FAMILY FUNCTIONING AND SUBSTANCE MISUSE AT AGES 12 TO 17

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The Edinburgh Study of Youth Transitions and Crime
2005

Published 2005 by Centre for Law and Society
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KEY FINDINGS

Between the ages of 12 and 17, prevalence of smoking, drinking and illicit drug use increased continuously amongst cohort members. From age 13 onwards, girls were more likely to smoke weekly than boys, although there was little or no gender difference in terms of weekly drinking or drug use in the last year.

Family characteristics and parenting styles were found to play a significant role in the substance using behaviour of young people. There was evidence of a causal link between these factors, since family related factors at age 15 predicted substance use at age 17.

Excessive drinking and involvement in drug use amongst parents strongly predicted young people's involvement in smoking and drug use. Parents' drinking and drug use was not related to their children's drinking. The difference may arise because smoking and drug use are considered deviant, whereas drinking is more widely accepted.

Five dimensions of parenting consistently predicted involvement in smoking, drinking and drug use. Ineffective parenting methods were characterised by high levels of parent/child conflict, poor parental monitoring and lack of leisure time spent doing activities together. Substance using children were likely to conceal information about their social activities from their parents, although they were more likely to report engaging in positive forms of conflict resolution.

There were important demographic differences between smokers and other substance users which have policy implications for prevention strategies. Smokers were more likely to be female and from less affluent backgrounds, whereas drinkers and drug users (at age 17) were likely to be from more affluent backgrounds.

These findings are broadly supportive of social learning theory and indicate the need to provide information on methods of parenting which may be more effective in tackling various forms of problematic behaviour, including substance use.

INTRODUCTION

This paper explores the relationship between family functioning and substance use among young people aged 12 to 17. It draws on findings from the Edinburgh Study of Youth Transitions and Crime (the Edinburgh Study), a longitudinal research programme exploring pathways into and out of offending among a single age cohort of young people who started secondary school in the City of Edinburgh in 1998. The key aims and methods of the study are summarized below.[1]

Aims of the programme

- To investigate the factors leading to involvement in offending and desistance from it
- To examine the striking contrast between males and females in criminal offending
- To explore the above in three contexts:
  - Individual development
  - Interactions with formal agencies of control
  - The social and physical structures of neighbourhoods
- To develop new theories explaining offending behaviour and contribute to practical policies targeting young people

Overview of methods

- Self report questionnaires (annual sweeps)
- Semi-structured interviews (Sweeps 2 and 6)
- School, social work, children's hearings records (annual sweeps)
- Teacher questionnaires (1999)
- Police juvenile liaison officer and Scottish criminal records (from 2002)
- Parent survey (2001)
- Geographic information system

Participating schools

- All 23 state secondary schools
- 8 out of 14 independent sector schools
- 9 out of 12 special schools

Response Rates

- Sweep 1 96.2% (n=4,300)
- Sweep 2 95.6% (n=4229)
- Sweep 3 95.2% (n=4296)
- Sweep 4 92.6% (n=4144)
- Sweep 5 89.1% (n=3856)
- Sweep 6 80.5% (n=3525)

Research Team

- David Smith, Lesley McAra
- Susan McVie, Lucy Holmes, Jackie Palmer

Study Funding

- Economic and Social Research Council (1998 - 2002)
- The Scottish Executive (2002- 2005)
- The Nuffield Foundation (2002 - 2006)

Information about family structure and changes within families was collected at each fieldwork sweep. In addition, a survey of one parent (the main care giver) of each cohort member was carried out in the autumn of 2001, concurrent with sweep 4. The data used for analysis in this paper are derived from both the young people's questionnaires and the survey of parents. Details of the variables used are presented in Appendix 1.

[1] See also Smith at al (2001) and Smith and McVie (2003) for further details of the study.

Generalised 'substance use' may be used as a convenient category for some analysis (especially at younger ages, when the number of children using each individual substance is much smaller), but for this report smoking cigarettes, drinking alcohol and use of illicit (i.e. illegal or prescribed for somebody else) drugs are analysed separately. (The Edinburgh Study also asks children about the use of volatile substances and 'Poppers', or Amyl Nitrate, which, while not strictly illegal, are nonetheless substance use behaviours). Smoking and drinking are, for young people under the legal age for consumption, status crimes. These behaviours are illegal for young people only through virtue of their age, and therefore deserve to be considered in a slightly different way from illicit drug use which remains illegal into adulthood.

