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Antecedents of hazardous teenage drinking: analysis of the 1970 British Cohort Study

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1. Introduction

While the proportion of UK teenagers drinking alcohol has remained relatively constant, the average volume of alcohol consumed by underage drinkers has increased significantly over the last decade or so (Erens & Hedges, 1998; Westlake & Yar, 2006). Such changes in drinking patterns have coincided with other alcohol related transformation, particularly in terms of the development of alcohol brand extensions and premixed drinks, discounted prices and the liberalising of drinking hours, leading to increased opportunities for engaging in "hedonistic consumerism", where extreme drunkenness is largely tolerated (Brain, 2000; Measham & Brain, 2005).

1.1 Antecedents of teenage drinking

1.1.1 Behavioural regulation

An inability to self-regulate internal impulses to engage in hedonistic behaviour has been proposed as a key risk factor in the development of adolescent drinking problems (Percy, in press). Young people who exhibit high levels of impulsiveness, aggression, sensation seeking and inattention tend to be at a significantly increased risk of future alcohol problems (Dawes, Tarter & Kirsci, 1997; Dawes et al., 2000; Iacono, Carlson, Taylor, Elkins & McGue, 1999; Sher & Gotham, 1999; Tarter, Kirisci, Habeych, Reynolds & Vanyukov, 2004, Wills & Dishion, 2004).[1] Behavioural regulation, and the cognitive executive functioning that underpins it, also appears to be an important intermediary mechanism linking inherited genetic vulnerability to alcohol and a subsequent escalation in consumption (Glantz & Leshner, 2000; Iacono et al., 1999; Sher & Gotham, 1999, Sher et al., 1996; Tarter et al., 1999; Vanyukov et al., 2003). In addition, prenatal exposure to high levels of alcohol may result in neurological abnormalities which may further compromise executive function (Connor et al., 2000; Noland et al., 2003; Streissguth et al., 1994) leading to higher levels of behavioural undercontrol (D'Onofrio ei al., 2007; Mick et al., 2002; Olson et al., 1997) and teenage drinking (Alati et al., 2006; Baer et al., 2003).

Attention Deficit and Hyperactivity Disorder (ADHD), an often used indicator of behavioural undercontrol, is however, a somewhat inconsistent predictor of alcohol use. In a case-control study, Biederman and colleagues (2003) found no difference in the risk of later alcohol use disorder amongst teenagers with and without ADHD diagnosis. In contrast, Kumpulainen (2000) found that hyperactivity in childhood predicted alcohol consumption in adolescence. One possible reason for the inconsistency may be due to the fact that ADHD (or hyperkinetic disorder as it is labelled under the International Classification of Diseases) is itself comprised of three

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[1] This cluster of behaviour problems has also been referred to as 'antisocial propensity' (Gottfredson & Hirschi, 1990; Lahey, Waldman & McBurnett, 1999) and 'antisocial alcoholism' (associated with adult problem drinking outcomes) and its variant 'developmentally limited alcoholism' (not associated with adult problem drinking outcomes) (Zucker, 1994, 2006).

core dimensions, namely inattention, impulsivity and hyperactivity (Biederman & Faraone, 2005; Swanson, et al., 1998). It is possible that these dimensions are related to behavioural undercontrol, and therefore to alcohol, in different degrees (Smith, Molina & Pelham, 2002). In a study of ADHD and smoking behaviour, Burke, Loeber and Lahey (2001) found that when conduct disorder was controlled for, full ADHD was not associated with tobacco use. However, when the dimensions were considered separately, inattention was significantly associated with smoking even after controlling for conduct disorder and other known predictors of substance use. Patterson, DeGarmo & Knutson (2000) have argued that it is preferable to conceptualise hyperactivity and antisocial behaviour as two points on the same developmental process (hyperactivity is a childhood manifestation of poor socialisation, and antisocial behaviour an adolescent manifestation of the same process) rather than two distinct, but comorbid, conditions. Hyperactivity and antisocial behaviour may be associated with early onset alcohol problems, while inattention may lead to internalising problems and later onset alcohol problems (Smith, Molina, & Pelham, 2002).Surprising, there have been very few community based studies of the association between the early manifestation of the three dimensions of ADHD and the development of later alcohol problems.

1.1.2 Socialisation processes

While poor behavioural regulation may have a high heritability (Iacono et al., 1999), it also appears to be subsequently moderated by parental behaviour and other sources of socialisation (Dawes et al., 1997; Dawes et al., 2000; Tarter et al., 1999). Much of the research on family socialisation has suffered from major methodological weaknesses (see Harris 1995, 1998). However, more recent research, which has begun to address these weaknesses, has confirmed that family socialisation effects still arise (Collins, Maccoby, Steinberg, Hetherington & Bornstein, 2000; Galambos, Barker & Almeida, 2003; O'Connor, 2002).

At the core of family socialisation is the transmission of parental norms and behaviours to the young person. Oetting and colleagues (1998) argued that a strong attachment relationship between parent and child was essential to ensure successful socialisation, and it is this that is susceptible to poor parenting practices. While this has initial appeal, the research base supporting this proposition is surprisingly limited, both in terms of the impact that the quality of attachment has on the effectiveness of parental socialisation attempts and on the impact that poor parenting practice has on formation and maintenance of adolescent-parent attachment bonds. While there is a small body of research that confirms the association between parent-child attachment quality and child competencies (for example, Armsden & Greenberg, 1987; Bell, Forthun & Sun, 2000) much of it is cross-sectional in design, and therefore of limited power in testing developmental hypotheses.

A lack of adequate parental supervision of adolescent behaviour has, in contrast, been found to be a consistent predictor of adolescent problem behaviours (see Kumpfer, Olds, Alexander, Zucker & Gary, 1998 for review). Stattin & Kerr (2000; Kerr & Stattin, 2000) have argued that parental attempts to monitor or supervise

adolescent behaviour are rather ineffective. Parental knowledge of child behaviour appears to be determined more by the child's spontaneous disclosure of information (which itself may be a function of the overall quality of the parent-child relationship), than by parents active attempts at tracking and surveillance. The relationship between parental knowledge and child behaviour is likely to be reciprocal in nature, with low knowledge leading to increased antisocial behaviour, which in turn precipitates a further decline in parental knowledge, possibly via the increasing reluctance of the antisocial child to disclose their own behaviour (Laird, Pettit, Bates & Dodge, 2003).

Reductions in family social capital, via marital conflict or family breakdown, may impact on the likelihood of a young person developing hazardous drinking behaviour through partially disrupting the parent-child socialisation processes (Bradley & Corwyn, 2002; Cummings & Davies 2002; Jacob & Leonard, 1994; Parcel & Menaghan, 1993; Wright, Cullen & Miller, 2001). Children raised in single parent households have consistently poorer outcomes than children raised with two biological parents (Duncan & Brooks-Gunn, 1997), including increased levels of substance use behaviours (Hetherington, Bridges & Insabella, 1998; McLanahan, 1999; McLanahan & Sandefur, 1994; O'Connor, Dunn & Jenkins, 2001; Wells & Rankin, 1991). Such an indicator of inflated risk may be a marker for a number of specific risk processes including family conflict prior to separation, increased poverty and family stress, or decreased parental monitoring (Duncan & Brooks-Gunn, 1997; Galambos & Ehrenberg, 1997; Rutter et al., 1998). Where the parent is a negative influence (for example, is highly antisocial themselves) separation may decrease risk (Jaffee, Moffit, Caspi & Taylor, 2003). As a result, divorce and parental separation can be both a health risk (reduced monitoring, increased poverty, absence of parental influence etc.) and an opportunity (removal of abusive parent, reduction in family conflict, and promotion of psychological maturity) (Galambos & Ehrenberg, 1997).

Poverty, itself, has also been linked to a wide range of negative social and health outcomes in young people (Bradley & Corwyn, 2002; Duncan & Brooks-Gunn, 1997). However, the relationship between poverty and adolescent drinking is rather inconclusive (Goodman & Huang, 2002; Johnstone, 1994) and is likely mediated by parenting practices (Bradley & Corwyn, 2002; Linver, Brooks-Gunn & Kohen, 2002). Magnuson and Duncan (2002) found that harsher and less responsive parenting was more common amongst low-income families. Lower job status and parental levels of education are also significantly related to higher rates of parental rejection of adolescent children (Felner et al., 1995).

Peers are a second source of information and norms on alcohol, and peer alcohol use is one of the most consistent predictors of adolescent drinking (see Hawkins, Catalano & Miller, 1992; Swadi, 1999). This association appears to result from two main processes, *social selection* (whereby adolescents choose to belong to friendship networks with similar drinking habits to themselves) and *social influence* (whereby social networks influence the behaviour of individual members through drinking offers, modelling and perceived drinking norms - see Borsari & Carey, 2001;

Coggans & McKellar, 1994 for general reviews). Although recent longitudinal studies have confirmed these effects in adolescents, the findings are inconsistent on which of the socialisation processes is the most influential (Bray, Adams, Getz & McQueen, 2003; Dishon, & Owen, 2002; Ferguson, Swain-Campbell & Horwood, 2002; Schulenberg et al., 1999; Sieving, Perry, & Williams, 2000; Urberg, Degirmencioglu & Pilgrim, 1997; Urberg, Luo, Pilgrim & Degirmencioglu, 2003; Wills & Cleary, 1999),

In addition to the peer group and the family, the school is the third primary socialisation agent in adolescent development (Oetting & Donnermeyer 1998). Here, the school can be considered a protective agent, where bonds to a pro-social organisation are established in the absence of others (for example, with the family). Schools, as recognised by Oetting and colleagues, are not uniformly effective in achieving this, where poor teaching, high class sizes, poor discipline, and a unsatisfactory learning environment may contribute to pupil disengagement from the school. Pupils' characteristics may also contribute to the establishment of weak school bonds. Behavioural problems, hyperactivity, attention problems and aggression may contribute to poor school performance, academic failure and decline in educational motivation (see Rutter et al., 1998 for discussion of this issue).

