Year 1	~~~				
Year 2	0.29	~~~			
Year 3	0.15	0.25	~~~		
Year 4	0.00	0.10	0.04	~~~	
Year 5	0.02	0.10	0.04	0.26	~~~

Table 5: Correlation coefficients for Parental Solicitation across five years

	Year 1	Year 2	Year 3	Year 4	Year 5
Year 1	~~~				
Year 2	0.29	~~~			
Year 3	0.15	0.25	~~~		
Year 4	0.01	0.11	0.04	~~~	
Year 5	0.01	0.10	0.03	0.25	~~~

Table 6: Correlation coefficients for Child disclosure across five years

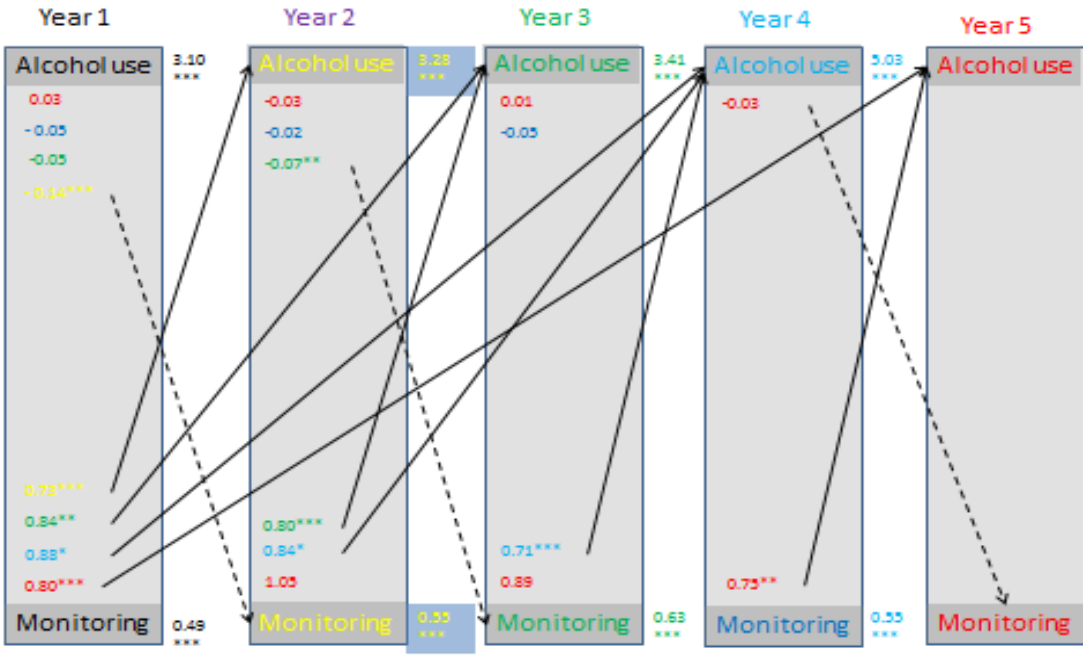
	Year 1	Year 2	Year 3	Year 4	Year 5
Year 1	~~~				
Year 2	0.29	~~~			
Year 3	0.15	0.25	~~~		
Year 4	0.00	0.10	0.04	~~~	
Year 5	0.01	0.09	0.03	0.25	~~~

Tables 3 to 6 show the correlation between monitoring scales over time. The difference in correlation comparing year 1 and year 5 shows the extent to which monitoring levels change with increasing age, it is these changes in monitoring levels, and the explanations for the changes, that the path analyses presented below aim to explore

Monitoring, alcohol use, and paths of causation

Figure 2 below shows the results of fully adjusted models investigating the association between overall levels of parental monitoring and alcohol use across the first five years. As expected, the strongest associations in the model are the time-trend associations. Levels of alcohol use in one year are highly predictive of use in the subsequent year. Similarly, prior and subsequent levels of monitoring are closely associated. The overall reading of the model suggests that there are bi-directional causal processes operating between alcohol and monitoring, however these mechanisms are dependent on the age at which each occurs.

Figure 2: Path diagram showing associations between alcohol use and parental monitoring



Alcohol use → Monitoring

Higher levels of alcohol use in any given year are associated with slightly lower rates of parental monitoring in the subsequent survey year, suggesting that teenagers who drink may change their relationship with their parents to exert greater autonomy, or provide their parents with less information on their day to day lives. The magnitude of this effect is rather small, with each step up in drinking rate (none to infrequently, infrequently to monthly, monthly to weekly or more), monitoring decreased in the following year by around 0.05 of a standard deviation in years 2,3 and 4. However, a step up in drinking in year 1 was

associated with a reduction in monitoring on 0.16 s.d. units, an effect three times larger than that in any subsequent year.

Monitoring → Alcohol use

Greater parental monitoring was associated with a lower rate of alcohol use in the subsequent years. The magnitude and time-lag for the effects of monitoring on alcohol use are of interest, in that they are somewhat at odds with the findings for the effect of alcohol use on monitoring. A one unit increase in parental monitoring is associated with around a 20% lower rate of alcohol use in the subsequent year: this 20% reduction appears in all years, with perhaps a slightly greater reduction at the youngest age, as appeared for the alcohol use → monitoring paths. The main difference is that high levels of parental monitoring at a young age are directly associated with lower rates of drinking up to four years later. That is, parental monitoring at a young age tends to encourage less frequent drinking, even after taking into account natural changes in levels of autonomy and monitoring, and the effect of monitoring at older ages.

Aspects of monitoring

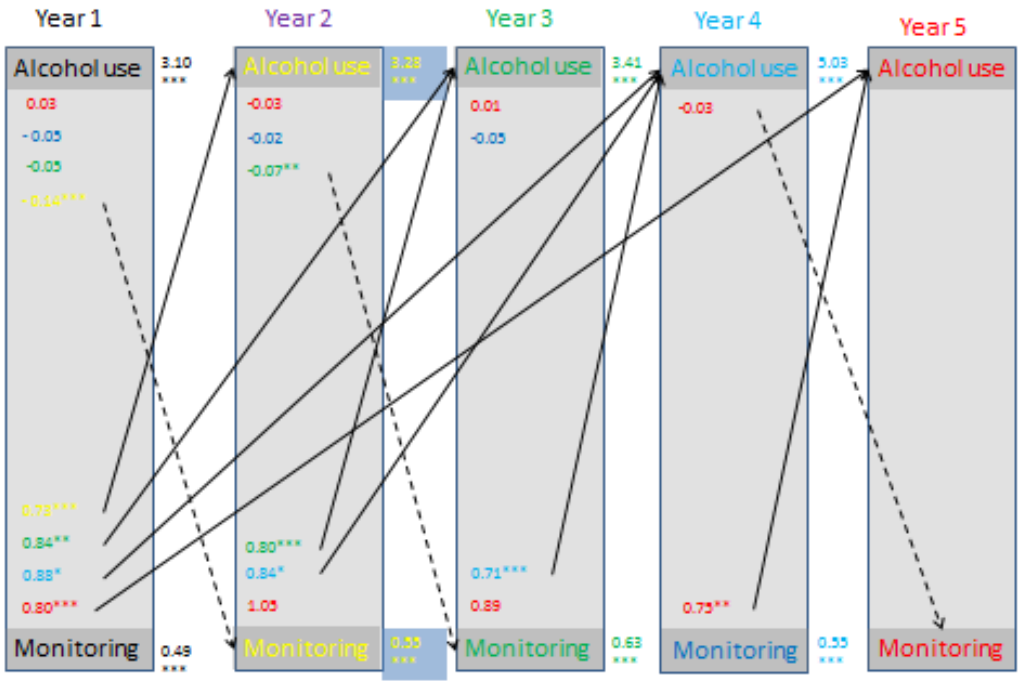
The model in figure 2 demonstrated the inter-relationship between parental monitoring and alcohol use, although more nuanced information on monitoring is available in the data. This study used data from the parental monitoring scale (the overall level of knowledge of child activities), and also three sources of monitoring information; parental solicitation, asking information of their children; child disclosure, the young person volunteering information about themselves; and parental control, the extent to which children must gain permission in order to do something, thereby providing parents information on their activities and whereabouts. Each of these dimensions is discussed below.

Parental solicitation

After accounting for confounding factors, parental solicitation showed very little evidence of association with alcohol use. Higher levels of alcohol use in sweep one were associated with lower parental solicitation in sweep two by around 0.1 sd units, while none of the other causal paths showed any significant associations. Prior alcohol use was a strong predictor of future alcohol use, as was the case in the model presented in Figure 2. Similarly, solicitation was predictive of future levels of solicitation; in this case, the association between sweep four and sweep five was greater than the association between sweep one and sweep two. This suggests that there is greater change in levels of solicitation in early adolescence than

in later adolescence. Parents who talk frequently to their children about their activities by sweep four continue to do so by sweep five (and low rates of solicitation similarly remain low), whereas in early adolescence, prior levels of solicitation are less predictive of later solicitation, as other factors have a greater impact, and greater levels of change in solicitation occur.

Figure 3: Path diagram showing association between alcohol use and parental solicitation

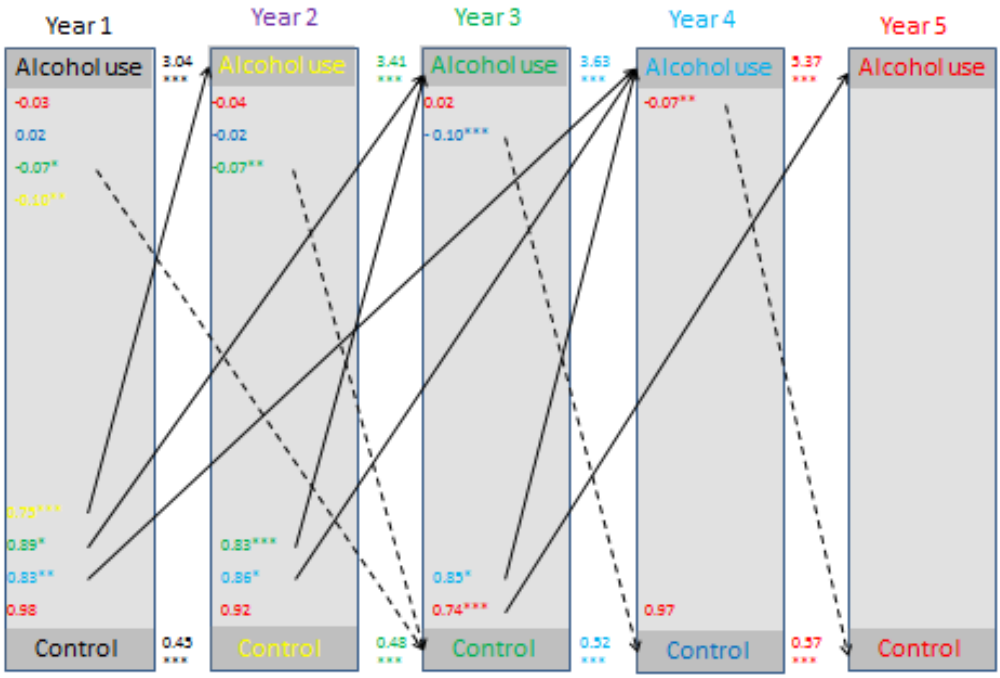


Parental control

Figure 4 shows the final model for alcohol use and its association with parental control. The pattern of association for control is not dissimilar to that found with the general parental monitoring scale, although it appears that alcohol use may have a greater influence on controlling behaviours than was found for overall levels of monitoring. Higher levels of alcohol use in sweep one, two and four were associated with between a 5% and 10% s.d. unit reduction in levels of control by sweep five; similarly, alcohol reduced control behaviours in the subsequent year, not just in sweep 5. This suggests that teenagers drinking more influences the extent of later autonomy, and this effect may occur at any stage of adolescent development, rather than being an effect of particularly early drinking, or an effect limited to later 'normative' drinking, when it might be argued that parents would exert less control due

to their children's age rather than their drinking habits. Higher parental control led to around a 15% to 25% reduction in odds of drinking, the effect was most pronounced at younger ages. The effect was reasonably long-lasting; higher parental control in year one was associated with less frequent drinking up to three years later.