1.1.3 Negative affect

Sher (1994; Sher & Gotham, 1999; Sher et al., 2005) suggested a link between drinking and negative affect (anxiety and depression) regulation, where the mood altering properties of alcohol are used to self medicate an emotional problem. A long-term reciprocal relationship between alcohol use disorders and anxiety disorders has been observed amongst college students (Kushner, Abrams & Borchardt, 2000; Kushner, Sher & Erickson, 1999). Amongst adolescents, however, there is inconsistent evidence for a longitudinal association between negative affect and alcohol consumption. Studies can be found that support a positive relationship, where high negative affect predicts high levels of drinking (for example, Rohde, Lewisohn & Seeley, 1996), a negative relationship, where high negative affect predicts low levels of drinking, (for example, Caldwell et al., 2002; Rodgers et al., 2000) and no relationship at all between alcohol and negative affect amongst adolescents (for example, Degenhardt, Hall & Lynskey, 2001). It is possible that the inconsistencies in the existing knowledge base are due to the fact that the etiological pathway may be gender specific, where low levels of anxiety or depression in childhood is predictive of problem drinking in young adult males, while high negative affect is predictive of problem drinking in young adult females (Chassin, Pitts & Prost, 2002; Pulkkinen & Pitkanen, 1994). It is also possible that the separate dimensions of negative affect are associated with alcohol in different ways. Kaplow, Curran, Angold & Costello (2001) found that overall anxiety was not predictive of later drinking, however, children with early symptoms of generalised anxiety were at greater risk of starting alcohol use, and children with separating anxiety were at a lower risk of early onset alcohol use. Zimmerman et al. (2003) identified social phobia and panic attacks as predictors of hazardous drinking amongst adolescents. While such findings may suggest a tension-reduction drinking process, Zimmerman et al. (2003) suggested

that their findings were more suggestive of a shared common cause generating both the anxiety disorders and the hazardous drinking.

The inconsistencies in the relationship between negative affect and alcohol use may also arise from methodological differences, in particular the short-term nature of the relationship between affect regulation and drinking and a lack of third variable controls. For example, Colder & Chassin, (1993) found that negative affect, and not behavioural undercontrol, mediated the relationship between stress and alcohol use, however, later work indicated that impulsivity moderated the relationship between negative affect and alcohol use, in that depressed impulsive children drank more than depressed non-impulsive children or non-depressed children (Husson & Chassin, 1994). Likewise, Jackson et al., (2000) found that depression significantly predicted alcohol use disorder in bivariate analysis, but was no longer significant when other variables were entered into the model.

1.1.4 Other potential risk factors

It is widely acknowledged that acute alcohol ingestion impairs cognitive functioning (Peterson, Rothfleisch, Zelazo & Pihl, 1990; Weissenborn & Duka, 2003). Chronic ingestion can also contribute to cognitive impairment in both adult and adolescent drinkers (Brandt, Butters, Ryan & Byog, 1983; Brown, Tapert, Granholm & Delis, 2000; Clark, 2004, Moss, Kirischi, Gordon & Tarter, 1994; Tapert & Brown, 2000; Tapert & Schweinsberg, 2005). In relation to the potential role cognitive deficits may play in the development of adolescent alcohol disorders, the research evidence is more limited. Most studies in this area have focused on case-control studies with the offspring of alcoholics. In one of the few community studies on this topic, Fergusson, Horwood and Ridder (2005) found a bivariate association between intelligence and later substance abuse. However, this relationship was non-significant once behavioural and family background were introduced into the model. Short term working memory capacity and general intelligence may independently moderate the impact of deviance proneness on later alcohol problems (Finn & Hall, 2004).

When compared to demographically matched controls, studies have found that children of substance abusers tend to exhibit more behavioural and emotional problems, less socially adaptive behaviour, higher rates of psychiatric disorder and greater use of substances, although there is still a degree of inconsistency in the research results (Johnston & Leff, 1999). While inherited vulnerability (genetic transmission) appears to account for a significant proportion of this association (Sher et al., 1996; Vanyukov et al., 2003), increased risk of negative outcomes associated with having a substance using parent is also partially mediated largely through behavioural undercontrol (Sher & Gotham, 1999; Tarter et al., 1999). Other social processes may also play a major part in the increased vulnerability of the children of substance users, including prenatal exposure, family disruptions, family conflict, family alcohol and drug use norms and poor parenting practices (Jacob & Johnson, 1997; Johnston & Leff, 1999; Lynskey et al., 2002; Sher, Grekin & Williams, 2005).

Research has consistently shown that the likelihood of substance use is increased amongst those young people with early onset puberty independent of age (Aro & Taiple 1987; Dick, Rose, Viken, & Kaprio, 2000; Patton et al., 2004; Stattin & Magnusson 1990; Wichstrom, 2001). A U-shaped curve may best represent the relationship between age of maturation and alcohol with early and later maturers reporting the highest levels of consumption relative to their normally maturing peers (Andersson & Magnusson, 1990). Interestingly, Robe, Robe and Wilson (1980) found that maternal heavy alcohol consumption was associated with later puberty onset, however, this was not confirmed in a later study (Windham, Bottomley, Birner & Fenster, 2004).

1.2 Research Questions

While there is a developing knowledge base on the etiological pathways underlying adolescent problem alcohol use, gaps in our understanding still exist. Many of the studies examining behavioural undercontrol and problem drinking have employed less than optimal methods, such as a case-control design (for example, Dawes et al., 1997; Tarter et al., 2004), studies restricted to a particular gender (Dawes et al., 1997; Tarter et al., 2004) or to the offspring of alcoholic parents (Sher & Gotham, 1999) and studies with small sample sizes (Tarter et al., 2004). The majority of community-sample risk studies in this area, which address these types of methodological weaknesses, by and large have focused on the onset of alcohol use or its social use (for example, Cleveland & Wiebe, 2003). Very few UK, or in fact European, studies have examined early childhood psychosocial processes associated with the development of more problematic drinking patterns in adolescence, which may differ from those that initiate drinking or maintain consumption levels at non-hazardous levels. Rather, UK studies have tended to rely on cross-sectional research designs (for example, Foxcroft & Lowe, 1997; Ledoux, Miller, Choquet & Plant, 2002; Sutherland & Shepherd, 2001a,b).

There is also considerable inconsistency in the research evidences on behavioural undercontrol. It is argued here that much of this may be due to differences in the definitions of behavioural undercontrol employed within studies. A wide range of different behavioural dimensions has been used to define this construct across different studies including antisocial behaviour, impulsivity, and hyperactivity, and this may contribute to the differing research findings produced. Examination of the association between the various individual dimensions of the broad construct of undercontrol and later drinking behaviours may give insights into the actual processes underlying the development of drinking problems in adolescence.

Given the limitations of sampling outlined above, few studies have failed to provide adequate control of background demographic covariates such as poverty. While an association between poverty and alcohol use is accepted (Goodman & Huang, 2002; Hawkins, et al., 1992), there is little evidence that the effect remains significant when more proximal factors are taken into consideration, for example antisocial behaviour.

This analysis has a number of objectives. At a broad level it is an examination of the early childhood predictors (assessed at birth, age 5 and age 10) of adolescent drinking patterns. At a more detailed level it addresses a number of specific research questions regarding the differentiation of separate etiological pathways.

1. Are the findings from the predominantly US risk factor research literature replicated in a UK general population sample?

2. Does behavioural undercontrol in childhood (here defined as a broad construct) predict adolescent alcohol consumption when other factors are controlled?

3. Do the different dimensions of behavioural undercontrol (antisocial behaviour, inattention, hyperactivity and impulsivity) differ in their association with alcohol use?

4. Does family socialisation contribute to increased risk in addition to a behavioural undercontrol main effect?

5. Is there a predictive association between negative affect/internalising problems and later drinking?

6. Is there evidence for the influence of additional risk factors in addition to the two main etiological pathways (behavioural undercontrol and negative affect), for example cognitive executive functioning and demographic factors?

2. METHODS

2.1 Respondents

This study utilises data from the 1970 British Cohort Study (BCS70), one of the four national longitudinal birth cohort studies within Great Britain. In 1970, data was collected on 17,196 babies and their families born in one week in April. These families were re-contacted in 1975, 1980, 1986, 1996, 2000 and 2004. At each occasion a wide range of information was collected, from multiple sources, on the child's physical, social and educational development. As such it provides an important and valuable resource for social scientists, detailing the life histories of a representative cohort of children. This study is primarily focused on the sixteen year old alcohol outcomes (assessed within the 1986 survey) and the earlier life experiences and characteristics that explain variations in adolescent outcomes.

Of the 16,500 target respondents in 1996, 11,622 (70%) cohort members were traced and completed one or more questionnaires. In addition to a self-completion questionnaire completed by the cohort members, data was also collected from parents and teachers. Cohort members were also asked to complete a diary and a series of standardised tests. The school doctor/nurse undertook a medical examination of cohort members. Supplementary questionnaires were distributed to respondents in two packs, a health pack and an education pack.

The alcohol measures within the 16-year-old follow-up where located on two questionnaire components; document F (health related behaviour) and document H (friends and the outside world). Both questionnaire components were completed by 5,039 respondents. A further 226 completed section F only, and 1251 completed section H only, giving a total of 6516 respondents who completed a least one of the two sections. Table 1 compares the restricted 16-year-old alcohol sample (completed either section F or section H) with the full 16-year old-sample (completed section 0). We see an under representation of boys and respondents from poorer family backgrounds. There are also fewer replies from stepparent and foster parents within the restricted alcohol sample. Mothers of young people who completed the alcohol questions are also less likely to smoke than those within the larger 16-year-old cohort.

Table 1: Response biases between the full sample and the 16-year-old alcohol sample.

	Full sample, %	Alcohol sample, %	Relative bias[1]
Gender			
Male	50.1	42.8	17.0
Female	49.9	57.2	-12.8
Ethnicity			
White	97.7	98.3	-0.6
Black	0.8	0.6	33.3
Asian	2.4	2.6	-7.7
Other	0.9	0.9	0.0
Relationship to mother figure			
Natural mother	95.3	96.0	-0.7
Adoptive/foster	1.7	1.6	6.3
Stepmother	1.0	0.7	42.9
Other	2.0	1.7	17.6
Relationship to father figure			
Natural father	82.4	84.8	-2.8
Adoptive/foster	2.5	2.3	8.7
Stepfather	6.7	5.8	15.5
Other	8.4	7.1	18.3
Income			
<£2600	2.5	1.8	38.9
£2600-£5199	14.3	12.3	16.3
£5200-£7799	14.0	13.7	2.2
£7800-£10399	14.5	14.5	0.0
£10400-£12999	11.6	11.6	0.0
£13000-£15599	9.2	10.6	-13.2
£15600-£18199	5.9	6.4	-7.8
£18200-£20799	3.6	4.0	-10.0
£20800-£23399	3.2	3.5	-8.6
£23400-£25999	1.5	1.8	-16.7
>£26000	3.7	4.3	-13.9
Refused	15.9	15.4	3.2
House type			
House	94.4	95.2	-0.8
Flat	3.8	3.4	11.8
Room	0.5	0.5	0.0
Mobile home	0.2	0.2	0.0
Other	1.1	0.8	37.5
House ownership			
Yes	18.4	19.8	-7.1
No	81.6	80.2	1.7
Maternal smoking			
Yes	36.1	31.3	15.3
No	64.9	68.7	-5.5

Notes: 1. Relative bias = ((Full sample % - Alcohol sample %) / Alcohol sample %)*100. A negative value indicates an over-representation and a positive value an under-representation within the alcohol sample.

2.2 Measures

Alcohol use at age 16: Four alcohol consumption indicators were used to construct the latent class typology of adolescent drinking patterns, namely; (a) the number of units consumed in the last week (none, 1-8 , 9+), (b) the frequency of alcohol consumption in last 12 months (never, monthly or less, weekly or more), (c) the number of alcohol related problems ever encountered (none, 1, 2+), and (d) the number of heavy drinking episodes in the last two weeks (none, 1-2, 3+). The original observed measures were all recoded to the three category ordinal variables above. A five class model provided best fit for the data (see Percy & Iwaniec, 2007 for full details).

The five classes were labelled: limited use (8% of respondents), occasional use (25%), moderate use (32%), heavy use (24%) and hazardous use (12%). Young people classified as hazardous users tended to drink alcohol at least weekly, to drink more than nine units per session, to have frequent 'binges' and a high probability of experiencing alcohol related problems even at this relatively young age. Heavy drinkers drank on a weekly basis, sometimes drinking over nine units in a session, but had a modest probability of experiencing one or more alcohol-related problem. There was a slightly higher proportion of males (11%) than females (7%) classified as hazardous drinkers (chi^2 = 75.271, *df* = 4 p <0.001). Also hazardous drinkers were exclusively White (English, Welsh, Scottish, Northern Irish, Irish or other European) or mixed race (defined here as 'mixed parentage' or any other ethnic group) (9% and 8.5% respectively). No Asian (Indian, Pakistani or Bangladeshi) or Black (West Indian or Guyanese) respondents were classified as hazardous drinkers, although 3% were considered heavy drinkers Almost 60% of Asian young people were considered to be limited drinkers on the basis of their alcohol scores. This compares to 16% of black respondents, 7% of white respondents and 6% of mixed race respondents. Hazardous drinkers were more likely to come from reconstituted families, that is, families that consist of one natural parent and one stepparent. A limited use drinking pattern was most prevalent amongst young people living in single parent households (9%).

There are clear associations between the latent class drinking patterns and other independent measures of drinking behaviour within the BCS70 indicating adequate discriminatory validity (Percy & Iwaniec, 2007). Young people classified as hazardous drinkers tended to have an earlier age of onset, both supervised and unsupervised (with friends) than other drinkers. Likewise, they spent more money on alcohol, drank on a greater number of days per week, were more likely to drink alcohol on days other than the weekend, drank a wider range of alcohol drinks, were most likely to drink high strength brands, were most likely to report specific reasons for drinking and, importantly, were most likely to consider that they regularly drank more than they should.

Behavioural undercontrol (age 5 and age 10) maternal rating: Versions of the Rutter Scales were utilised at age 5 and age 10. At age five mothers completed a modified Rutter A scale. Four items were dropped from the scale due to high levels of missing

data relative to the other items. These items were a) biliousness, b) tears on arrival at school, c) stammers and stutters, and d) other speech difficulties. For this analysis a subset of 19 items similar to those used in the 16-year-old questionnaire was selected. Three subscale scores (hyperactivity, externalising behaviours and internalising behaviours) were calculated using factors derived from the analysis of the 16-year-old data (results available from the corresponding author on request). This was used to ensure comparability across the various data sweeps. The mean score for hyperactivity was 4.94 (sd=1.61), and for externalising behaviour the mean was 9.29 (sd=2.08). Within the 10-year follow-up instrument the Rutter A items were measured along an analogue scale rather than a three-point likert scale. Mothers were asked to make a mark along a line between 'certainly' (scored 0) and 'doesn't apply' (scored 10). The reversal of direction of scoring with the 10-year-old follow-up was taken into account within the allocation to ensure equivalence. The mean score for hyperactivity was 8.73 (sd=6.83), and for externalising behaviour the mean was 12.04 (sd=8.08)

Negative affect (age 5 and age 10) maternal rating: As outlined above, the Rutter scale used at age 5 and 10 also included a measure of internalising behaviours. This subscale consisted of items such as "Often worries about many things?" and "Often appears miserable, unhappy, tearful or distressed?".The mean score for internalising behaviours at age 5 was 8.69 (sd=2.10), and at age 10 it was 16.77 (sd=10.02).

Behavioural undercontrol (age 5 and age 10) teacher rating: In addition to parental rating of the child's behaviour, teachers were also asked to complete what was termed the Child Behaviour Scale. This was a combined scale comprising items selected from the Rutter B (Teacher) Scale, the Conners' Teachers Scale, and items on specific behaviours not covered by the two main scales (items relating to anxiety, and fine and gross motor coordination, etc). A maximum likelihood factor analysis (with Kaiser varimax rotation) was used to identify eight subscales within the main child behaviour measure (results available from the corresponding author on request). The subscales were:

1. Antisocial behaviour (incorporating items on impulsivity)
2. Inattention
3. Anxiety/neurosis
4. Fine motor control
5. Gross motor problems
6. Extraversion
7. Toileting
8. Hyperactivity

Scales 1, 2 and 8 represent the three dimensions of attention-deficit hyperactivity disorder, namely impulsivity (here combined within a larger antisocial behaviour construct), inattention and hyperactivity (Biederman & Faraone, 2005; Swanson, et al., 1998). The Diagnostic and Statistical Manual of Mental Health Disorders (Fourth Edition – Text Revision) classification permits three symptom-based subtypes (mainly inattentive, mainly hyperactive-impulsive or both combined) (American Psychiatric Association, 2000). However, as Biederman & Faraone, (2005) comment, the existence of a pure inattentive disorder distinct from a combined ADHD has not been widely confirmed.

Negative affect (age 5 and age 10) teacher rating: The child behaviour scale also included a measure of negative affect (subscale 3) in addition to those assessing behavioural undercontrol. Items within this subscale include "Is fearful or afraid of new things or situations?", "Behaves nervously?" and "Is worried or anxious about many things?".

Parental monitoring (age 10): Mothers were asked to rate the frequency in which their child tells them where they are going before they go out (*Child disclosure*). Frequency was rated on a four point likert scale (rarely or never/yes-occasionally/yes-usually/yes-always). This was collapsed into a binary variable (rarely or never/yes). Parents were also asked to indicate the time at which the child was usually in at night.

Child's education at age 10: A number of indicators of the child's primary education were obtained from the maternal self-report, including, *difficulties in maths, reading and writing* (these were rated on a three point scale (no difficulties/ some difficulties/ great difficulties) and *receipt of free school meals* (yes/no). Additional information was also obtained from the young person's teacher. This included:

a. *Special education provision* (attends special school or receives specialist therapeutic input at school);

b. *Level of concentration, fidgeting, and serious behaviour aberrations* (rated percentage of class time spent on each listed activity);

c. *Parental engagement in education* (teachers asked to rate both maternal and paternal interest in the child's education on a four point scale – very interested/moderately interested/very little interest/uninterested).

d. *Popularity with peers within school* (teachers asked to rate children on an analogue scale, rated between 1 and 47 in relation to the four dimensions - child's popularity with peers, number of friends, shyness, and cooperation with peers. Items scores were summed).

Locus of control and self-esteem: Pupils undertook a short self-completion questionnaire containing a measure of both self-esteem (LAWSEQ, Lawrence, 1981) and locus of control (CARALOC, Gammage, 1975).

Auditory working memory (British Ability Scale Forward Recall of Digits – 34 items): Detailed descriptions of the BAS subscales presented here were sourced from the BAS Technical Manual (Elliot, Smith & McCulloch, 1997). In the forward recall of digits test the child was given a series of numbers and asked to recall the series back to the teacher. The number sets start with two digits, and after five consecutive sets the sequence is increased by one digit, up to a maximum of eight digits. A point was given for each correct recall. Forward digit recall reflects the child's short-term auditory memory, concentration, attention and verbal expression, and is considered part of basic storage, search and retrieval cognitive processes.

Fluid reasoning ability (British Ability Scale Matrices - 28 items): In this subtest the child was presented with a self-completion task in which they had to complete a pattern by drawing the appropriate shape in an empty square in a matrix depending on the pattern presented in the completed squares of the matrix. The matrices ranged from 2x2 squares (3 cells completed 1 uncompleted) to 3x3 squares (with 8 squares completed and 1 uncompleted). To solve the problems the child had to first deduce the relationship between figures in the completed cells and then devise and draw the solution. Matrices scores reflect visual-spatial analysis, and non-verbal inductive reasoning, including the identification of rules governing abstract figures and the formulation of hypotheses about those rules.