Figure 4: Path diagram showing association between parental control and alcohol use

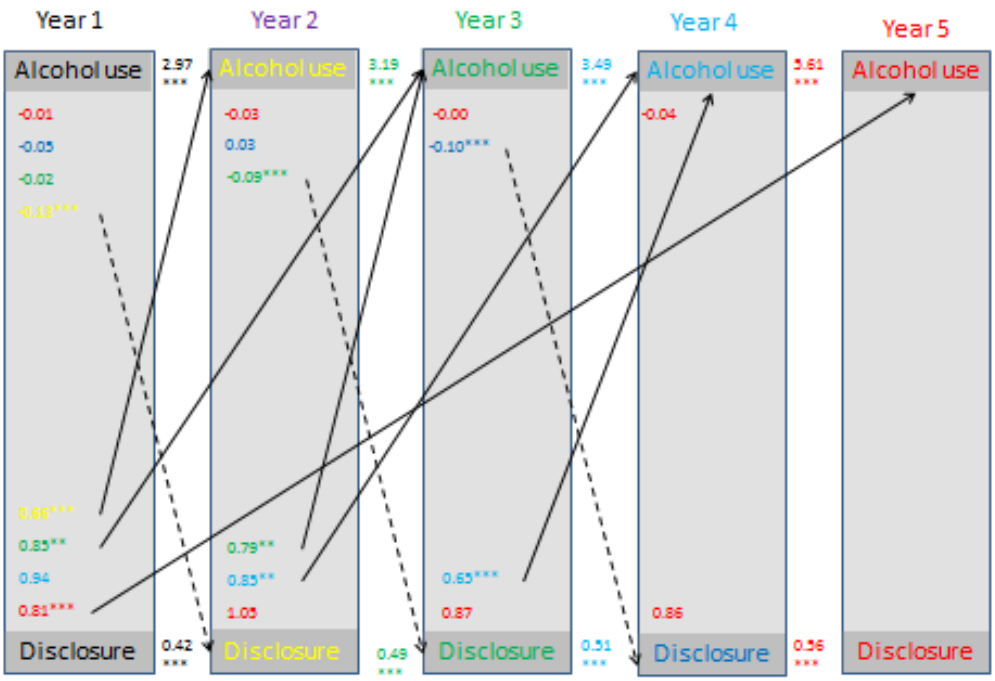


Teenager disclosure

Higher levels of teenager disclosure were associated with lower alcohol use, although the magnitude of association reduced with increasing age; the size of effect was around a 20% - 25% reduction on the subsequent year's drinking for sweeps three and four, with little effect on drinking by sweep five, and a larger effect (35% reduction) between the first and second sweep of the study. High levels of disclosure at a younger age were also associated with long-lasting reductions in alcohol use; as demonstrated by the coefficients linking sweep one disclosure to sweep two, three and five rates of drinking.

Higher rates of alcohol use were associated with lower rates of disclosure in subsequent years. Unlike for the disclosure → Alcohol pathways, this association was transient, effecting lower rates of disclosure in the directly subsequent year only, rather than over the course of the school years. The year-on-year trend for disclosure was rather stable, with a coefficient of around 0.4 from one year to the next, with an increase to 0.5 between sweep four and five. This suggests that the factors affecting disclosure have similar effects throughout the school years, unlike parental solicitation, which does seem more prone to external influences at younger ages.

Figure 5: Associations between teenager disclosure and alcohol use



Gender differences in the monitoring: alcohol relationship

Interaction terms were used to test if the associations between alcohol use and monitoring - and the converse pathways – differed comparing males and females. These tests are discussed briefly below for each of the monitoring scales in turn.

Overall monitoring

Figure 2 above showed that higher rates of drinking led to lower subsequent rates of monitoring, this relationship did not differ comparing males and females. Likewise, rates of monitoring did not affect alcohol boys' and girls' alcohol use differently. The one exception to this was the association between year three monitoring and year four alcohol use, where the protective effect for monitoring appeared greater for females than for males. It is possible that this was a spurious association due to making multiple comparisons of similar coefficients, and thus we would not interpret this finding as a meaningful association.

Parental solicitation

There were no differences between males and females in terms of the association between parental solicitation and alcohol use, there was little evidence of such an association in the first place so this can be expected. However, this analysis has confirmed that there is no 'masked association' due to for example, a positive association among males and negative association among females averaging out to a zero association.

Parental control

As was found for solicitation, there were no gender differences in the influence of control on drinking, nor did rates of drinking differentially affect parental control behaviour.

Child disclosure

Interaction terms gave no suggestion that the relationship between disclosure and alcohol use differed between males and females.

School influences

The previous section outlined the inter-relationship between parental behaviour and alcohol use. This section will further explore the extent to which school environment influences these associations. The first stage was to explore the extent of school level differences in the main outcome of interest, alcohol use. Given that there is a trend for increasing alcohol use at older ages, variation between schools was assessed in the last year of the study, when presumably most respondents will have begun drinking, thus maximising the difference between the lightest and heaviest drinking individuals, and thus, by extension making it easier to assess differences between lighter and heavier drinking schools. The first section of analysis will investigate school variation in alcohol use; the second section will look at variation in parental monitoring.

School variation in alcohol use

The first set of models investigated the extent of variation in alcohol use between schools in year five, controlling for year four alcohol use, gender, affluence (combined measure: year five), parental attachment (ippa: year four), and mental health (SDQ: year four). Scaled likelihood ratio tests gave a clear indication that rates of alcohol use varied between schools ($p < 0.001$). The between school variance in alcohol use after accounting for the background factors is 0.22. This translates to a school level intracluster correlation of around 6.3% that is, around 6.3% of the variation in drinking – after accounting for background factors that affect drinking rates – is attributable to differences between schools.

The next set of models assessed whether or not the effect of parental monitoring varied between schools. Scaled likelihood ratio tests for the year four parental monitoring parameter gave a strong suggestion that this was indeed the case ($p > 0.001$). The variance for the year four parental monitoring parameter was 0.022. Based on this variance, the 95% coverage interval for the effect of monitoring is -0.357 (-0.648, -0.07). On average, a one unit increase in parental monitoring in year

four was associated with a 30% reduction in drinking rates (the antilog of -0.357 = 0.7); at the upper 95th percentile, a one unit change in monitoring was associated with a 48% reduction, while at the 5th percentile the change was around 7%, suggesting a great deal of between-school variation.

The next model assessed the variation in the effect of parental monitoring in year 1. Again, scaled LR tests indicated there was variation between schools in terms of the effect of monitoring ($p < 0.001$). The variance in year 1 monitoring was 0.065; giving a coverage interval of -0.134 (-0.634, 0.366). This coverage interval suggests that monitoring was associated with around a 47% reduction in alcohol use in some schools, while at the other extreme there was a 44% increase in risk of drinking. This coverage interval indicates a high level of general variability, and it seems likely there may be many schools where there is no association between early monitoring and later drinking. The broad range indicates the level of variation between schools, although there may not be a significant positive association between year one monitoring and alcohol use.

Intercept/slope covariance

The models for year one and year four monitoring variance also assessed how intercept and slope covaried; in other words, were schools with high levels of alcohol use those schools with stronger protective effects of monitoring, or vice versa? The analyses suggested that there was little or no correlation between intercept and slope, for the year four slope (-0.03 $p<0.001$) or year one (0.05 $p<0.001$) slope parameters.

Models were re-run looking at the parental monitoring subscales. As there was no association between parental solicitation and alcohol use, between school variation was not assessed.

Child disclosure

The between school variance parameter for these models was 0.31, or around 8.6% school level variance in alcohol use – this reflects the same variation between schools

as found when looking at overall monitoring levels in the model, with some difference in rounding due to fluctuations in model estimation. Further models assessed the change in levels of year one disclosure on alcohol use, again indicating there was between-school variation ($p<0.001$). The variance parameter for year one disclosure was 0.036; this translates to a coverage interval of -0.159 (-0.53, 0.213) – the effect of disclosure varied from between a 41% protective effect to a 23% harmful effect, with a 15% protective effect in the 'average school'. Again, the harmful effect may not have been statistically significant, but simply indicates there was between – school variation in the extent to which child disclosure was protective against later alcohol use.

Parental control

For this section of the analysis, we encountered a great deal of computational difficulties. The latent variable model approach used requires intense computational power, but this can still pose a problem for analysis, in that it is difficult to produce robust mathematical solutions. Several alternative parameterisations were attempted, and a great deal of time spent on verifying model results. This process suggested that the parameters reported below may be prone to error, and caution taken in their interpretation.

The model looking at parental control had a somewhat lower variance of 0.16, or around 4.6% school level variance in alcohol use. This reduction may be due to the issues with computation mentioned above. Looking at the variation in the effect of year three monitoring on alcohol use, the variance of the slope parameter was 0.06; this corresponds to a coverage interval of -0.235 (-0.715, 0.245). These translate into coverage intervals on the odds ratio scale from a 51% protective effect to a 28% increase in risk, with a 20% risk reduction on average. Again, the increased risk may be non-significant rather than indicating actual increased likelihood of drinking due to control.

There was a very small negative correlation between the intercept and slope parameters (-0.07 $p<0.001$), suggesting that schools with higher rates of alcohol use also had slightly more negative slope parameters, indicating more of a protective effect of parental control.

These results are broadly comparable to those found for the other monitoring scales, but with some sign of differences relating to lower between-school variation and higher intercept/slope correlation. Given the computation difficulties, it would be unwise to read too much into these differences. Further analyses based in other datasets are warranted to test for differences between the monitoring scales in relation to between school variations in the effect of parental monitoring.

School level predictors of drinking

The next set of models assessed the association between the following school characteristics and their association with individuals' drinking patterns, and the school level variation in drinking.

Single gender /co-educational schools

The between-school variance in alcohol use in the base model above was around 0.27, after including coefficients for boys' school and girls' school, this variance dropped to 0.18; hence, around one third of the between school variation in alcohol use can be explained by the difference between single sex and coeducational schools. The main driver of this variation was an elevated risk of drinking in girls' schools. After accounting for prior alcohol use, gender, parental monitoring in year 1 and year 4, parental attachment and mental health in year four, pupils attending boy only schools had comparable rates of alcohol use to pupils at coeducational schools (OR 1.14 $p=0.68$), while those attending girl only schools had a 63% elevated rate of drinking (OR 1.63 $p<0.01$).

The next model assessed if the effect of parental monitoring varied comparing school types. There was no evidence that the protective effect of parental monitoring varied with school gender (scaled LR test p=0.33).