Verbal knowledge and expressive language skills (British Ability Scale Word Definitions – 37 items): For each item of the 37 items in this subscale, the child was presented with a single word (for example collect) and asked, "What does XXXX mean?" The child's answers were recorded by the teacher verbatim and scored later by the BCS research team. The Word Definitions module is part of the verbal ability scales within the BAS, and measures comprehension of words and fluency in expressing definitions.

Verbal reasoning (British Ability Scale Verbal Similarities – 42 items): The Word Similarities module is a further component of the verbal ability scale. Here, children were presented with three words (for example orange, strawberry, banana) and asked to give another word that would go with these three (for example apple – referred to as a group example). If no response was forthcoming the child was prompted. The child was then asked "Why do orange, strawberry, banana and apple go together?". An example answer would be "because they are all fruit" (superordinate answer), or "because they have skin" (subordinate answer). The child's answers were recorded by the teacher verbatim and scored later by the BCS research team. Superordinate answers were scored higher than subordinate answers. This scale reflects children verbal reasoning and language skills. Low scores may indicate a reluctance to speak or poor working memory.

Shortened Edinburgh Reading Test (self-completion): This shortened version of the Edinburgh Reading Test (ERT) was comprised of 67 items selected to assess overall reading ability (vocabulary, syntax, sequencing, comprehension and retention) across the ability range, from age 7 to age 13. Particular attention was given to ensuring the assessment of poor reading abilities.

Friendly Maths Test: This was a test specifically devised for the BCS70 ten-year-old sweep. It consisted of 72 multiple-choice items covering the essential rules of arithmetic, number skills, fractions, algebra, geometry and statistics.

Maternal malaise (age 5): A 24-item self-completion version of The Rutter Malaise Inventory (Rutter, Tizard & Whitmore 1970) was used to assess maternal reported experiences of psychological symptoms (for example, Do things worry you?) and somatic symptoms (for example, Do you suffer from indigestion?). The version of the

scale used at age 5 employed of a two-point response code (Yes, No). The number of experienced symptoms was counted across the various items.

Medical history at age 10: Mothers were asked a series of questions about the child's medical history to age 10. These include whether a) the child had any major or minor *congenital abnormalities* or defects (for example, Down's Syndrome, hydrocephalus, congenital heart problems); b) they had <u>ever</u> had *a fit or convulsion* or other turn in which they lost consciousness or any part of their body made abnormal movements; c) they had <u>ever</u> been referred to *family guidance or child psychiatry*; d) they had been *seen by a social worker* in last <u>12 months</u>; e) *how much time they had missed school* in the last <u>12 months</u> due to ill health or emotional disturbance (coded on a four point likert scale - none or less than 1 week/ over one week and up to one month, over a month and up to three months/ over three months); f) they had <u>ever</u> been *in care* .

Medical examination: In addition to the maternal self-report children underwent a medical examination at age 10. Relevant information taken from this examination included;

a. the existence of *emotional or behavioural problems*;

b. *motor coordination* - children were asked to complete a series of motor tests including throwing a ball in the air, sorting matches, and figure drawing on the palm of hand. Children were classified into one of four categories – normal limb coordination, questionably clumsy, mildly clumsy, and moderate to markedly clumsy;

c. *body mass index*- a ratio of height to weight was calculated in a similar way to that of the parent's body mass index (see below).

Early puberty: Mothers were asked, within the 16-year-old maternal self-completion section, to indicate the age at which their teenage daughter had her first period. No equivalent male indicator of early puberty was incorporated within the BCS70.

Parental health behaviour in 1980 (child age 10): A number of indicators of parental health behaviour were constructed. These included a crude *body mass index score* for both fathers and mothers. This was calculated by dividing paternal weight in kilograms by the square of their height in meters. Mothers were asked to recall their *alcohol consumption during early and late pregnancy*. This was reported on a four-point likert scale (most days/2-3 times per week/once a week or less/not at all). This was recoded into a binary variable (not at all/ once a week or more often). And finally, mothers were asked to record the *smoking behaviours* of themselves, the child's father and other household members.

Maternal and paternal education in 1980 (child age 10): Mothers were asked to list their own educational qualifications, and the qualifications of the child's father. Each of the series of responses was subsequently recoded into a single multiple response variable for each parent.

Social Class in 1980 (child age 10): On the basis of current and previous employment status both mother and fathers were allocated a social class category. This provides alternative family social class indicators. Social class categories are based on the 1980 census classification. Households are classified into one of six categories ranging from Class I to Class V, with Class III being divided into two subcategories Class III – non-manual, and Class III – manual.

Receipt of benefits in 1980 (child age 10): Mothers were asked to indicate whether the family was in receipt of any of the following benefits: child benefit increase for single parents, family income support, supplementary benefit, widows benefit, retirement pension, sickness/invalidity benefit, disability pension, attendance/mobility allowance, unemployment benefit. Receipt of such income support benefits provides another indicator of family poverty. Child benefit, due to its universal coverage across the sample was not included within this measure. This indicator is more likely to reflect benefit uptake rather than entitlement.

Gross family income in 1980 (child age 10): Mothers were asked for the range in which the family's total gross weekly income fell. The range was to include all earned and unearned income for both mother and father before deductions for tax and national insurance but was to exclude earnings by other household members and child benefits.

2.3 Statistical analysis

The initial latent class model was estimated in LEM (Vermunt, 1997a,b) (see above). A modal assignment rule was then used to allocate respondents to the latent class that corresponded to the highest posterior conditional response probability across the observed indicators. Bivariate exploratory statistics and multinomial logistic regression were used to examine the relationship between covariates and assigned drinking patterns. It is worth noting that there is a small degree of error associated with a two-stage 'classify-analysis' procedure such as this, as it ignores the uncertainty associated with a probabilistic class allocation (Chung & Martin, 2001;). However, a two-stage procedure is more efficient, convenient and easier to estimate (see for example, Roeder, Lynch, & Nagin, 1999). Multiple imputation (MI) was employed to minimise biases in parameter estimates and standard errors due to item non-response. Here, the ten independently imputed datasets were constructed using the programme NORM (Schafer, 2000). The regression models were then estimated in Mplus using the IMPUTATION option (Muthén & Muthén, 1998-2005a; Muthén & Muthén, 1998-2005b). Covariates were introduced into the regression models in a single block.

3. Results

Tables 2 and 3 provide bivariate analysis of the associations between early child and family characteristics and drinking patterns at age 16 (as indexed by latent class membership).

Behavioural undercontrol

While maternal reports of high externalising behaviour at age five were associated with later drinking behaviour, hyperactivity was not significantly different across the latent classes at age 5, but was at age 10. At this age higher levels of hyperactivity predicted higher levels of drinking. The association between these elements of behavioural undercontrol and later drinking behaviour was confirmed by the teacher reports. Again, hazardous drinkers at age 16 had higher levels of reported antisocial behaviour, higher level of extraversion and poorer attention. However, while hyper-kinesis was not significantly different across the five latent drinking classes, teachers report that these young people with later alcohol problems spent more time fidgeting in class than other pupils. In addition, teachers identified those young people in the hazardous drinking category as the most popular with their peers. Limited drinkers, in contrast had the lowest popularity. As the assessment was made at age 10, popularity cannot be a function of drinking behaviour, but rather it is due to other social characteristics of this group, such as their extraversion, and rebellious behaviour. The medical examinations recorded the highest rates of behavioural problems amongst the limited use and hazardous use groups. Here, over 5 percent of the limited use group and nearly four percent of the hazardous use group had a defined behavioural problem.

Negative affect pathway

While internalising behaviours (as reported by mothers) and anxiety problems (as reported by teachers) were both significant in the bivariate tests, in general negative affect was associated with lower levels of adolescent drinking (Table 2). Heavy and hazardous drinkers were considered to have the lowest mean negative affect, while the limited use alcohol group was rated as having the highest levels of internalising problems.

To test the possibility that a negative affect etiological pathway was gender specific, in that it may exist for girls but not boys, separate ANOVAs were estimated for each gender group. Amongst boys and girls teacher reports of anxiety problems were significantly different across the various latent drinking groups (Boys: $F = 7.295$; df = 4; $p = <0.001$) (Girls: $F = 3.27$; df = 4; $p = 0.011$). However, as noted above the higher levels of anxiety were reported for those young people who drank less when older. For maternal reports of internalising problems the difference did not reach significance for either gender.

An alternative method for identifying behavioural and emotional problems in children is to assess the level of specialist psychiatric or support services. No differences in

the proportion of children attending family guidance or child psychiatry services before the age of 11 were reported (around 2% in each drinking class) (Table 2). However, there was a difference in the proportion of children seen by social workers in the 12 months previous to the 10-year-old follow-up data wave. The rates of social work intervention amongst the limited and occasional use group were double that of the other three groups (around 2% compared with 1%).

Menstruation

Girls classified as hazardous drinkers had a significantly earlier age of onset of first menstruation although the differences in actual age were relatively small. A difference of less that half a year was observed between hazardous drinkers and limited use drinkers (12.5 compared with 12.8 respectively). Unfortunately the BCS70 did not contain a similar measure of age of puberty in boys so this analysis is single gender only.

Cognitive ability and attainment at age 10

All the cognitive tests utilised within the BCS70 were significantly different across the drinking classes. In general, the limited and occasional use groups scored lower in the ability and attainment tests than the other three higher level drinking classes. Of the six tests employed, heavy drinkers scored highest in three (digit recall, ERT and FMT), while hazardous drinkers scored highest on two (word definitions and similarities), and moderate drinkers scored highest on one (matrices).

The differences in the test scores were confirmed by parental rating of the child's performance at school. Young people in the limited use group were more likely to be rated by their mothers as having great difficulties with maths, reading and writing at age 10 than the other drinking classes. Generally, the heavy drinking group was the least likely to be rated in this way, followed by the hazardous drinkers. It is unsurprising therefore, that the limited use group was the most likely to be receiving special educational provision (22%) followed by the moderate use group. There was little difference in the levels of special educational input across the other three drinking categories. This relationship was also observed in relation to teacher reports of parental engagement and interest in the child's education. The highest levels of disinterest were observed within the limited use and moderate use groups.

Family capital

A range of family financial capital measures was incorporated within the BCS70 at age 10. This included paternal and maternal education, social class (based on employment), weekly income, and receipt of free school meals and other state benefits. In general the lowest levels of family capital were recorded amongst those households where the young person would be later classified as having a limited or occasional drinking pattern at age 16. These families had the highest level of free school meals uptake, and state benefits, and the lowest weekly incomes. They also reported the lowest levels of paternal educational attainment and social class. The

highest levels of family capital were recorded amongst the moderate and heavy drinking young people.

Similar levels of maternal separation were observed across the five latent class groups at age 5. In contrast, however, paternal separation at age 5 was more common amongst hazardous drinkers than the other categories of young people. In particular, having a stepfather (6.0%) was more common amongst the hazardous drinkers than other groups (ranging from 1.8% to 4.6%).

Parental behaviour at age 10

Both parents were asked about their smoking behaviour, and mothers were asked about their consumption of alcohol during pregnancy. Around about half of fathers and a third of mothers smoked in 1980 (Table 3). Smoking rates were highest amongst the parents of those young people who were later classified as drinking at a hazardous level (56% of fathers and 42% of mothers. Smoking rates were lowest in the limited use group (42% of fathers and 28% of mothers). However, the likelihood of an non-parental figure smoking in the house was not associated with later drinking patterns in the young people. As with maternal smoking behaviour, drinking during pregnancy was more common amongst the heavy drinking group than the other categories, and again the limited use group mothers reported the lowest rates of drinking during pregnancy.

Other factors

Other factors found to vary significantly across the five latent drinking classes were external locus of control (higher in limited drinkers), maternal BMI (U shaped relationship with BMI highest in limited and hazardous drinkers), child BMI (highest in hazardous drinkers), motor coordination problems (highest in limited drinkers), time in at night and the child's willingness to tell the parent what they do with their free time (hazardous drinkers were both in latest at night and least willing to disclose) (Tables 2 and 3).

Table 2: Association between child characteristics at age 5 and 10 (mean scores) and latent drinking classes at age 16

	Latent Class					
	Limited use	Occasional use	Moderate use	Heavy use	Hazardous use	*p*
Maternal report						
Hyperactivity at 5	4.86	4.91	4.78	4.86	4.84	0.253
Externalising behaviour score at 5	9.16	9.00	8.91	9.07	9.13	**0.023**
Internalising behaviour at 5	8.62	8.72	8.68	8.61	8.51	0.336
Hyperactivity at 10	8.00	8.12	7.73	8.24	8.80	**0.011**
Externalising behaviour score at 10	11.97	11.41	10.40	10.94	11.58	**<0.001**
Internalising behaviour at 10	17.44	17.36	16.29	16.28	15.78	**0.001**
Age of menarche (girls only)	12.82	12.70	12.69	12.60	12.47	**0.032**
Maternal malaise	4.08	4.16	3.84	3.98	3.80	0.095
Father's BMI	24.19	24.43	24.42	24.32	24.42	0.554
Mother's BMI	23.97	23.31	23.19	23.27	23.33	**0.003**
Time child is in at night	7:09	7:23	7:20	7:25	7:30	**<0.001**
Medical examination						
Child's BMI	16.62	16.80	16.89	16.93	17.05	**0.020**
Teacher report						
Time spent on concentration on school work	71.23	72.25	72.13	71.35	69.65	0.133
Time spent on fidgeting	3.95	4.29	3.89	4.33	5.06	**0.010**
Time spent on serious behavioural aberrations	0.08	0.10	0.18	0.13	0.22	0.516
Popularity with peers	102.76	103.18	104.75	105.67	105.75	**<0.001**
Mean scores on the Child Developmental Behaviour Scale						
Antisocial behaviour	9.06	9.18	8.83	9.52	10.46	**<0.001**
Inattention	15.60	17.76	18.73	17.93	16.24	**0.022**
Anxiety	15.28	14.52	13.70	12.90	13.13	**<0.001**
Fine motor control	49.02	49.28	50.59	51.44	49.98	**<0.001**
Gross motor problems	9.54	9.18	8.21	7.35	7.83	**<0.001**
Extraversion	3.54	6.16	9.31	11.12	12.41	**<0.001**
Toileting	1.99	1.81	1.80	1.74	1.70	0.393
Hyper-kinesis	5.62	5.80	5.29	5.22	5.74	0.113
Educational tests						
BAS word definitions	9.52	10.48	11.13	11.41	11.48	**<0.001**
BAS word similarity	27.30	28.32	28.89	26.20	29.12	**<0.001**
BAS matrices	17.42	17.16	17.90	17.79	17.41	**0.005**
BAS digit recall	21.69	22.54	22.78	22.97	22.60	**<0.001**
Edinburgh Reading Test	38.25	41.08	41.98	42.56	41.22	**<0.001**
Friendly Maths Test	42.64	45.05	47.12	48.09	47.73	**<0.001**
LAWSEQ (low self esteem)	1.91	1.66	1.32	1.31	1.11	0.072
CARLOC (external locus of control)	5.69	4.71	4.22	4.17	4.21	**<0.001**

Table 3: Association between child characteristics at age 5 and 10 (proportions) and latent drinking classes at age 16

	Latent Class					
	Limited use	Occasional use	Moderate use	Heavy use	Hazardous use	*p*
Natural father (%)	92.2	85.1	88.5	85.1	83.9	-
Natural mother (%)	97.0	96.7	97.3	96.8	97.1	-
Been 'in care' before age 11 (%)	1.9	2.0	1.4	1.6	1.0	0.515
Abnormality (%)	7.4	8.9	7.6	6.7	6.2	0.208
Convulsions before age 6 (%)	8.7	11.3	10.6	11.3	10.6	0.600
Referred to family guidance before 11 (%)	2.1	2.1	1.4	2.0	2.2	0.545
Referred to child psychiatry before 11 (%)	2.1	2.2	1.6	1.5	2.0	0.684
Seen by social work, last 12 mths (at 5) (%)	1.7	2.0	0.9	0.9	0.8	**0.032**
One week or less off school (%)	60.8	61.5	64.1	61.9	66.3	0.298
Father educated to degree level (%)	12.8	13.0	17.7	16.8	15.9	NA
Mother educated to degree level (%)	3.1	3.2	3.8	3.3	3.3	NA
Social class V (father's occ.) (%)	5.4	4.5	2.5	3.2	2.2	**0.050**
Social class V (mother's occ.) (%)	11.2	10.6	7.7	7.1	8.5	0.156
Gross weekly income below £35 (%)	1.5	2.0	1.3	1.1	0.6	**<0.001**
Receipt of benefits	22.7	23.8	17.9	19.1	20.9	**<0.001**
Alcohol in early pregnancy (%)	28.5	42.1	49.9	51.4	57.0	**<0.001**
Alcohol in late pregnancy (%)	26.3	39.4	46.7	46.3	52.2	**<0.001**
Father current smoker (%)	47.5	52.7	49.4	50.4	56.0	**0.033**
Mother current smoker (%)	28.3	38.9	34.6	37.8	42.1	**<0.001**
Other household members smoke (%)	7.0	7.5	6.2	7.4	7.2	0.584
Behaviour problems (med report) (%)	5.3	2.6	1.9	1.5	3.6	**<0.001**
Motor coordination problem (med report) (%)	2.4	1.5	0.8	0.6	0.2	**0.017**
Child self-disclosure YES - always (%)	71.6	71.7	72.0	66.7	63.9	**<0.001**
Great difficulty with maths (%)	3.4	3.4	2.3	2.3	2.4	**0.048**
Great difficulty with reading (%)	2.5	2.0	2.0	1.2	1.8	**0.010**
Great difficulty with writing (%)	3.2	2.4	1.6	1.3	1.8	**0.004**
Free school meals (%)	17.8	14.6	9.9	11.2	10.7	**<0.001**
Receives special educational provision (%)	21.9	13.0	10.6	10.6	9.7	**<0.001**
Mother uninterested in child's education (%)	3.5	2.3	1.6	1.8	1.2	**0.002**
Father uninterested in child's education (%)	5.8	3.7	3.0	3.2	2.8	0.217

Notes: – chi squared test unstable due to small counts for many of the contingency table cells; NA not applicable as a multi-response variable.

Multinomial logistic regression

To control for the impact of various confounders on the bivariate associations outlined above, a multinomial logistic regression was conducted to assess the relative importance of the predictor variables within a multivariate framework. Given potential problems of co-linearity (high level of correlation between variables included within the model) not all covariates identified as significant in the bivariate analysis presented above were included within the model. Rather one indicator was selected to represent the broad construct assessed by the multiple covariates. Table 4 presents the parameter estimates, odds ratios and confidence intervals for the selected indicators. Hazardous drinkers were selected as the reference category for the logistic models.

There was little association between adolescent drinking behaviour and child cognitive ability and performance at age 10, family socioeconomic status, social characteristics (parental interest in education, child disclosure, peer isolation, and locus of control) at age 10 and contact with social services. None of these indicators were significant predictors of drinking status across the four comparisons made, once other indicators were controlled for, that is, hazardous drinkers compared with each of the other drinking categories in turn).

Limited use drinkers were more likely to have a lower body mass index, to be in receipt of special education support, and to have a mother who smokes, at age 10. High extraversion and antisocial behaviour at age 10 and maternal drinking in pregnancy were predictive of being in the hazardous drinking group six years later when the two groups were compared (hazardous and limited use). When the occasional users were compared with hazardous drinkers, higher levels of childhood body mass index, antisocial behaviour, and extraversion, along with maternal drinking in pregnancy remained significant predictors of being in the hazardous category. In addition, a gender difference was detected, with girls being more likely to be classified as occasional drinkers than hazardous drinkers in adolescence, after controlling for the other significant childhood predictors of drinking outcomes.