Catholic / State schools

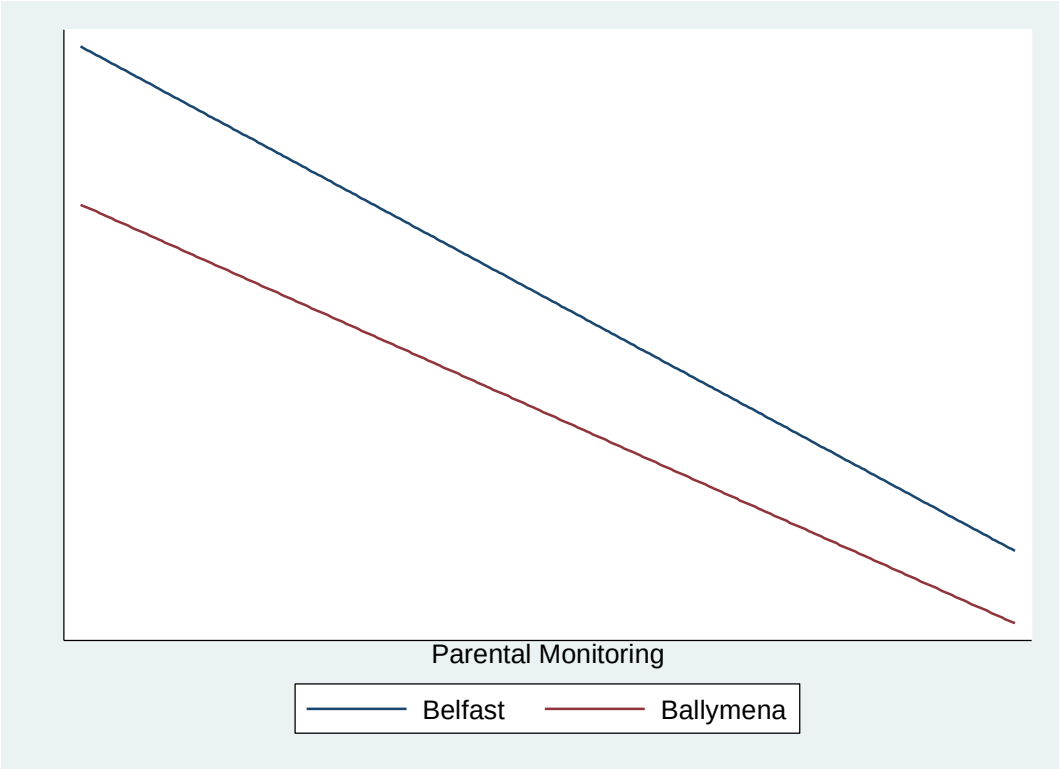
There was no change in the between school variance after accounting for school denomination. The model suggested there was no difference in the rates of drinking at catholic maintained compared to state maintained schools (OR=0.07 p=0.79).

School location

Including a term for urban vs . intermediate/rural schools did not improve model fit; there was no difference in the drinking rates comparing the areas, nor did the between-school variation change after accounting for urban vs other region. There was, however, a difference comparing Belfast and Ballymena, in terms of overall drinking rates and the influence of monitoring on drinking. Pupils attending schools in Ballymena drank less frequently by a factor of 0.63 ($p<0.05$), they had around a 37% lower rate of drinking than Belfast pupils. There was no difference comparing Belfast and Downpatrick pupils (OR 1.40 p=0.43). After accounting for the difference in drinking rates for Ballymena schools, the between school variance fell from 0.22 to 0.11.

There was also some evidence that the protective effect of parental monitoring varied between Belfast and Ballymena. Interaction terms suggested that, holding all other factors constant, parental monitoring had less of an influence on rates of drinking in Ballymena than in Belfast (Interaction term p=0.03). Figure 6 shows the differential association between schools by area. In Ballymena, there is a smaller change in drinking frequency comparing the most and least highly monitored young people, this may be explained in part by the lower overall rates of drinking in Ballymena compared to Belfast.

Figure 6: The effect of school location and parental monitoring on risk of drinking among adolescents



Mean level of parental monitoring within schools

There was no association between level of parental monitoring within schools in year four and alcohol use in year five (OR 0.72 p=0.6), after accounting for individual alcohol use and individual and family characteristics.

Mean level of alcohol use within schools

The overall level of alcohol use in the school in year 4 was associated with a much higher rate of drinking in year 5. An odds ratio of 6.76 (p=0.001), indicated that there was a very strong association between having a higher proportion of frequent drinkers in the school in year four and frequency of alcohol use in year five. The between school variance in alcohol use was 0.22 after including the school use variable in the model.

It was not possible to investigate all school characteristics simultaneously, these variables were heavily collinear and there were not enough schools in the study to deal with this effectively. For example, there were no girls only schools in Ballymena. Similarly, the proportion of frequent drinkers was much lower in Ballymena schools than in Ballymena and Downpatrick, making it difficult to disentangle the independent effects of these influences. To deal with this, we decided to remove one potential influence, school gender, and investigate the remaining school-level effects.

We fitted a model which simultaneously modelled the effect of school location (is there a higher rate of drinking in Ballymena compared to elsewhere), average level of frequent drinking in the school (proportions drinking frequently by school), and the interaction between monitoring and school location (does the protective effect of monitoring differ in Ballymena compared to elsewhere). In this model, the effect of average school drinking disappeared (OR 0.98 p=0.99), and the protective effect of being at a Ballymena school, while of comparable magnitude, did not attain statistical significance (OR 0.68, p=0.25). The interaction of parental monitoring and school location did retain statistical significance (p=0.02), suggesting that parental monitoring was less protective against frequent drinking in Ballymena than elsewhere, even after accounting for differences in the overall rate of drinking within the school.

Variation in monitoring

The next stage of models assessed between-school variation in levels of parental monitoring. Scaled chi square tests did not clearly indicate that there was variation between schools in terms of monitoring score (p=0.053). Models accounting for gender, affluence, parental attachment and mental health problems found a between school variance of 0.004, this translates into less than 1% of the variance occurring between schools. As there was no evidence of a difference in monitoring between schools, no further analyses investigating school level variations were performed.

Peer effects on drinking

Exploratory models were used to assess the association between the average level of parental monitoring, and the average level of drinking among respondents' peer groups. Each respondent was asked to name their best friend, and up to nine other friends within their school. This information allowed the calculation of average monitoring and drinking rates for their closest friends in the year.

It must be noted that this analysis is only preliminary and suggestive of trends. The clustering of friends within cliques means that one of the key assumptions of regression models – that each respondent is randomly selected from the population – is not upheld. It is also not possible to fully account for the clustering by friend groupings, as individuals may fall into more than one friendship group, or none at all, they may be nominated as a friend by others but not reciprocate the friendship nomination etc.. For these reasons, the results below should be interpreted with caution. In-depth study based on more complex analytical methods (such as Simulation Investigation for Empirical Network Analysis) would be required to confirm or refute the indicative associations reported here. Given the exploratory nature of associations, the overall monitoring scale was used in analyses.

Using the same control variables as outlined in the school level variation analyses, models assessed the association between alcohol use and monitoring in years one and four, and alcohol use in year five. As was found for the first set of models, higher levels of individual monitoring in year one (OR 0.84 p=0.02) and year four (OR 0.74 p

< 0.001) led to lower levels of alcohol use in year five. The mean level of parental monitoring within peer group in year four was not associated with alcohol use (OR 1.18 p=0.26), whereas higher levels of monitoring in peer groups in year one was related to less drinking (OR 0.70 p=0.001). Individuals with higher rates of drinking in year four were much more likely to drink in year five (OR 4.46 p<0.001), and higher rates of drinking among peers in year four was also predictive of individual year five alcohol use (OR 1.91 p<0.01).

Aspects of Monitoring

There were four measures of parental monitoring available in the data, an overall monitoring measure, and three 'means' of obtaining monitoring information: Monitoring - an overall measure of the extent to which the parent(s) are aware of their child's activities; Control – the extent to which the child must require permission to do things; Solicitation – the extent to which parents ask for information about their child's activities, and; Disclosure – the extent to which children volunteer information to their parents. The models described below were based on these monitoring scales in year four, as previous stages of analysis demonstrated that the year four levels of parental monitoring were associated with alcohol use in year five.

The next set of analyses tried to determine if there were distinct profiles of responses on these four scales, in other words, are there certain natural groupings within the population who have similar patterns of responses to the four monitoring scales?

Latent profile analyses were used to determine measures of model fit; for two profile models right through to ten profile models. The three profile model provided the best model fit according to the entropy measure (0.79). The Vuong Lo Mendell Rubin test also showed an improvement of the three profile model over the two profile model (p<0.001); there was no evidence that four profiles gave a better description of the data than three profiles (p=0.15). As such, the analysis suggested that there were three profiles, or patterns of parental monitoring in the sample. The SSBIC measure decreased marginally with each increase in number of classes, suggesting a greater number of classes provided modest improvements in describing the pattern

of responses; although, the entropy measure for the 2, 3 4 and 5 class models were 0.789, 0.792, 0.754 and 0.751 respectively. These entropy measures demonstrate that fewer classes describe the data better, and the three class solution fares best. The normal cut-off for 'good fit' is 0.8, showing that even the best three profile description here doesn't do particularly well at describing all individual's behaviour. This indicates that there is considerable variation between classes, respondents don't cluster neatly into high / medium / low monitoring on these scales. The entropy scores continued to deteriorate up when investigating up to ten profiles, indicating that the reason was most likely not due to more specific clustering or patterns. Rather, it appears more likely that there is a continuous distribution of monitoring levels ranging from low to high in the general population, rather than monitoring occurring in discrete groupings.

Figure 7: Mean Scores for standardised monitoring scales by three latent profiles

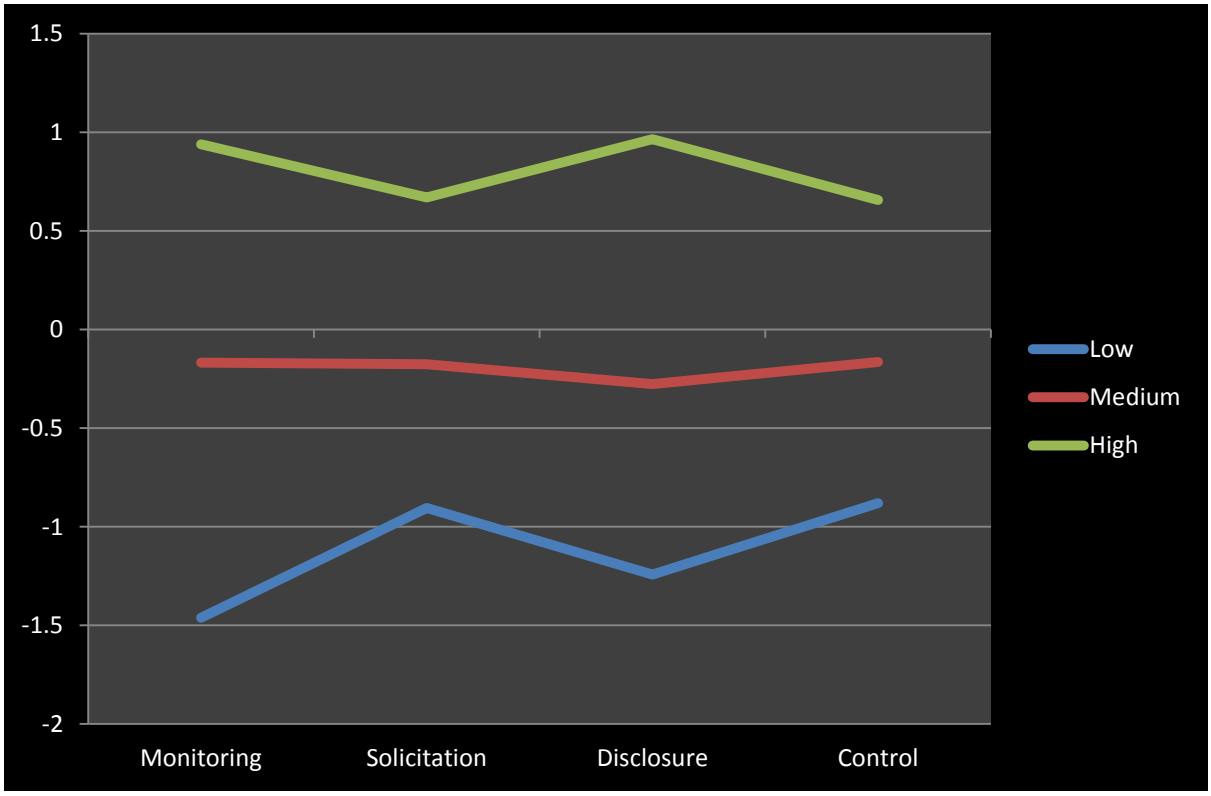


Figure 7 shows the pattern of responses on the parental monitoring scales for the three profiles determined in the analyses described above. The three patterns quite

clearly demarcated the groups as low, medium or high monitoring. The model predicted that around 18% of the respondents were in the 'low monitoring' group, 46% were in the medium group, and 36% highly monitored group. It is noteworthy that child disclosure is the construct that most closely reflected the level on the overall monitoring scale: the disclosure scale was lower than solicitation and control in the low group, and disclosure was higher than the other two scales for the high monitoring group.