Childhood antisocial behaviour, extraversion, maternal drinking and gender remained consistent predictors of adolescent drinking status when hazardous drinkers were compared with moderate drinkers. Again, boys, those with high levels of antisocial behaviour, extraversion, and those whose mother drank in early pregnancy were more likely to develop hazardous drinking patterns by age 16. When the logistic models were compared for only hazardous and heavy drinkers, only one indicator was found to be significant. Alcohol consumption during early pregnancy was again predictive of the development of hazardous drinking patterns in teenagers. No other indicator significantly differentiated these two groups beyond maternal drinking.

Table 4 Predictors associated with drinking pattern: multinomial logistic regression

	Limited drinkers vs hazardous drinkers			Occasional drinkers vs hazardous drinkers			Moderate drinkers vs hazardous drinkers			Heavy drinkers vs hazardous drinkers		
	OR	95% C.I.	Sig	OR	95% C.I.	Sig	OR	95% C.I.	Sig	OR	95% C.I.	Sig
Gender												
Male	1.00	-		1.00	-		1.00	-		1.00	-	
Female	1.33	0.99, 1.79		**1.68**	**1.33, 2.12**	**	**1.51**	**1.22, 1.86**	**	1.19	0.94, 1.51	
Social worker contact												
Yes	1.00	-		1.00	-		1.00	-		1.00	-	
No	0.61	0.16, 2.30		0.43	0.14, 1.31		0.74	0.24, 2.30		0.82	0.25, 2.68	
Child BMI	**0.92**	**0.86, 0.99**	*	**0.95**	**0.90, 1.00**	*	0.97	0.93, 1.02		0.98	0.93, 1.03	
Received special education support												
Yes	1.00	-		1.00	-		1.00	-		1.00	-	
No	**0.59**	**0.39, 0.90**	*	0.80	0.55, 1.17		0.84	0.57, 1.22		0.80	0.53, 1.20	
Isolation	1.01	0.97, 1.06		0.99	0.96, 1.03		1.00	0.96, 1.03		1.00	0.96, 1.03	
Child Developmental Behaviour Scale												
Antisocial behaviour	**0.97**	**0.95, 1.00**	*	**0.97**	**0.95, 0.99**	*	**0.97**	**0.95, 0.99**	**	0.99	0.97, 1.01	
Inattention	1.01	1.00, 1.02		1.01	1.00, 1.02		1.00	0.99, 1.01		1.00	0.99, 1.01	
Anxiety	1.01	0.98, 1.04		1.01	0.99, 1.03		1.01	0.99, 1.03		1.00	0.98, 1.02	
Gross motor prob.	1.01	0.99, 1.04		1.01	0.99, 1.04		1.01	0.99, 1.03		1.00	0.98, 1.02	
Fine motor control	1.00	0.99, 1.02		1.00	0.98, 1.01		1.00	0.99, 1.02		1.01	1.00, 1.03	
Extravert	**0.99**	**0.98, 1.00**	**	**0.99**	**0.99, 1.00**	**	**1.00**	**1.00, 1.00**	**	1.00	0.99, 1.00	
Hyperkinesis	1.02	0.99, 1.04		1.02	1.00, 1.04		1.02	0.99, 1.04		1.00	0.98, 1.02	
British Ability Scale												
Word definitions	0.98	0.94, 1.02		0.98	0.95, 1.01		0.98	0.96, 1.01		0.99	0.96, 1.02	
Recall of digits	1.00	0.96, 1.04		1.02	0.98, 1.05		1.01	0.98, 1.04		1.02	0.99, 1.05	
Word similarities	0.97	0.92, 1.02		0.99	0.95, 1.02		1.00	0.96, 1.03		1.01	0.97, 1.04	
Matrices	1.03	0.99, 1.07		1.00	0.97, 1.03		1.01	0.98, 1.04		1.00	0.97, 1.04	
Friendly Maths Test	0.98	0.96, 1.00		0.99	0.97, 1.00		0.99	0.98, 1.01		1.00	0.98, 1.02	
Edin. Reading Test	1.00	0.99, 1.02		1.01	0.99, 1.02		1.00	0.99, 1.01		1.00	0.99, 1.02	
Locus of Control	1.01	0.98, 1.04		1.00	0.98, 1.03		1.00	0.98, 1.02		1.01	0.98, 1.03	
Income												
Income 1	1.00	-		1.00	-		1.00	-		1.00	-	
Income 2	0.84	0.33, 2.16		1.05	0.50, 2.22		0.92	0.44, 1.91		0.86	0.41, 1.82	
Income 3	1.00	0.54, 1.86		0.91	0.54, 1.54		0.88	0.52, 1.50		0.95	0.55, 0.63	
Income 4	0.99	0.54, 1.83		0.87	0.52, 1.47		0.98	0.59, 1.64		1.04	0.61, 1.79	
Income 5	0.76	0.39, 1.49		0.77	0.44, 1.35		0.84	0.50, 1.43		0.97	0.56, 1.67	
Income 6	0.68	0.30, 1.54		0.80	0.39, 1.62		1.17	0.60, 2.27		1.15	0.57, 2.33	
Income 7	0.83	0.37, 1.87		0.58	0.30, 1.12		1.04	0.57, 1.91		0.95	0.50, 1.79	
Drinking in pregnancy	**0.40**	**0.31, 0.51**	**	**0.60**	**0.49, 0.75**	**	**0.75**	**0.62, 0.91**	**	**0.79**	**0.64, 0.98**	*
Interest in education	0.79	0.59, 1.06		0.79	0.62,1.00		0.80	0.63, 1.00		0.86	0.66, 1.11	
Paternal smoking	1.26	0.96, 1.67		1.10	0.88, 1.38		1.17	0.95, 1.45		1.15	0.93, 1.42	
Maternal smoking	**1.51**	**1.15, 2.01**	**	1.08	0.86, 1.36		1.18	1.95, 1.47		1.09	0.87, 1.36	
Child disclosure	0.86	0.48, 1.52		1.11	0.70, 1.76		1.21	0.76, 1.93		1.02	0.63, 1.66	

[1] Hazardous drinkers are the reference category. * = $P < 0.05$; ** = $P < 0.01$. Maternal interest in education was collapsed into a binary variable for the regression analysis.

To test the possibility that the lack of evidence for a negative affect pathway may be due to the gendered nature of anxiety as a causal mechanism, a further multinomial logistic model was estimated with an anxiety gender-interaction term included. All three interaction terms (anxiety; gender; anxiety*gender) were only significant within the occasional and hazardous drinking class comparison. The revised interaction terms coefficients for this comparison are as follows (anxiety = 0.087; gender = 0.937;

anxiety* gender = -0.031). When gender is zero (male) an increase in anxiety is associated with an increased log odds (0.087) of being in latent class 2 (occasional drinker). When anxiety is constrained to be zero, a unit increase in gender (female) is associated with an increase in the log odds (0.937) of being an occasional drinker. With an increase in gender (switching from male to female) the slope of the anxiety effect is also slightly reduced (-0.031); however this effect is not large enough to result in anxiety being associated with an increased risk of being a hazardous drinker at age 16. While anxiety is still associated with a reduction in the risk of being a hazardous drinker, it is just that the effect is less for females than for males.

4. DISCUSSION

From the bivariate analysis it is possible to construct a stereotypical picture of the various types of young drinkers when they were aged 10. The limited use group appeared, in general, to have lower educational ability and attainment together with a higher likelihood of attending special educational provision. They also were more anxious, introverted and clumsy, with fewer friends than their school peers. As adolescent alcohol consumption is a social activity, the limited alcohol consumption of this group may be a function of poorer social skills. In contrast, the hazardous and heavy drinkers, performed well at school, came from wealthier families, were more popular, extrovert, and had fewer worries or anxieties than the others. In a longitudinal study of early adolescents, Allen et al. (2005) found that popular adolescents displayed positive markers of social development, however, they also tended to display increased behaviours associated with growing peer approval, including alcohol and drug use.

Moderate to hazardous drinking appears to be associated with successful adjustment in adolescence. In most respects, poor adaptation at age 10 is associated with lower levels of alcohol consumption in later years. This may reflect, to a large degree, the role that alcohol plays in modern adult society. Alcohol consumption, even though it is legally forbidden at age 16, could be considered a normal part of the transition from adolescence to young adulthood. It is those children with higher levels of social problems, as indexed by cognitive ability, internalising problems, coordination problems or social isolation, who appear to be the ones least likely to engage in drinking behaviour.

Amongst girls there was evidence that alcohol consumption and antisocial behaviour was tied up with early maturation. Moffit et al. (2001) found that the link between alcohol problems and early menarche was associated with joining older more deviant peer groups. However, girls, in general, were more likely to be in the moderate or occasional drinking class than the hazardous drinking group. No gender difference was detected when hazardous drinkers were compared with either heavy or limited drinkers. It is assumed that these groups are predominantly male.

The bivariate and multivariate analysis lends strong support to the deviant proneness pathway of adolescent alcohol problems. This study found that behavioural undercontrol was a key predictor of adolescent drinking patterns across all types of drinking with the exclusion of the highest end of the spectrum. Between heavy and hazardous drinker no differences could be found on the behavioural undercontrol indicators.

In relation to the relative importance of the various dimensions of undercontrol that have been suggested as etiological mechanisms, antisocial behaviour appears to be the main predictor of adolescent drinking rather than hyperactivity or attention problems. The analysis presented would indicate that any associations between alcohol consumption and hyperactivity or attention problems are likely, in the main, to be due to their common association with antisocial behaviour. This is similar to the

findings of King et al., (2004) who concluded that amongst externalising disorders, ADHD was the weakest predictor of adolescent alcohol consumption, and conduct disorder the strongest. ADHD was predictive of smoking behaviour and cannabis use, but not alcohol use. These findings contrast, however, with a recent study, Niemelä et al., (2006), where the frequency of drunkenness at age 18 was predicted by teacher reports of both conduct disorder and hyperactivity at age 8. Although, when parents reports were considered, only conduct disorder was found to predict drunkenness. While it could be argued that the divergence in these findings is due to the fact that teachers are better able to identify ADHD as a result of ready comparisons with their class peers, the analysis presented here also used teacher ratings of hyperactivity.