Table 7: Table showing personal and family characteristics for low, medium and high monitoring profiles

	Monitoring			
	Low	**Medium**	**High**	**Total**
Total	680	1,780	1,387	3,847
Gender				
Male	350 (51)	922 (52)	532 (38)	1,804 (47)
Female	330 (49)	858 (48)	855 (62)	2,043 (53)
Affluence (mean s.d.)	3.20 (1.50)	3.36 (1.43)	3.50 (1.42)	3.38 (1.45)
Mental Health Standardised SDQ Year 4: mean (s.d.)	0.52 (0.97)	0.09 (0.93)	-0.42 (0.92)	-0.02 (0.99)
Parental attachment Standardised IPPA Year 4: mean (s.d.)	0.86 (0.99)	0.18 (0.84)	-0.64 (0.76)	0.00 (1.00)
Year 4 Alcohol use				
None	22 (3)	87 (5)	222 (18)	331 (9)
Rarely	100 (15)	512 (30)	552 (45)	1,164 (33)
Monthly	117 (18)	419 (25)	240 (19)	776 (22)
Weekly or more	418 (64)	664 (39)	225 (18)	1,307 (37)

Totals does not sum to 3,847 due to missing data

Table 7 shows the distribution of personal and family characteristics across the three monitoring groups. The highly monitored group was more often female than the medium or low groups (62%, 48% and 49% respectively). The most highly monitored

were slightly more affluent and were in better mental health, they also reported poorer attachment to their parents than the less heavily monitored. As demonstrated with the previous analyses, monitoring had a large influence on alcohol use, around 3% of the low monitoring group never drank alcohol compared to 18% of the high monitoring group. The proportions drinking weekly or more frequently in the low medium and high monitoring groups were 64%, 39% and 18% respectively.

Monitoring, mediation and moderation

This phase of analysis assessed more complex associations between alcohol use and parental characteristics; primarily, whether levels of parental monitoring acts as a mediator between parental attachment, and reported levels of alcohol use. In other words: does good parental attachment affect the amount that young people drink, or is it rather that parental monitoring affects alcohol use, and good relationships with parents indirectly affect drinking via parental monitoring?

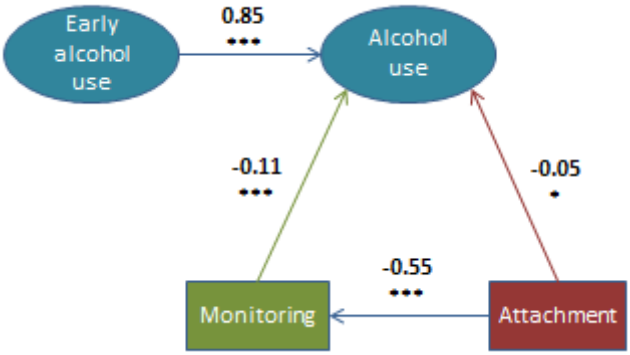
To assess this hypothesis, we developed structural equation models to measure levels of alcohol use in the later years of the study, and simultaneously assess the indirect effects of parental monitoring and attachment.

The responses to the alcohol frequency questions for year 4 and year 5 were used to create a latent variable representing average level of alcohol use between the ages of 14-16. A latent variable for early alcohol use was based on the same questions asked in years 1, 2 and 3. The parental monitoring (overall) scale and inventory of peer and parental attachment scale in year three were used to predict subsequent levels of drinking. Finally, models assessed the indirect effect of parental attachment via its effect on parental monitoring. Models controlled for prior alcohol use, gender, mental health affluence, and grammar school.

Figure 8 below presents the overall model; showing the linear associations between alcohol, parent-child interactions (monitoring and attachment), and also background characteristics. As could be expected, prior alcohol use was strongly associated with

later alcohol use. Being female and in poorer mental health increased the overall rate of drinking slightly. Those attending grammar schools had lower drinking rates, and there was no discernible variation in drinking frequency related to household affluence. In terms of the parental characteristics, higher rates of parental monitoring (i.e. more monitoring behaviour) were associated with a lower rate of alcohol use. Better parental attachment led to lower rates of alcohol use.

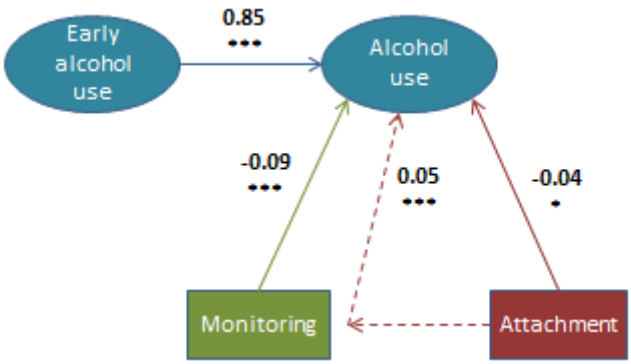
Figure 8: Path diagramme showing the linear associations between alcohol use and parent-adolescent relationships, controlling for individual and family risk factors



The standardised coefficients show the relative size of the protective effect of the two factors, an equal magnitude of change in monitoring or attachment corresponds to a 0.13 and 0.06 point respective reduction in alcohol use. The path model also demonstrates an association between attachment and monitoring; better relationships with parents being associated with lower levels of parental monitoring. These associations all remained after accounting for variations due to gender, mental health, affluence, school type and prior alcohol use.

While figure 8 showed the overall model, with simply direct associations between each variable and alcohol use independent of the influence of the other factors, Figure 9 shows the how these factors interact with each other and ultimately alcohol use. The solid lines show the direct associations, higher levels of monitoring lead to lower levels alcohol use, and better attachment also leads to less alcohol use.

Figure 9: Direct and indirect effects of parental relationship on alcohol use



The dashed line shows the indirect effect of attachment via parental monitoring; in this case, higher levels of attachment lead to higher rates of alcohol use, and this increased risk can be explained by the tendency for more securely attached young people to be less heavily monitored. This lower monitoring thus increases the risk of drinking. This indirect effect of attachment on alcohol use appears even after accounting for the effects of gender, mental health, affluence and school type. In other words, good parental attachment is protective against drinking, but is simultaneously a risk factor, due to its tendency to reduce parental monitoring.

Figure 10 shows the total effect parameters for this model. Whereas Figure 7 showed the average effect of attachment after removing the influence of factors such as monitoring, this model presents the overall effect of different levels of attachment, including how it affects children's alcohol use directly; and how it affects monitoring, the other key driver of alcohol use.

Figure 10: Total effects of parent relationships on alcohol use, accounting for indirect effects, personal and school characteristics

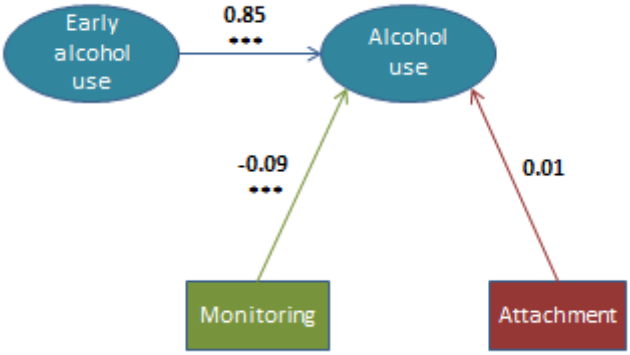


Table 8: Indirect, direct and overall effect of parental attachment on drinking, adjusting for various confounders

	Model 1	Model 2	Model 3	Model 4	Model 5
Predictors of alcohol use					
Monitoring	-0.11***	-0.11***	-0.11***	-0.10***	-0.10***
Attachment					
Direct effect	-0.04*	-0.04*	-0.03	-0.02	-0.02
Indirect effect via monitoring	0.05***	0.05***	0.05***	0.04***	0.04***
Total effect	0.01	0.01	0.01	0.02	0.02
Prior alcohol use	0.85***	0.85***	0.86***	0.84***	0.84***
Gender (Female)		-0.03	-0.03	-0.3	-0.03
Mental Health			-0.02	-0.02	-0.02
Affluence				0.01	0.001
Grammar school				-0.05*	-0.07*
Lives with:					
Biological parents					Reference
Reconstituted family					0.02*
Single parent					0.01
Effect of attachment on monitoring	-0.55	-0.55	-0.55	-0.55	-0.55

Summary of findings

The analysis above assessed the coevolution of alcohol use and parental monitoring; examined school level variations in alcohol use and overall levels of monitoring, assessed if differences appeared in the co-evolution of alcohol use and monitoring in different school contexts, looked to see if there were distinct patterns of parental monitoring, and finally, examined the interplay between parental monitoring, parental attachment, and alcohol use.

Monitoring and Alcohol use over time

By looking at survey responses over five years, from ages 11 to 16, we found evidence of a bi-directional association between frequency of alcohol use and parental monitoring, weighted towards monitoring being the more important factor. Young people who were drinking alcohol tended to experience less parental monitoring in later years, this effect was rather modest, except in the case of those who had started drinking by age 11. Those reporting early drinking experienced lower rates of subsequent monitoring; the reducing effect was three times larger than that occurring in later years. A much stronger association appeared for monitoring tending to reduce alcohol use, there was a consistent tendency for higher levels of monitoring leading to lower levels of drinking in the subsequent survey year. Higher levels of monitoring at an early age had a lasting protective effect, and were predictive of less frequent drinking right up to age 16.

Three methods by which parents could obtain monitoring information from their children were assessed in the study, each of these having a different association with alcohol use. Parental solicitation showed virtually no association with alcohol use. There was some evidence that more frequent drinkers in the first year of the study experienced less solicitation in the following year, but there was no evidence of solicitation influencing alcohol use. Parental control by comparison was very strongly associated with alcohol use. Respondents whose parents exert greater control over

their free time activities tend to drink less frequently, this was a consistent effect across time, and early control had a lasting influence on alcohol use. This was a distinct pattern suggesting alcohol use led to lower levels of parental control. There was a consistent and long term effect, with higher rates of drinking at early ages leading to lower control, drinking at age 11 was predictive of control levels at age 16. However, this effect was relatively small by comparison to the effect of control on alcohol use. Voluntary disclosure of the respondents' activities to parents was also associated with lower alcohol use, although this effect tended to reduce at older ages, to the extent that it appeared unrelated to alcohol use by age 15/16. Alcohol use was associated with slightly lower rates of disclosure in subsequent years, there is a slightly larger effect for those drinking at age 11, this again is a marginal effect by comparison to the effect of disclosure on alcohol use.

The study did not uncover large gender differences, neither in the influence of monitoring on alcohol use, nor in the tendency for alcohol use to affect monitoring. There was some suggestion that females experienced a greater protective effect from monitoring in year 3 in terms of alcohol use in year 4. The lack of consistent association across the years suggests caution in interpreting a gender difference.

Variation between schools

There was some evidence that there was systematic variation in the rates of drinking attributable to differences between schools, rather than due to differences between individuals. The influence of schools was rather small, with school factors accounting for only 6% of the variation in rates of drinking. Some schools had higher overall rates of drinking than others; importantly, there were also large differences between schools in the association between parental monitoring and subsequent alcohol use. In most schools, parental monitoring was protective against alcohol use, but there was a great deal of variation, and in some schools there was little to no protective effect. The protective effect of parental monitoring was not related to overall level of drinking within the schools. If there was a strong relationship, for example if schools with low rates of alcohol use were the schools that had less of a protective effect of

monitoring, then this might be evidence of a 'floor effect'. A floor effect is where the lack of protective association is due to the low rates of drinking being 'at the floor' and thus cannot drop any further. There is no evidence of a floor effect in schools, hence it appears that something else must explain the change in protective effect of monitoring. This pattern was the same for all monitoring scales, apart from parental solicitation which showed no association with alcohol use in the first place. There no evidence that parental monitoring varied according to the school pupils attended.

There was some evidence that respondents' peer group influenced their drinking. Young people who had friends that drank more often were more likely to drink themselves, even after controlling for their own levels of drinking, while average level of parental monitoring among friends was not protective against drinking.

After accounting for the individual effect of gender on rates of drinking, and the influence of other personal and family characteristics, being in a school with a higher proportion of frequent drinkers was associated with a higher risk of frequent drinking. Pupils attending girls only schools had elevated rates of drinking compared to those attending co-educational schools, while boys schools did not differ from co-educational schools. The effect of parental monitoring did not differ across school type. There was no difference comparing catholic and state maintained schools. Attending a school in Ballymena was associated with lower drinking rates, even after accounting for personal characteristics, and the protective effect of parental monitoring was weaker in Ballymena than elsewhere, this phenomenon persisted even after accounting for the fact that Ballymena schools had lower overall rates of drinking.

Latent profile analyses were used to assess if there were distinct patterns of each parental monitoring subscales. Results showed that there was no strong evidence towards selective use of monitoring strategies among the cohort; respondents who were reported high levels of monitoring on one scale tended to report high values on all other scales. Statistical tests indicated that the most efficient description of the patterns in the data was by three groups; low, medium and high monitoring. People

within each group reported high, medium or low levels on all four scales, monitoring, solicitation, control and disclosure. In the low monitoring group, child disclosure was on average lower than solicitation or control, and similarly in the high group, disclosure was higher than the other two.

The final stage of analysis looked at the relationship between monitoring, attachment and alcohol use. When looked at in isolation, good parental attachment and higher levels of monitoring both have a protective effect to reduce frequency of alcohol use. When looking at the inter-relationship between these factors, parental attachment shows a negligible net effect on alcohol use; this is because parental attachment simultaneously reduces the likelihood of a young person's drinking, while simultaneously reducing the extent to which they are monitored. Lower monitoring in turn increases their likelihood of drinking.

Discussion

The first phase of analysis set out to describe test two mechanisms to explain the association between parental monitoring and alcohol use, alcohol affecting monitoring, and monitoring affecting alcohol use. Firstly, we assessed if higher monitoring leads to lower rates of alcohol use. The results of the models suggested that this was indeed the case. Higher monitoring was associated with reduced risk of frequent alcohol drinking in subsequent years. It also appeared that higher parental monitoring in year one was associated with lower drinking in years two, three and five of the study, suggesting that there was a longer term influence of early parenting styles. Rates of parental monitoring tend to reduce throughout adolescence. These results suggest that higher than average levels of monitoring, at any given age, reduces drinking frequency. These results are in agreement with much of the international literature in the field. The results presented here have the advantage of showing associations over time, demonstrating both a consistent protective effect across the early teenage and late pre-teen years, and additionally the lasting influence of higher parental monitoring at an early age.

Secondly, we assessed if alcohol use influenced levels of parental monitoring. The models suggested that this was the case, respondents who reported drinking more frequently tended to report lower levels of parental monitoring in the subsequent year. Unlike the results for the opposite direction, there was no evidence that more frequent drinking at an early age had an influence on longer term levels of monitoring.

These findings are relevant to public health approaches to reducing alcohol use among young people. Creating higher levels of parental monitoring for parents of children, in particular encouraging higher parental monitoring around ages 10 – 13 may be an effective method of reducing the frequency of alcohol use throughout adolescence. Parental monitoring is associated with reducing the risk of other risky behaviours, suggesting that interventions that can lead to elevated monitoring will

produce broad global benefits, a major caveat of this interpretation would involve considering the influence of school environment (see below).

Once young people begin using alcohol, this has a tendency to reduce the rates at which they are monitored. This reverse causal mechanism is important, as there may be a tendency for children to negotiate parental boundaries in order to facilitate further drinking. What is not clear from these results is the extent to which these influences represent children negotiating monitoring behaviour to facilitate drinking, or alternatively they represent parents' voluntary reduction in monitoring behaviour as part of accepting their children's alcohol use as part of growing up. This effect appears to be somewhat reversible and potentially transient, as - after adjusting for background factors - year one drinking is not strongly associated with monitoring in years two, three, or four. The finding of early alcohol use being associated with less monitoring at later ages disappears or is greatly attenuated after accounting for variations due to gender, affluence, parental attachment and living arrangements (reconstituted families and single parent families faring worse than two biological parents). This suggests that the majority of this effect is due to shared environmental features, which reduce parental monitoring and increase early onset drinking somewhat independently. Despite this finding, the effect did not disappear altogether, suggesting that parental monitoring is to some extent youth-driven. Taken in combination with the environmental influences, and the wider body of work suggesting that these environmental influences also affect parental drinking; these findings suggest that alcohol use from as early as 11 years old is having a detrimental effect on family dynamics. The policy implications of this finding are thus; improved parental monitoring may be appropriate for a 'risk reducing' approach for parents of alcohol using children, rather than useful only as a preventive approach for parents of non-drinking children. However, early drinkers tend to experience other environmental stressors within the home (deprivation, change in living arrangements, poorer parental attachment), this would suggest that any interventions aimed at a 'risk reducing' approach will have to contend with the additional risks posed by deprivation and family discord after effecting change in monitoring behaviour.

Alongside looking at the overall parental monitoring scale, we assessed the importance of the source of information about the young person's activities. Similar to previous studies (see Stavrinides, Georgiou & Demetriou, 2010), parental solicitation, the extent to which parents ask about activities or enquire about how a person spends their free time showed little to no signs of association with alcohol use.

Parental control, the extent to which the young person must seek permission to go out / visit friends etc. showed a similar pattern as appeared for the overall monitoring scale. Previous studies have also found that higher control is associated with lower rates of drinking (Foxcroft & Lowe, 1991).
An additional finding from our results, is the fact that prior alcohol use seems to have a greater effect to reduce subsequent control behaviours than was found for the overall monitoring scale, with alcohol use at several ages being associated with lower rates of parental control by year five.
This supports the idea that adolescents act to exert greater autonomy in order to facilitate their drinking behaviour.

Greater levels of child disclosure were also associated with less frequent alcohol use. As with the overall monitoring parental control scales, higher levels at early ages had a lasting influence on alcohol use throughout the study, with a consistent effect of a one unit increase in child disclosure leading to a 20% reduction in drinking frequency. By comparison, the effect of alcohol use on child disclosure is much less persistent. There is a tendency for drinking in any year to lead to less disclosure in the subsequent year, but not over the longer term.

The fact that early experience of drinking has a greater influence on the need to obtain permission from parents than it does overall parental knowledge or child disclosure indicates that early alcohol use may act as a catalyst to change the dynamics of the parent-child relationship and how young people relate information to their parents, rather than alcohol acting to reduce monitoring independently of the quality of parental relationship.

There was little evidence to suggest that the pattern of associations differed comparing male and female respondents. Female respondents reported higher levels of monitoring at all ages and across all subscales. Males also reported drinking more frequently at all ages. Despite the overall difference between the two groups, the protective effect of monitoring to reduce drinking does not differ by gender. Similarly, the effect of prior alcohol use to change subsequent monitoring levels does not change according to gender. This would suggest interventions aimed at improving alcohol related outcomes by focussing on improving parental monitoring should be equally effective for parents of boys as for parents of girls. This should allow for much easier deployment of interventions, as there is no need to tailor programmes according to gender.

School variations in alcohol use

With pupils from over 40 schools participating in the study, the BYDS is well suited to investigating school level influences on alcohol use. The analyses presented here found that, even after accounting for individual level influences, (gender, prior alcohol use, parental monitoring etc.) there was a fair amount of difference between schools in terms of frequency of drinking by year five (around age 16). This has important implications for public health relating to alcohol use, as it appears that the school environment plays an important role in shaping young people's alcohol use. Besides the overall frequency of drinking varying between schools, there was quite a large amount of variation in the protective effect of parental monitoring across schools. On average, a one unit increase in monitoring in year four was associated with a 30% reduction in drinking rates in the following year. At one extreme (for schools at the 5th percentile) this effect increased up to a 48% protective effect, while at the other extreme the effect was only a 7% reduction. This variation between schools appeared even more marked for year one monitoring, for some schools, early levels of monitoring were associated with a 47% reduction, while in others there appeared to be no protective effect whatsoever. A similar pattern appeared for parental control and child disclosure, in that some schools there was little or no

protective effect. This finding underlines the importance of influences beyond the parent or family unit. The most likely intervening factor leading to this variation is of course peer socialisation. In some schools, the influence of peers may be such that young people are more likely to drink, regardless of the extent to which their parents' monitoring aims to prevent them doing so. In other schools, the influence of peers may be less pronounced, and parents may be better placed to counter the influences on drinking behaviour.

The fact that the early influence on alcohol use (year 1 to year 5) showed greater variation than the 'short-run' protective effect (year 4 to year 5) is also noteworthy. This could be due to the difference in the social context of drinking in some schools compared to others. In schools where social drinking is more common, the early protective effects may be 'washed out' as children may experience more change in their social behaviours outside the home than for other children where there is less opportunity for social drinking.

After accounting for individual characteristics (including the gender difference in drinking rates) pupils attending girls only schools were more likely to drink frequently than those attending co-educational schools. Pupils attending boys only schools were no more likely to drink than those attending co-educational schools. By year five, the proportions of weekly or more frequent drinkers in co-educational, boys' and girls' schools were 42%, 50% and 52% respectively. In co-educational schools, there was no gender difference in the proportions drinking frequently (42% for both groups). The protective effect of parental monitoring did not vary by school gender. These findings again point to the importance of school environment for risk of drinking. The reason for the elevated risk in girls' schools is unclear, it certainly appears that the gender difference in rates of drinking for this cohort of younger people is negligible. The change in gender roles over the last century has seen a corresponding increase in alcohol use among women, and the results here attest to the erosion of the traditional pattern of abstinence from alcohol among women. Single gender schools have higher overall rates of drinking, after accounting for confounding factors, the rate remained elevated for girls' schools. This suggests that

there may be differences in girls' and boys' schools in the extent to which factors such as monitoring affect drinking risk. Girls in co-educational schools are more heavily monitored than their peers in girls only schools, while boys in boys' schools experience less monitoring than boys in co-educational schools. It may be the case that girls attending co-educational schools are more heavily monitored, perhaps due to parental concerns surrounding sexual relationships, and this has the protective effect on alcohol use. Parents of girls attending girls' schools may have less concern over sex and pregnancy due to less frequent contact with boys, but this has the effect of facilitating more frequent drinking.

Pupils attending schools in Ballymena had lower risk of drinking alcohol as frequently. The protective effect of parental monitoring on alcohol use was also less pronounced in Ballymena than elsewhere. The demographic profile of Ballymena contains a large proportion of people from religious groups that traditionally abstain from alcohol. This may in part account for the lower overall rates and frequency of alcohol use; however, the tendency for a less protective effect of monitoring in Ballymena persisted after accounting for the difference in rates of drinking between schools. This suggests that the difference in peer influences on alcohol use between Ballymena and Belfast go beyond simple rates of exposure to alcohol. There are other differences in the environment that make parental influence less important a protective factor.

Latent profile analyses were used to assess the inter-relationship between the overall monitoring scale, and the three subscales representing different means of receiving information about children's activities. These findings found that all scales correlated to a large degree, scoring highly on one of the scales was predictive of scoring highly on all others. The best model predicted three classes, each scoring high, medium or low on all scales. This finding is important, as it suggests there is some degree of consistency – at least from a child's perspective – in the extent to which parents understand their children's day to day lives. Were it the case that the scales demarcated different methods of gaining monitoring information, this would

suggest that there are distinct styles of parenting behaviours in the population, some of which may be more or less amenable to intervention than others. For example, had some parents relied exclusively on controlling behaviour, while others relied solely on soliciting information from children instead of controlling their child's activities, an intervention aimed at improving the extent to which children disclose information about their free time activities might appear completely unsuitable to these family dynamics. In fact, it appears to be the case that parents rely to a greater or lesser extent on all three means of monitoring styles, and thus global improvement in monitoring and communication can improve outcomes for children.