Little support was found for a negative affect pathway in adolescent drinking behaviours. In the bivariate analysis higher levels of anxiety were associated with lower levels of alcohol consumption rather than higher. In the multivariate analysis, anxiety did not differ significantly across the various drinking classes once other predictors were controlled for. This conclusion did not alter even when a gender*anxiety interaction term was introduced to the model. In fact, the multivariate analysis indicates the reverse, a higher teacher rating of extraversion (also referred to as positive emotionality) was predictive of later alcohol consumption. Extrovert children tend to be outgoing, expressive, popular and active and one possible explanation for these findings is that high levels of alcohol consumption in adolescents is an extreme manifestation of this positive sociable personality. It is also possible that the outgoing nature of these young people results in their greater exposure to situations where the unsupervised consumption of alcohol with peers is possible (environmental selection or manipulation processes) (see Shiner & Caspi, 2003, for a discussion of these processes). However, it must be recognised that the relationship between extraversion and psychopathology has received little attention relative to the negative emotionality (Nigg, 2006).

This lack of association between early negative affect and later adolescent drinking confirms the findings of other community-based studies (King et al., 2004; Niemelä et al., 2006). It is possible that a negative affect pathway represent etiological mechanisms that do not emerge before the transition to adulthood. Zucker (2006) in a major review suggested that a negative affect pathway, while it had many childhood antecedents, emerged in early adulthood rather than early adolescence, as is common with a deviant proneness pathway. In a large-scale high-risk case controlled study Chassin, Pitts and Prost (2002) also found that early onset high frequency drinkers were characterised by parental drinking, antisociality, externalising behaviour, low depression and peer drinking. This study confirms and extends these findings within a community sample.

In addition to those variables that were significant predictors of later drinking status, it is also worth considering those indicators that were not significant given the large sample size (and associated statistical power) involved in this analysis. In particular, adolescent drinking behaviour was not predicted by childhood cognitive functioning or family socioeconomic status once other key predictors such as the level of

antisocial behaviour were controlled for. While both these factors varied significantly across the drinking classes when examined in isolation, their predictive association with alcohol consumption six years later is due to correlations with other 'third variable' factors.

One important finding emerging from this study is the different subsets of predictors that were significant across the various comparisons made. When hazardous drinking was compared with limited use a broad range of indicators was associated with the odds of being in the two drinking categories. These indicators comprised both social indicators (such as receipt of special education or maternal smoking) and individual/ behavioural indicators (such as BMI or antisocial behaviour). However, while the gap in the level of consumption decreased between the various pairs of drinking classes included within the model, the number of significant indicators decreased.

When the logistic model was comprised of only heavy and hazardous drinkers the only significant predictor is maternal drinking during pregnancy. This confirms the findings of existing case-control and clinical sample studies that familial drinking is associated with increased risk of later adolescent drinking problems (e.g. Hill & Yuan, 1999; Reich, Earls, Frankel & Shayka, 1993; Sher, 1991). In one of the few other community based studies examining this issue (the Early Developmental Stages of Psychopathology Study), Lieb et al. (2002) also found that maternal (and paternal) drinking history predicted dependent adolescent transition from occasional use to regular use and hazardous use. In terms of extending current knowledge, this study shows that the temporal association between risk exposure and later outcome can extend over a considerable period of time (from the prenatal period to late adolescence). It also has shown that this risk exposure can also differentiate between drinking patterns, even at the extreme level of adolescent consumption and even after controlling for other known risk factors.

The significance of parental drinking suggests three possible mediating processes. First, the links between maternal and dependent child drinking could be due to a shared genetic liability. What is suggested here is that the genetic vulnerability that contributes to a mother's inability to restrain her consumption of alcohol during pregnancy (when she is most likely to be bombarded by numerous anti-drinking health messages) may also contribute to her child's inability to restrain their drinking at age 16. It is generally accepted that alcohol behaviours are highly heritable (McGue, 1994) .

Another possible mechanism is that early pregnancy drinking results in minor neurological deficits during the early stages of foetal development. These deficits could then interfere with the child's ability to regulate and control their own behaviour resulting in higher levels of antisocial behaviour and alcohol consumption. And finally, it is possible that the findings also represent an indirect social mediated risk. For example, Nash, McQueen and Bray (2005) found that family environment, and in particular parental expectations about adolescent drinking, moderated adolescent alcohol consumption. Unfortunately, however, this study is not of a design that can

pick apart the genetic and neurobiological factors that underpin increased liability to adolescent alcohol problems (for a discussion of these factors see Zucker, 2006).

Implications

Early antisocial behaviour is a strong predictor of later drinking problem amongst adolescents. This supports the established Problem Behaviour Theory (Jessor & Jessor, 1977), and more specific deviant proneness models outlined above. This finding has two main implications for the design of alcohol abuse prevention programmes. First, it may be advantageous to address adolescent alcohol problems through the provision of childhood externalising behaviour programmes. Reducing or disrupting the development of antisocial behaviour in children may impact on young peoples' likelihood of developing later alcohol misuse problems. The efficacy of prevention programmes challenging heavy drinking amongst adolescents may be restricted if antisocial behaviour is not addressed or permitted to develop unrestricted. Secondly, children and adolescents in contact with the Criminal Justice System (CJS) can be recognised as young people at increased risk of serious alcohol problems. The developmental association between alcohol and antisocial behaviour compounds the clustering of negative outcomes amongst a small subpopulation of young people. The CJS does, however, provide a valuable opportunity to provide selective prevention interventions for the reduction of alcohol related harm. There is a long history of CJS interventions aimed at reducing alcohol and offending behaviours within the UK (Baldwin, 1990; 1991).

Beyond the deviant proneness pathway, little else appears to be a consistent predictor of drinking status. In particular, social indicators did not appear to be independently associated with later drinking outcomes. However, it must be said that logistic regression models may not be necessarily the best test of complex moderating or mediating roles. It may still be the case that social processes do play an important role in the etiology of adolescent alcohol use, but that once antisocial behaviour and maternal alcohol consumption are accounted for within a logistic model these effects are no longer observed (due to the way in which regression model parameters are estimated). More complex statistical procedures such as structural equation modelling may be required to fully tease apart these complex interrelationships between predictors of adolescent drinking.

Successful adaptation in late childhood is associated with moderate, albeit underage, alcohol consumption in adolescence. It could be argued that alcohol consumption at around age 16 is a normal part of successful adolescent development. Children who do well at school, are popular with their peers and have a good relationship with their parents do go on to engage in moderate underage drinking. To fully understand the role that alcohol consumption plays in successful adolescent development and the transition to adulthood, requires the consideration of the continuity between adolescent and adult drinking patterns. If these patterns do exhibit a high degree of temporal stability, that is, they are linked with moderate and controlled adult drinking it could be argued that even though drinking at age 16 is considered inappropriate, at least in social policy terms, it plays an important function in the development of the

behavioural and social skill required to manage exposure to mood altering substances.

Whilst the difficulties of interpreting the relationship between maternal drinking in pregnancy have been outlined above, the finding still warrants careful consideration. As social policy implications, however, are likely to differ across the potential causal processes, a response to this research is to suggest further work to fully explore this important predictor. Notwithstanding this requirement, it is still possible to consider the implication of this finding. If maternal drinking represents a genetic etiological pathway, the important point to note is that it appears that mother's drinking in addition to fathers drinking is indicative of heightened risk amongst the young person. To date, most research examining the children of alcoholics has focused on the dependent offspring of male problem drinkers (for example Sher, 1991; Tarter et al., 2004). Further recognition is required of the increased risk of having a mother with a drinking problem. Special consideration should be given to the needs of children and young people of mothers in contact with alcohol services in addition to the needs of the mother. If maternal drinking represents a neurological risk process it highlights the importance of health education messages presented to women of childbearing age. It could be possible that the alcohol consumption reported here represents normal, that is, non-pregnant drinking in the very early stages of pregnancy before the mother is aware of her pregnancy. If this is the case then the message to women should be to ensure that care is taken with regards to the level of alcohol consumed, when the possibility of pregnancy is heightened.

4.1 Strengths and limitations of the study

To date, most studies on the development of adolescent drinking patterns have originated within the US or New Zealand. As this is one of a small number UK and European studies to examine this issue over such an extended time period, the findings are important for the design and provision of local (i.e. European) prevention intervention services. However, the study is not simply a replication of existing research within a new jurisdiction, it has also extended and advanced current knowledge. An example of this is the study's testing of the unique contribution to the development of hazardous drinking patterns made by each of the three components of ADHD. This analysis may go someway to determining why so much research in this area has produced highly inconsistent findings. Again, this has important implications for the targeting and provision of services to high-risk young people.

National birth cohort studies, such as the BCS70, offer a number of important methodological advantages over other research designs, when addressing the types of developmental research questions posed in this study. In particular, their prospective longitudinal perspective permits the examination of the onset and course of behavioural disorders within individuals (without the bias of retrospective recall) and the early childhood predictors of later adolescent and adult outcomes, which is not possible within alternative cross-sectional designs. The BCS70, and similar cohort studies, allow researchers to begin to tease apart the temporal ordering of complex social processes, a necessary part of determining risk and outcome.

This study has harnessed the methodological power of longitudinal birth cohort data within a theoretical and analytical framework of developmental psychopathology. This analysis is able to draw upon the wealth of individual-linked data collected within the survey. For example, the study was able to examine the influence of maternal behaviour during pregnancy on the subsequent behaviours and choices of their offspring in adolescence. Only studies such as this are able to address these types of research questions.

The study also employed innovative statistical techniques for the development of a typology of adolescent drinking behaviour. This addressed a number of methodological limitations inherent within more traditional classification methods. The resultant typology appeared to be valid and highly discriminating. In addition to the use of latent class methods, the study also employed state-of-the-art methods for minimising biases due to missing data (multiple imputation), a common problem with longitudinal studies.

However, as with any social research, this study has certain limitations. While previous analysis chapters identified and discussed specific technical restrictions, this section will focus on broader problems and issues that warrant consideration. These limitations, to some extent, reflect general weaknesses of secondary analysis as a social research method. However, certain limitations are specific to this analysis.