The final stage of analysis looked at the relationship between parental monitoring, attachment, and alcohol use. The findings were that, in the short term, better parental attachment did not affect drinking frequency. The underlying reason for this was more complex. Better parental attachment, independent of other influences, tends to reduce the amount that young people drink. Better attached children also tend to be less heavily monitored; this lower monitoring then enables drinking behaviour and thus acts to increase the risk of drinking. The combination of the positive and a negative effect on drinking risk, is thus a zero association. On face value, this finding would suggest that if an intervention wants to reduce alcohol use among young people, then it would be better focussing on improving parental monitoring behaviour rather than aiming to improve parent-child attachment. This of course ignores the complex relationship between parent-child relationship and the extent to which this can determine monitoring behaviour. It may be impossible to change monitoring, control, parental solicitation and child disclosure without first acting to improve the relationships, communication and openness which may underpin these behaviours. Furthermore, intervening to increase parental monitoring may lead parents to adopt more authoritarian and controlling behaviours, which may worsen family relationships without a corresponding improvement in parental knowledge. Levels of monitoring tend to decrease into later adolescence, with teenagers exerting greater autonomy and having greater freedom to drink and engage in other 'risky' behaviours. As such, the role of monitoring plays an increasingly smaller role in outcomes for young people. Quality of relationships, with

parents, other adults, peers and partners do play an important part at all ages, and the relative importance of these factors is likely to increase. The data reported here only looked at outcomes around 16 years; it may be the case that in the longer term, attachment becomes the greater influence on outcomes.

The outcome for this study was frequency of alcohol use, ranging from non-drinking, infrequent drinkers, monthly drinkers, or weekly or more frequent drinkers. This outcome measure may not serve as a useful indicator of problematic alcohol use. There is no indication of drunkenness, amount consumed when drinking, or other indications of problematic alcohol use, even for those who stated they are drinking weekly or more frequently. As such, there is a limitation on the extent to which these results demonstrate school variation, or protective family level factors in terms of 'risky' or harmful alcohol use. Further studies should assess the extent to which the parenting and family characteristics identified here are related to longer term indicators of harmful drinking. The major strength of the approach used here is that the measure of alcohol use, while less indicative of longer term problems, was equally applicable at all ages in the study. Measure such as expenditure on alcohol, or Alcohol Use Disorders Identification Test scores would not be applicable to 11 year olds in the same way as they are for 18 year olds. By using a less specific measure of alcohol problems, the study was more sensitive to less dramatic changes in the development of alcohol behaviours; the results were able to demonstrate the relationship between monitoring and alcohol use throughout the early teenage years across a time period when both behaviours are changing. Furthermore, drinking alcohol once a week or more frequently below age 16 is a risk factor for longer term negative health outcomes.

The findings of this study are of importance to the academic understanding of adolescent development and alcohol use, and to the field of alcohol harm reduction, family support, and youth alcohol policy.

The scale of this study makes it rather exceptional in the study of the interaction between adolescent and family behaviour; it is the size of this study that allowed us

to uncover both environment-driven, and youth-driven influences of greater alcohol use being followed by lower monitoring, making an important contribution to the current understanding of the monitoring – child behaviour literature.

The ability to investigate between school differences underlines the importance of the wider context of alcohol use beyond the influence of the family. Any attempt to improve alcohol outcomes must take into account how the relative influence of parents and peers changes with age.

Lastly, these findings have demonstrated how policies or practices which target a single aspect of social functioning are likely to be inadequate in achieving improved outcomes for young people. Influencing one aspect of family functioning will have knock-on consequences for other aspects of family life and subsequent adolescent outcomes, and all of these influences are further limited depending on the relative influence of school and peer environments.

These findings may have resonance for policy and practice surrounding young people's use of alcohol, family environment and school environment. While we have highlighted some of these issues, further work is needed to communicate these findings to stakeholders, gain feedback on the implications, and find ways in which the public response to alcohol related harms can change.

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Appendix 1 Statistical Output for Models Included in the Report

This appendix reports the results of models analysed using Mplus, as described in text and in diagrams in phase 1 and 2 of the analysis above.

Model 55: Associations between Alcohol use and Parental Monitoring

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 1 Monitoring	0.796	<0.001
Year 4 Monitoring	0.746	0.002
Year 4 Alcohol Use	5.027	<0.001
Year 4 Parental Attachment	0.896	0.079
Year 4 Alcohol Use		
Year 1 Monitoring	0.878	0.037
Year 2 Monitoring	0.837	0.036
Year 3 Monitoring	0.71	<0.001
Year 3 Alcohol Use	3.405	<0.001
Female	1.264	0.013
Year 1 Sdq	1.016	0.776
Year 3 Affluence	1.028	0.45
Year 3 Parental Attachment	0.906	0.031
Reconstituted Family	1.645	0.04
Single Parent	1.359	0.037
Year 3 Alcohol Use		
Year 1 Monitoring	0.842	0.004
Year 2 Monitoring	0.796	<0.001
Year 2 Alcohol Use	3.281	<0.001
Year 2 Affluence	1.089	0.055
Single Parent	1.455	0.006
Year 2 Alcohol Use		
Year 1 Monitoring	0.732	<0.001
Year 1 Alcohol Use	3.098	<0.001
Female	1.205	0.076
Year 2 Affluence	1.101	0.004
Year 1 Parental Attachment	1.065	0.118
Reconstituted Family	1.524	0.011
Single Parent	1.357	0.007

Year 5 Monitoring	Linear Regression Coefficient	P Value
Year 2 Alcohol Use	-0.034	0.065
Year 4 Monitoring	0.548	<0.001
Female	0.087	0.016
Year 4 Sdq	-0.041	0.094
Year 4 Parental Attachment	-0.15	<0.001
Reconstituted Family	-0.232	<0.001
Year 4 Monitoring		
Year 1 Alcohol Use	-0.052	0.047
Year 3 Alcohol Use	-0.051	0.022
Year 3 Monitoring	0.626	<0.001
Female	0.108	0.024
Year 1 Sdq	-0.036	0.01
Year 3 Affluence	0.021	0.078
Year 3 Parental Attachment	-0.069	0.021
Year 3 Monitoring		
Year 1 Alcohol Use	-0.049	0.062
Year 2 Alcohol Use	-0.071	0.002
Year 2 Monitoring	0.553	<0.001
Year 1 Parental Attachment	-0.123	<0.001
Year 2 Monitoring		
Year 1 Alcohol Use	-0.143	<0.001
Year 1 Monitoring	0.494	<0.001
Year 1 Affluence	0.027	0.064
Year 1 Parental Attachment	-0.136	<0.001
Reconstituted Family	-0.189	0.005
Single Parent	-0.12	0.029
Ssbic		
Log Likelihood		
Correction Factor		
Free Parameters		

Model 65: Alcohol Use and Child Disclosure

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 1 Disclosure	0.806	<0.001
Year 4 Alcohol Use	5.608	<0.001
Reconstituted Family	1.429	0.017
Year 4 Alcohol Use		
Year 2 Disclosure	0.849	0.004
Year 3 Disclosure	0.645	<0.001
Year 3 Alcohol Use	3.489	<0.001
Female	1.214	0.031
Year 1 Sdq	1.058	0.296
Year 3 Parental Attachment	0.869	0.004
Reconstituted Family	1.584	0.062
Single Parent	1.306	0.046
Year 3 Alcohol Use		
Year 1 Disclosure	0.849	0.006
Year 2 Disclosure	0.785	<0.001
Year 2 Alcohol Use	3.203	<0.001
Year 2 Affluence	1.093	0.039
Reconstituted Family	1.391	0.074
Single Parent	1.537	0.002
Year 2 Alcohol Use		
Year 1 Disclosure	0.659	<0.001
Year 1 Alcohol Use	2.91	<0.001
Female	1.236	0.038
Reconstituted Family	1.415	0.044
Single Parent	1.369	0.004

Year 5 Disclosure	Linear Regression Coefficient	P Value
Year 4 Disclosure	0.561	<0.001
Female	0.126	<0.001
Year 4 Parental Attachment	-0.189	<0.001
Reconstituted Family	-0.207	0.019
Year 4 Disclosure		
Year 1 Alcohol Use	-0.043	0.108
Year 3 Alcohol Use	-0.098	<0.001
Year 3 Disclosure	0.514	<0.001
Female	0.107	0.024
Year 1 Sdq	-0.027	0.078
Year 3 Affluence	0.02	0.021
Year 3 Parental Attachment	-0.16	<0.001
Year 3 Disclosure		
Year 2 Alcohol Use	-0.085	<0.001
Year 2 Disclosure	0.485	<0.001
Female	0.079	0.014
Year 1 Parental Attachment	-0.136	<0.001
Reconstituted Family	-0.157	0.006
Single Parent	-0.075	0.151
Year 2 Disclosure		
Year 1 Alcohol Use	-0.13	<0.001
Year 1 Disclosure	0.418	<0.001
Year 1 Affluence	0.051	0.001
Year 1 Parental Attachment	-0.173	<0.001
Reconstituted Family	-0.133	0.053
Ssbic	37778.678	
Log Likelihood	-18740.642	
Correction Factor	1.436	
Free Parameters	67	

Model 75: Alcohol Use and Parental Control

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 3 Control	0.742	0.001
Year 4 Alcohol Use	5.369	<0.001
Year 4 Sdq	1.123	0.033
Year 4 Alcohol Use		
Year 1 Control	0.828	0.002
Year 2 Control	0.862	0.019
Year 3 Control	0.849	0.01
Year 3 Alcohol Use	3.671	<0.001
Female	1.274	0.008
Year 1 Sdq	1.104	0.058
Reconstituted Family	1.56	0.074
Year 3 Alcohol Use		
Year 1 Control	0.89	0.017
Year 2 Control	0.834	<0.001
Year 2 Alcohol Use	3.413	<0.001
Year 2 Affluence	1.092	0.021
Year 1 Parental Attachment	1.137	0.02
Reconstituted Family	1.385	0.084
Single Parent	1.467	0.003
Year 2 Alcohol Use		
Year 1 Control	0.746	<0.001
Year 1 Alcohol Use	3.039	<0.001
Female	1.233	0.034
Year 1 Parental Attachment	1.157	<0.001
Reconstituted Family	1.431	0.057
Single Parent	1.324	0.014

Year 5 Control	Linear Regression Coefficient	P Value
Year 2 Alcohol Use	-0.039	0.076
Year 4 Alcohol Use	-0.072	0.001
Year 4 Control	0.571	<0.001
Female	0.198	<0.001
Year 4 Control		
Year 3 Alcohol Use	-0.097	<0.001
Year 3 Control	0.516	<0.001
Female	0.301	<0.001
Year 1 Sdq	-0.011	0.582
Year 3 Affluence	0.04	0.007
Year 3 Control		
Year 1 Alcohol Use	-0.065	0.018
Year 2 Alcohol Use	-0.072	0.001
Year 2 Control	0.479	<0.001
Female	0.079	0.016
Year 1 Sdq	0.027	0.167
Year 1 Parental Attachment	-0.076	<0.001
Reconstituted Family	-0.197	0.005
Year 2 Control		
Year 1 Alcohol Use	-0.096	0.005
Year 1 Control	0.45	<0.001
Female	0.144	0.012
Year 1 Sdq	0.04	0.041
Year 1 Affluence	0.036	0.022
Year 1 Parental Attachment	-0.102	<0.001
Reconstituted Family	-0.149	0.015
Single Parent	-0.138	0.02
Ssbic	38902.604	
Log Likelihood	-19381.302	
Correction Factor	1.578	
Free Parameters	70	

Model 85 – Parental Solicitation

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	5.639	<0.001
Year 4 Alcohol Use		
Year 2 Solicitation	1.021	0.607
Year 3 Alcohol Use	3.963	<0.001
Year 1 Sdq	1.115	0.043
Reconstituted Family	1.857	0.011
Single Parent	1.35	0.027
Year 3 Alcohol Use		
Year 2 Alcohol Use	3.523	<0.001
Year 3 Affluence	1.063	0.051
Year 3 Parental Attachment	1.35	<0.001
Year 2 Alcohol Use		
Year 1 Alcohol Use	3.351	<0.001
Year 1 Parental Attachment	1.196	<0.001
Reconstituted Family	1.526	0.012
Single Parent	1.287	0.022

	Linear Regression Coefficient	P Value
Year 5 Solicitation		
Year 4 Solicitation	0.549	<0.001
Female	0.149	<0.001
Year 4 Parental Attachment	-0.115	<0.001
Reconstituted Family	-0.058	0.44
Single Parent	-0.031	0.571
Year 4 Solicitation		
Year 3 Solicitation	0.484	<0.001
Female	0.243	<0.001
Year 3 Affluence	0.043	<0.001
Year 3 Parental Attachment	-0.13	<0.001
Year 3 Solicitation		
Year 2 Solicitation	0.408	<0.001
Female	0.174	<0.001
Year 2 Affluence	0.022	0.069
Year 1 Parental Attachment	-0.124	<0.001
Year 2 Solicitation		
Year 1 Solicitation	0.306	<0.001
Year 1 Alcohol Use	-0.102	0.001
Female	0.179	<0.001
Year 1 Parental Attachment	-0.164	<0.001
Reconstituted Family	-0.227	0.01
Single Parent	-0.133	0.026
Ssbic	39889.550	
Log Likelihood	-19822.002	
Correction Factor	1.646	
Free Parameters	55	

Gender Interaction Models:
Model 56: Gender Difference in Alcohol use and Parental Monitoring

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 1 Monitoring	0.805	0.003
Year 4 Monitoring	0.776	0.032
Year 4 Alcohol Use	4.869	<0.001
Female	0.958	0.793
Female * Year 4 Monitoring	1.094	0.536
Female * Year 1 Monitoring	1.022	0.871
Year 4 Alcohol Use		
Year 1 Monitoring	0.807	0.01
Year 2 Monitoring	0.787	0.065
Year 3 Monitoring	0.906	0.272
Year 3 Alcohol Use	3.4	<0.001
Female	1.273	0.017
Female * Year 1 Monitoring	1.241	0.072
Female * Year 2 Monitoring	1.08	0.635
Female * Year 3 Monitoring	0.736	0.015
Year 3 Alcohol Use		
Year 1 Monitoring	0.813	0.008
Year 2 Monitoring	0.826	0.003
Year 2 Alcohol Use	3.352	<0.001
Female	1.18	0.091
Female * Year 1 Monitoring	1.123	0.271
Female * Year 2 Monitoring	0.904	0.371
Year 2 Alcohol Use		
Year 1 Monitoring	0.783	0.006
Year 1 Alcohol Use	3.228	<0.001
Female	1.23	0.046
Female * Year 1 Monitoring	0.938	0.521

Year 5 Monitoring	Linear Regression Coefficient	P Value
Year 2 Alcohol Use	-0.049	0.069
Year 4 Monitoring	0.647	<0.001
Female	0.067	0.217
Female * Year 2 Alcohol Use	0.012	0.697
Year 4 Monitoring		
Year 1 Alcohol Use	-0.047	0.108
Year 3 Alcohol Use	-0.013	0.639
Year 3 Monitoring	0.664	<0.001
Female	0.199	0.002
Female * Year 1 Alcohol Use	-0.012	0.819
Female * Year 3 Alcohol Use	-0.06	0.114
Year 3 Monitoring		
Year 1 Alcohol Use	-0.082	0.014
Year 2 Alcohol Use	-0.039	0.197
Year 2 Monitoring	0.592	<0.001
Female	0.007	0.921
Female * Year 1 Alcohol Use	-0.007	0.911
Female * Year 2 Alcohol Use	-0.039	0.253
Year 2 Monitoring		
Year 1 Alcohol Use	-0.111	0.016
Year 1 Monitoring	0.55	<0.001
Female	0.099	0.012
Female * Year 1 Alcohol Use	-0.071	0.171

Ssbic	37899.137
Log Likelihood	-18882.569
Correction Factor	1.584
Free Parameters	67

Model 66: Gender Differences Alcohol Use And Child Disclosure

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 1 Disclosure	0.806	<0.001
Year 4 Alcohol Use	5.608	<0.001
Reconstituted Family	1.429	0.017
Year 4 Alcohol Use		
Year 2 Disclosure	0.849	0.004
Year 3 Disclosure	0.645	<0.001
Year 3 Alcohol Use	3.489	<0.001
Female	1.214	0.031
Year 1 Sdq	1.058	0.296
Year 3 Parental Attachment	0.869	0.004
Reconstituted Family	1.584	0.062
Single Parent	1.306	0.046
Year 3 Alcohol Use		
Year 1 Disclosure	0.849	0.006
Year 2 Disclosure	0.785	<0.001
Year 2 Alcohol Use	3.203	<0.001
Year 2 Affluence	1.093	0.039
Reconstituted Family	1.391	0.074
Single Parent	1.537	0.002
Year 2 Alcohol Use		
Year 1 Disclosure	0.659	<0.001
Year 1 Alcohol Use	2.91	<0.001
Female	1.236	0.038
Reconstituted Family	1.415	0.044
Single Parent	1.369	0.004

Year 5 Disclosure	Linear Regression Coefficient	P Value
Year 4 Disclosure	0.65	<0.001
Female	0.118	0.001
Female * Year 4 Disclosure	0.03	0.41
Year 4 Disclosure		
Year 1 Alcohol Use	-0.035	0.335
Year 3 Alcohol Use	-0.106	<0.001
Year 3 Disclosure	0.565	<0.001
Female	0.186	0.008
Female * Year 1 Alcohol Use	-0.043	0.519
Female * Year 3 Alcohol Use	-0.032	0.351
Year 3 Disclosure		
Year 2 Alcohol Use	-0.056	0.031
Year 2 Disclosure	0.542	<0.001
Female	0.083	0.138
Female * Year 2 Alcohol Use	-0.036	0.327
Year 2 Disclosure		
Year 1 Alcohol Use	-0.09	0.009
Year 1 Disclosure	0.521	<0.001
Female	0.129	0.023
Female * Year 1 Alcohol Use	-0.083	0.138

Ssbic	40794.507
Log Likelihood	-20262.524
Correction Factor	1.557
Free Parameters	60

Model 76: Gender Differences in alcohol use and Parental Control

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 3 Control	0.674	0.001
Year 4 Alcohol Use	5.124	<0.001
Female	0.834	0.313
Female * Year 3 Control	1.174	0.297
Year 4 Alcohol Use		
Year 1 Control	0.811	0.004
Year 2 Control	0.871	0.079
Year 3 Control	0.92	0.14
Year 3 Alcohol Use	3.594	<0.001
Female	1.346	0.002
Female * Year 1 Control	1.004	0.974
Female * Year 2 Control	1.071	0.557
Female * Year 3 Control	0.8	0.053
Year 3 Alcohol Use		
Year 1 Control	0.835	0.001
Year 2 Control	0.822	0.004
Year 2 Alcohol Use	3.24	<0.001
Female	1.177	0.085
Female * Year 1 Control	1.061	0.556
Female * Year 2 Control	0.932	0.519
Year 2 Alcohol Use		
Year 1 Control	0.736	<0.001
Year 1 Alcohol Use	3.281	<0.001
Female	1.344	0.001
Female * Year 1 Control	0.967	0.738

Year 5 Control	Linear Regression Coefficient	P Value
Year 2 Alcohol Use	-0.05	0.007
Year 4 Alcohol Use	-0.068	0.001
Year 4 Control	0.577	<0.001
Female	0.225	<0.001
Female * Year 2 Alcohol Use	0.007	0.871
Female * Year 4 Alcohol Use	-0.008	0.779
Year 4 Control		
Year 3 Alcohol Use	-0.084	0.012
Year 3 Control	0.509	<0.001
Female	0.305	<0.001
Female * Year 3 Alcohol Use	0	>0.999
Year 3 Control		
Year 1 Alcohol Use	-0.052	0.399
Year 2 Alcohol Use	-0.092	0.007
Year 2 Control	0.501	<0.001
Female	0.09	0.119
Female * Year 1 Alcohol Use	-0.051	0.523
Female * Year 2 Alcohol Use	-0.003	0.951
Year 2 Control		
Year 1 Alcohol Use	-0.056	0.167
Year 1 Control	0.475	<0.001
Female	0.202	0.004
Female * Year 1 Alcohol Use	-0.041	0.471
Ssbic	38814.486	
Log Likelihood	-19342.243	
Correction Factor	1.593	
Free Parameters	65	

Model 86: Gender Differences In Alcohol Use And Parental Solicitation

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	5.577	<0.001
Year 4 Alcohol Use		
Year 2 Solicitation	1.035	0.602
Year 3 Alcohol Use	4.039	<0.001
Female	1.131	0.21
Female * Year 2 Solicitation	0.935	0.437
Year 3 Alcohol Use		
Year 2 Alcohol Use	3.515	<0.001
Female	0.994	0.971
Female * Year 2 Alcohol Use	1.057	0.6
Year 2 Alcohol Use		
Year 1 Alcohol Use	3.112	<0.001
Female	0.941	0.626
Female * Year 1 Alcohol Use	1.348	0.022

Year 5 Solicitation	Linear Regression Coefficient	P Value
Year 4 Solicitation	0.571	<0.001
Female	0.17	<0.001
Female * Year 4 Solicitation	0.055	0.121
Year 4 Solicitation On		
Year 3 Solicitation	0.35	<0.001
Female	0.254	<0.001
Female * Year 3 Solicitation	0.271	<0.001
Year 3 Solicitation On		
Year 2 Solicitation	0.355	<0.001
Female	0.147	<0.001
Female * Year 2 Solicitation	0.134	0.002
Year 2 Solicitation On		
Year 1 Solicitation	0.303	<0.001
Year 1 Alcohol Use	-0.138	<0.001
Female	0.17	<0.001
Female *Year 1 Solicitation	0.12	0.005

Ssbic	42381.259
Log Likelihood	-21084.884
Correction Factor	1.813
Free Parameters	47

Model 301: School variation in Alcohol use

Year 5 Alcohol Use	Odds Ratio	P Value
Year 1 Monitoring	0.857	0.037
Year 4 Monitoring	0.693	<0.001
Year 4 Alcohol Use	4.867	<0.001
Female	1.038	0.77
Year 4 Affluence	1.011	0.739
Year 4 Parental Attachment	0.827	0.002
Year 4 Sdq	1.066	0.258
Level 2 Variance	0.27	
Ssbic	9970.070	
Log Likelihood	-4952.677	
Free Parameters	14	

Model 302: School variation in Effect of year 4 Monitoring

Year 5 Alcohol Use	Odds Ratio	P Value
Year 1 Monitoring	0.856	0.029
Year 4 Monitoring	0.7	<0.001
Year 4 Alcohol Use	4.71	<0.001
Female	1.044	0.752
Year 4 Affluence	1.007	0.84
Year 4 Parental Attachment	0.822	0.002
Year 4 Sdq	1.092	0.12
Level 2 Intercept Variance	0.121	
Year 4 Mon Variance	0.022	
Intercept/Slope Covariance	-0.028	
Ssbic	17299.898	
Log Likelihood	-8631.949	
Free Parameters	18	

Model 303: School variation in effect of Year 1 Monitoring

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 1 Monitoring	0.874	0.023
Year 4 Monitoring	0.691	<0.001
Year 4 Alcohol Use	4.571	<0.001
Female	1.071	0.713
Year 4 Affluence	1.003	0.926
Year 4 Parental Attachment	0.877	0.012
Year 4 Sdq	1.056	0.221
Level 2 Intercept Variance	0.095	
Year 1 Mon Variance	0.065	
Intercept/Slope Covariance	-0.05	
Ssbic	20851.116	
Log Likelihood	-10407.558	
Free Parameters	18	

Model 311: School variation in Disclosure

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 1 Disclosure		0.842
Year 4 Alcohol Use		5.132
Female		0.879
Year 4 Affluence		1.01
Year 4 Parental Attachment		0.967
Year 4 Sdq		1.148
Level 2 Intercept Variance	0.314	
Ssbic	10284.199	
Log Likelihood	-5111.844	
Free Parameters	13	