4.1.1 Age of the data

The data collected on adolescent drinking is now over two decades old. Information obtained on parental behaviours and early childhood social conditions is considerably older. It is highly likely that there have been noticeable changes in parenting practices, youth sub-culture and adolescent drinking patterns in the intervening years. Therefore, consideration must be given to the 'historical' period in which the data was collected. This may somewhat weaken the generalisability of the study findings to current adolescent drinkers.

This delay between data collection and presentation of results is a common problem associated with single cohort longitudinal research. Whereas cross-sectional studies can collect data across a range of different age groups, all within a single sweep, single age cohort studies must allow time for the cohort member to grow older. Here, *age effects* (changes in behaviour linked to developmental or maturational processes) are the primary focus of the research design, and cohort studies give a more accurate estimation of such age effects. The implications are, however, that a single age cohort study examining adolescent determinants of adult behaviours must wait until the cohort members reach adulthood, meaning that any adolescent data collected are dated.

4.1.2 Period and cohort effects

While cohort studies, such as the BCS70, are designed to examine age effects, these results can be confounded by related *period* and *cohort* effects that may also impact on the social process observed within this study (Sacker & Wiggins, 2002). Period effects are changes in behaviours associated with the specific period in which the data were collected. Such effects influence all age cohorts during the period in which the effect operates. For example, changes in the tax regime for alcohol may instigate secular changes in drinking behaviour (increases or decreases) that are observed across all age ranges. Cohort effects, in contrast are observed differences between different age cohorts due to specific characteristics of the cohort and their interactions with the unique cultural periods in which the cohort grew up. These are lasting differences between different cohort groups. One of the most widely observed cohort effects is the Easterlin effect (Easterlin, 1987), in which the level of adult economic attainments within a cohort was shown to be a function of the size of the cohort and the resulting availability of financial resources and opportunities. Age, period, and cohort effects have been observed in adolescent alcohol use during the period covered by this study (O'Malley, Bachman & Johnston, 1998). Therefore, the interpretation of the age effects observed within this study must countenance possible period and cohort confounders.

4.2 Operational definitions

One of the main limitations of secondary analysis is that the range of topics covered by the survey and the actual questions used (and therefore the variables within the dataset) are predefined, not by the secondary analyst, but by the preceding research team. Therefore, secondary analysis always involves a degree of compromise between what the researcher would like to examine and what variables are available within the dataset.

While the quality of the alcohol data (at age 16) and the time period that the BCS70 covers (birth to age 26) makes the BCS70 a valuable, if under-exploited, resource within this field, the range of covariates included within each data sweep, limit the scope of the research questions that can be considered and the models that can be estimated. The measures included at each data sweep were designed by researchers who had to attempt to anticipate the types of research questions, and statistical techniques, that would be a high priority many years later. The secondary analyst is, therefore, bounded by the decisions taken by other researchers (the originators of the data). As a result, any secondary analysis study may be missing important theoretical constructs or they may be measured with a less than optimal method.

Within this study the impact of this restriction has been limited. However, while the study does address a number of important issues, other key research questions were not addressed due to the natural limitations of the BCS70 dataset.

Given the considerable expense of longitudinal cohort studies, the data collection strategy usually employed tends to be more "wide and thin" rather than "narrow and deep". As a result, studies such as the BCS70 attempt to capture information on a very wide range of medical, educational and social topics to maximise the potential for secondary exploitation. In many cases, only one or two indicators are used to assess key constructs, thus ensuring a large number of separate constructs can be included within the data sweep. Where multiple item measures are used there is a general pressure to reduce the length of such scales. The downside of this approach is that many social phenomenon are complex multi-dimensional processes, and information can be sacrificed. One implication for this study was a restriction in the range of statistical methods that could be used to examine the data. For example, full structural equation models were not estimated due to the limited number of multi-indicators measures. This meant that more comprehensive testing of the theoretical models presented were not undertaken beyond that offered by traditional regression techniques. Likewise, latent class growth models or latent transition models were also not feasible, due to the limited number of time points and the lack of continuity in the alcohol measures over time.

4.3 Future work

While this study has addressed a number of fundamental weaknesses within the existing empirical knowledge base, it has also raised a number of new questions, issues and possibilities that require consideration. Now that the preliminary multivariate analysis of the alcohol data within the BCS70 has been completed, a logical next step would be to develop and estimate more complex structural equation models (SEMs) to further investigate the interrelationships between model covariates. The regression analysis presented here, while providing a lot of valuable information about the predictors of teenage drinking, does not permit the sophisticated testing of theoretical models that incorporate mediating and moderating relationships between covariates. The work presented here offers a general framework for the development and testing of such models.

As the BCS70 is a national study with a relatively large sample size it is able to examine rare experiences and characteristics with satisfactory statistical power. Where sample size and sampling design are insufficient is in the study of how local areas and conditions influence teenage drinking behaviours. To examine neighbourhood effects, studies need a large number of respondents in each small area. The BCS70 sample is too widely spread across the UK mainland for this type of analysis to be undertaken. Neighbourhood effects on individual drinking are still a relatively untapped research area.

In addition to these general areas of future work, a large number of more specific research questions can also be generated from this initial work. While this study has demonstrated the important link between maternal and adolescent drinking, for example, further work is needed to unpick the actual process through which this influence is mediated. Without this additional knowledge intervention attempts to

mitigate the effects of this risk exposure will be hampered.

A new round of short-term longitudinal studies (tracking young people over shorter periods of time usually 5 to 10 years) have been commissioned in recent years, including the Belfast Youth Development Study, The Edinburgh Study on Youth Transitions and Crime, and the Peterborough Adolescent Development Study. These studies have, in general, been established to address the weaknesses inherent in the existing large-scale birth cohort studies. In particular, they have tended to utilise highly localised clustered samples to examine the neighbourhood effects, frequent follow-up to assess the short-term ebbs and flows in behavioural development, and employ data collection tool specifically designed to facilitate complex, state-off-the-art statistical techniques. Together with continued exploitation of the existing birth cohort studies, further work on this new generation of longitudinal research should lead to major breakthroughs in our understandings of the development of problem behaviours in adolescents and young adults.

5. Summary

Two etiological models were presented and tested in this paper; a deviant proneness model and a negative affect model. The deviant proneness pathway emphasised the role of behavioural undercontrol, characterised by impulsivity, sensation seeking, inattention and disinhibition, in the development of adolescent problem alcohol use. Young people with high levels of behavioural disinhibition may fail to develop suitable regulatory competence over their developing alcohol use. This model also recognised the role that socialisation processes (family and peers) can play in moderating the relationship between undercontrol and drinking outcomes.

The negative affect etiological pathway proposes a link between alcohol use and comorbid affective disorders (anxiety and depression). Here, problem drinking may develop as a method for coping with extreme emotional thoughts and feelings as a source of self-medication. In addition to these two models a range of other identified risk factors were reviewed including cognitive ability and functioning parental alcohol and drug use, family capital, and early maturation.

This study provided an analysis of a UK community sample, which addresses a number of known weaknesses within the existing knowledge base, including the over-reliance on US clinical case-control studies. Multivariate logistic regression analysis (with multiple imputation for missing values) was used to identify early childhood predictors of later adolescent drinking behaviour. In particular, the analysis sought to examine the relative importance of various indicators of behavioural undercontrol and negative affect in identifying adolescent problem drinkers. In addition, the models also included indicators of family socialisation and other risk factors such as executive cognitive functioning.

Adolescent drinking was predicted by a constellation of characteristics that included maternal drinking during pregnancy, antisocial behaviour, extraversion, and gender. Once these indicators were taken into account there was little evidence for a predictive influence of negative affect, cognitive ability, or family capital. When young people who are drinking at the higher levels are compared, (heavy drinkers versus hazardous drinkers), only maternal drinking is significantly associated with increased odds of being in the hazardous category. This, together with the behavioural undercontrol predictors may suggest a genetically mediated etiological risk process. In contrast, children with cognitive difficulties as indexed by receipt of special education, cognitive functioning or difficulties at school reported the highest levels of abstinence.

There is some evidence; albeit in the form of univariate findings, that suggests that moderate drinking at age 16 is not associated with indicators of unsuccessful childhood adaptation. Rather, it seems that those children with indicators of successful childhood development, including success at school, established peer friendships, and good parental relationships do not progress to abstinence in adolescence but rather, moderate drinking outcomes. However, once maternal drinking and behavioural undercontrol (as indicated by the levels of antisocial

behaviour and extraversion) were controlled for, no real variation in these indicators of successful adaptation were noted across the drinking categories.

What are of almost equal importance to the positive associations found in this analysis are the negative findings, where hypothesised relationships were not supported by the data. In particular, adolescent problem drinking was not associated with low family capital. No differences in the likelihood of being in the different drinking classes were noted across the different income groups. Neither did parental interest in the child's education predict later drinking.

Certain dimensions of behavioural undercontrol, together with maternal drinking did appear to be the most important predictors of adolescent hazardous drinking. Family socialisation, beyond that captured by maternal drinking behaviour, did not appear to contribute to increased risk above that accounted for by undercontrol. However, the model did not permit the testing of moderating or mediating interaction between undercontrol and socialisation. This would require a more sophisticated structural model. Negative affect did not appear to be predictive of drinking behaviour. However. this does not mean that a negative affect pathway may not be important in explaining the drinking behaviour of subpopulations within the overall cohort or may be influential at a later developmental period. Further models would be required to explore this issue. There is limited evidence of alternative predictors of adolescent drinking behaviour outside of the main undercontrol pathway.

These findings have considerable implications for the design and development of interventions aimed at preventing or reducing the harm associated with adolescent drinking. These findings identify two key opportunities for service development. The first is in relation to early intervention service for children at risk of conduct or antisocial behaviour problems. These young people are exhibiting behavioural undercontrol and are at increased risk of later alcohol problems in addition to any conduct problems they may have. This research would suggest that alcohol education should be considered as an important component in any services provided to this population. The second intervention opportunity is within services provided to mother with drinking problems. In addition to the needs of the mother, the needs of the child should be given serious consideration to reduce the risk of a generational transmission of drinking problems.

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