Model 312: School variation in Effect of Year 1 Disclosure

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 1 Disclosure	0.853	<0.001
Year 4 Alcohol Use	4.956	<0.001
Female	1.043	0.766
Year 4 Affluence	0.998	0.948
Year 4 Parental Attachment	0.995	0.928
Year 4 Sdq	1.123	0.005
Level 2 Intercept Variance	0.041	
Year 1 Dis Variance	0.036	
Intercept/Slope Covariance	-0.037	
Ssbic	21690.253	
Log Likelihood	-10828.127	
Free Parameters	17	

Model 321: School variation in Alcohol use adjusting For parental control

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 3 Control	0.775	<0.001
Year 4 Alcohol Use	4.877	<0.001
Female	0.923	0.512
Year 4 Affluence	1.013	0.607
Year 4 Parental Attachment	0.991	0.85
Year 4 Sdq	1.157	0.001
Level 2 Intercept Variance	0.157	
Ssbic	13394.402	
Log Likelihood	-6665.201	
Correction Factor	1.838	
Free Parameters	13	

Model 322: School variation in Effect Of Year 3 Control

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 3 Control	0.792	<0.001
Year 4 Alcohol Use	4.969	<0.001
Female	0.974	0.855
Year 4 Affluence	1.023	0.348
Year 4 Parental Attachment	1.008	0.869
Year 4 Sdq	1.122	0.007
Level 2 Intercept Variance	0.167	
Year 3 Con Variance	0.043	
Intercept/Slope Covariance	-0.041	
Ssbic	23919.372	
Log Likelihood	-11916.799	
Correction Factor	1.734	
Free Parameters	17	

Model 401: School variation in Monitoring

Year 5 Monitoring	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	-0.024	0.106
Year 3 Alcohol Use	-0.026	0.215
Year 4 Monitoring	0.549	<0.001
Female	0.114	<0.001
Year 4 Affluence	-0.006	0.622
Year 4 Parental Attachment	-0.155	<0.001
Year 4 Sdq	-0.032	0.079
Level 2 Intercept Variance	0.004	
Ssbic	23718.961	
Log Likelihood	-11819.360	
Correction Factor	1.938	
Free Parameters	16	

Model 501: School variation in Solicitation

Year 5 Solicitation	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	0.027	0.103
Year 4 Solicitation	0.527	<0.001
Female	0.176	<0.001
Year 4 Affluence	0.005	0.653
Year 4 Parental Attachment	-0.103	<0.001
Year 4 Sdq	-0.039	0.014
Level 2 Intercept Variance	0.004	
Ssbic	15704.022	
Log Likelihood	-7821.889	
Correction Factor	1.706	
Free Parameters	12	

Model 601: School variation in Solicitation

Year 5 Control	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	-0.053	0.004
Year 2 Alcohol Use	-0.045	0.002
Year 1 Alcohol Use	-0.014	0.525
Year 4 Control	0.582	<0.001
Female	0.212	<0.001
Year 4 Affluence	0.007	0.436
Year 4 Parental Attachment	-0.034	0.031
Year 4 Sdq	0.003	0.835
Level 2 Intercept Variance	0.006	
Ssbic	28352.970	
Log Likelihood	-14126.118	
Correction Factor	1.867	
Free Parameters	20	

Model 701: School variation in Disclosure

Year 5 Disclosure	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	-0.051	<0.001
Year 4 Disclosure	0.512	<0.001
Female	0.157	<0.001
Year 4 Affluence	-0.01	0.22
Year 4 Parental Attachment	-0.174	<0.001
Year 4 Sdq	-0.049	0.008
Level 2 Intercept Variance	0.005	
Ssbic	15332.060	
Log Likelihood	-7635.890	
Correction Factor	1.689	
Free Parameters	12	

Model 800: Peer Alcohol effect on individual Alcohol use

Year 5 Alcohol Use	Odds Ratio	P Value
Year 4 Alcohol Use	4.476	<0.001
Female	0.982	0.901
Year 4 Affluence	0.985	0.681
Year 4 Parental Attachment	0.87	0.03
Year 4 Sdq	1.085	0.172
Year 4 Monitoring	0.74	<0.001
Year 1 Monitoring	0.827	0.01
Year 4 Mean Peer Alcohol use	1.929	0.008
Year 1 Mean Peer Alcohol use	1.571	0.482
Ssbic	9248.046	
Log Likelihood	-4590.015	
Correction Factor	1.749	
Free Parameters	15	

Model 801: Peer Monitoring effect on Alcohol use

Year 5 Alcohol Use	Odds Ratio	P Value
Year 4 Alcohol Use	4.577	<0.001
Female	1.068	0.622
Year 4 Affluence	0.987	0.727
Year 4 Parental Attachment	0.856	0.021
Year 4 Sdq	1.094	0.139
Year 4 Monitoring	0.734	<0.001
Year 1 Monitoring	0.832	0.011
Year 4 Mean Peer Alcohol use	1.032	0.823
Year 1 Mean Peer Alcohol use	0.679	<0.001
Ssbic	9243.236	
Log Likelihood	-4587.617	
Correction Factor	1.737	
Free Parameters	15	

Model 802: Peer Monitoring & Peer Alcohol effects on individual Alcohol use

Year 5 Alcohol Use	Odds Ratio	P Value
Year 4 Alcohol Use	4.463	<0.001
Female	1.029	0.829
Year 4 Affluence	0.992	0.834
Year 4 Parental Attachment	0.87	0.031
Year 4 Sdq	1.09	0.154
Year 4 Monitoring	0.739	<0.001
Year 1 Monitoring	0.842	0.019
Y4pmon	1.175	0.264
Y1pmon	0.698	0.001
Year 4 Mean Peer Alcohol use	1.905	0.007
Year 1 Mean Peer Alcohol use	1.02	0.977
Ssbic	9174.860	
Log Likelihood	-4570.430	
Correction Factor	1.655	
Free Parameters	17	

Model 901: All school level effects on Alcohol Use, except School sex

Year 5 Alcohol Use	Odds Ratio	P Value
Year 4 Alcohol Use	4.834	<0.001
Female	1.019	0.893
Year 4 Affluence	1.011	0.766
Year 4 Parental Attachment	0.829	0.002
Year 4 Sdq	1.073	0.21
Year 4 Monitoring	0.669	<0.001
Year 1 Monitoring	0.853	0.029
Ballymena	0.675	0.248
Year 4 Monitoring * Ballymena	1.259	0.015
Year 4 School Alcohol Use	0.98	0.986
Between School Variance	0.226	
Ssbic	9976.726	
Log Likelihood	-4949.072	
Correction Factor	1.616	
Free Parameters	17	

Model 910b: School location Effect on Alcohol use – Single Level

Year 5 Alcohol Use	Odds Ratio	P Value
Year 4 Alcohol Use	4.738	<0.001
Female	0.994	0.965
Year 4 Affluence	0.98	0.569
Year 4 Parental Attachment	0.818	0.002
Year 4 Sdq	1.075	0.204
Year 4 Monitoring	0.7	<0.001
Year 1 Monitoring	0.837	0.012
Downpatrick	1.221	0.314
Ballymena	0.613	0.001
Ssbic	9976.726	
Log Likelihood	-4949.072	
Correction Factor	1.616	
Free Parameters	17	

Model 911b: School location Effect on Alcohol use – Random Intercept

Year 5 Alcohol Use	Odds Ratio	P Value
Year 4 Alcohol Use	4.806	<0.001
Female	1.013	0.93
Year 4 Affluence	1.005	0.877
Year 4 Parental Attachment	0.826	0.002
Year 4 Sdq	1.068	0.251
Year 4 Monitoring	0.692	<0.001
Year 1 Monitoring	0.856	0.037
Downpatrick	1.338	0.193
Ballymena	0.756	0.313
Level 2 Variance	0.180	
Ssbic	9972.824	
Log Likelihood	-4949.432	
Correction Factor	1.741	
Free Parameters	16	

Model 913b: School location effect on Alcohol use with Monitoring * Ballymena Interaction – Random Intercept

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	4.778	<0.001
Female	0.975	0.828
Year 4 Affluence	0.997	0.926
Year 4 Parental Attachment	0.817	0.002
Year 4 Sdq	1.074	0.207
Year 4 Monitoring	0.646	<0.001
Year 1 Monitoring	0.843	0.012
Downpatrick	1.398	0.431
Ballymena	0.638	0.016
Year 4 Monitoring * Downpatrick	1.071	0.554
Year 4 Monitoring * Ballymena	1.276	0.025
Level 2 Variance	0.107	
Ssbic	9937.306	
Log Likelihood	-4950.653	
Correction Factor	1.572	
Free Parameters	18	

Model 913b_Adj: School location Effect on Alcohol use with Monitoring* Ballymena Interaction, controlling for mean School alcohol Use – Random Intercept

Year 5 Alcohol Use On	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	4.780	<0.001
Female	0.96.	0.722
Year 4 Affluence	1.012	0.750
Year 4 Parental Attachment	0.827	0.002
Year 4 Sdq	1.070	0.227
Year 4 Monitoring	0.647	<0.001
Year 1 Monitoring	0.854	0.020
Downpatrick	1.403	0.126
Ballymena	0.849	0.712
Year 4 School Alcohol Use	6.676	0.131
Year 4 Monitoring * Downpatrick	1.066	0.569
Year 4 Monitoring * Ballymena	1.271	0.028
Level 2 Variance	0.164	
Ssbic	9984.611	
Log Likelihood	-4948.392	
Correction Factor	1.426	
Free Parameters	19	

Model 916: Average level of School Monitoring effect on Alcohol use – Random Intercept

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	4.793	<0.001
Female	0.997	0.983
Year 4 Affluence	1.002	0.942
Year 4 Parental Attachment	0.817	0.002
Year 4 Sdq	1.075	0.198
Year 4 Monitoring	0.683	<0.001
Year 1 Monitoring	0.85	0.02
Year 4 School Monitoring	0.72	0.609
Level 2 Variance	0.184	
Ssbic	9978.540	
Log Likelihood	-4954.601	
Correction Factor	1.672	
Free Parameters	15	

Model 918: Average Level of School Monitoring, and Interaction between Individual and School Level Monitoring Effect on Alcohol use – Random Intercept

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	4.802	<0.001
Female	0.993	0.955
Year 4 Affluence	1.003	0.928
Year 4 Parental Attachment	0.82	0.002
Year 4 Sdq	1.075	0.204
Year 1 Monitoring	0.852	0.023
Year 4 Monitoring	0.679	<0.001
Year 4 School Monitoring	0.698	0.603
Year 4 Monitoring * School Monitoring	1.193	0.638
Level 2 Variance	0.186	
Ssbic	9982.687	
Log Likelihood	-4954.363	
Correction Factor	1.712	
Free Parameters	16	

Model 921: Average level of School Alcohol use – Random Intercept

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	4.791	<0.001
Female	0.968	0.76
Year 4 Affluence	1.013	0.695
Year 4 Parental Attachment	0.826	0.002
Year 4 Sdq	1.072	0.229
Year 4 Monitoring	0.682	<0.001
Year 1 Monitoring	0.862	0.033
Year 4 School Alcohol Use	6.757	0.001
Level 2 Variance	0.216	
Ssbic	9973.358	
Log Likelihood	-4952.010	
Correction Factor	1.482	
Free Parameters	15	

Model 923: Average level of School Alcohol use with Monitoring * School Alcohol Interaction – Random Intercept

Year 5 Alcohol Use	**Odds Ratio**	**P Value**
Year 4 Alcohol Use	4.802	<0.001
Female	1.01	0.931
Year 4 Affluence	1.009	0.794
Year 4 Parental Attachment	0.826	0.003
Year 4 Sdq	1.069	0.244
Year 4 Monitoring	0.716	0.082
Year 1 Monitoring	0.857	0.023
Year 4 Monitoring *School Alcohol	0.863	0.793
Level 2 Variance	0.201	
Ssbic	9973.358	
Log Likelihood	-4952.010	
Correction Factor	1.482	
Free Parameters	15	