All analysis of data from sweeps 5 and 6 has been conducted using weighted data. Although the Edinburgh Study sample is large, from Sweep 4 onwards response rates declined slightly. Weighting responses from Sweeps 5 and 6 minimises the risk of producing biased estimates during analysis due to non-response amongst the cohort. For a detailed description of the weighting method see Appendix 2.

Context

Adolescent drinking, smoking and drug use are widely recognised as major health problems in Scotland. In recent years, the Scottish Executive has attempted to address these via the publication of a large number of policy and consultation documents and increased funding to expand the range of services available to tackle these issues (for a summary see McVie and Bradshaw 2005). In addition, the children's hearing system is able to accept referrals for young people on the grounds that they *misused alcohol or any drug whether or not a controlled drug within the meaning of the Misuse of Drugs Act 1971.* Yet other research evidence published from the Edinburgh Study suggests that very few children in the Edinburgh cohort who regularly drank alcohol or took drugs were known to the hearings system (McAra 2005), which means that parents are rarely formally involved in addressing such problems. The impact of poor parenting on offending behaviour amongst young people has been addressed through the introduction of *parenting orders* in the Antisocial Behaviour etc. (Scotland) Act 2004. However, there has been little or no recognition within the policy context that styles of parenting and family functioning may have an impact on adolescent substance use.

Much research has been done to examine the influence of family life on young people, and in particular young people's offending behaviour. Loeber and Stouthamer-Loeber (1986) conducted a comprehensive review of many studies and concluded that parental supervision, parental rejection, and parent-child involvement were among the strongest predictors of delinquent behaviour. Parents' marital relationships and criminality were moderately strong predictors, while weaker predictors include lack of parental discipline, parental physical/mental health and parental absence. David Farrington has also summarised evidence from a range of studies that suggest family factors have a profound impact on delinquency (Farrington 2002). He identified the most significant family factors as parental conflict and family disruption caused by divorce and separation rather than death of a parent. Parental remarriage was also found to be criminogenic. Analysis based on the Cambridge Study in Delinquent Development suggested that it was not disruptive events in themselves - such as family

break-up - that explained delinquency so much as the way that family members changed and adapted following such events (Farrington 2002).

Summarizing evidence from a range of studies and adopting a life-course perspective, Farrington concluded that it was the 'post-traumatic trajectory' following a disruptive family event that could best explain its consequences for the later behaviour of young people. Also, he concluded that a developmental theory of the adaptation to trauma provided a better explanation than rival theories such as those that focus on the direct effect of the trauma itself, or others that see family conflict as an indicator of other causes of delinquency. This implies that the factors that best account for delinquency are the stresses associated with family conflict, parental loss, changing economic circumstances, changes in parent figures and poor parenting styles, rather than the loss of a parent in and of itself, or inherent differences in broken families (compared to intact families) in terms of risk factors (see also Juby and Farrington, 2001).

The link between substance use and other forms of delinquent behaviour has been well established by research (see, for example, White et al 2002), including the Edinburgh Study. In *Adolescent Smoking, Drinking and Drug Use,* McVie and Bradshaw (2005) found that "multiple substance users report higher levels of delinquency and victimisation; higher impulsivity and lower self-esteem; greater involvement in unconventional activities; weaker parental supervision and stronger peer influence than single substance users and non-users". Further, a report on patterns of referral to the children's hearing system by McAra (2005) reported that children who become known to the agencies for substance misuse are also likely to be in trouble for other types of delinquent behaviour: "Children known to the system for drug and/or alcohol misuse exhibited high levels of anti-social and disruptive behaviour, had problematic family and peer relationships and absconded regularly from school." (McAra, 2005)

Analysis of data from the Edinburgh Study has also demonstrated that certain aspects of family functioning are linked to both delinquent and substance using behaviour in adolescence. In *Parenting and Delinquency at Ages 12 to 15,* Smith (2004) demonstrated that substance use was related to different aspects of parenting in a similar way to serious delinquency amongst young people. Multivariate analysis conducted for this report indicated that level of parental monitoring, frequency of parent/child conflict and the child's willingness to disclose information were significantly correlated with substance use among the cohort members at age 15. Smith provides evidence for a causal link between parenting and delinquency and proposes that these findings support a social learning theory of child development; however, multivariate analysis of parenting and substance use was not developed further here.

The aim of this report is to develop these earlier findings from the Edinburgh Study by extending the analysis to include data from sweeps 5 and 6, and by conducting multivariate analysis of substance use and family functioning. In addition, this report includes analysis of other family related variables, including family structure and parental substance use.

Structure of the Report

The first section of this report summarises trends in substance use among the young people in the Edinburgh Study cohort, from ages 12 to 17. The second section examines the relationships between adolescent substance use and family structure, socioeconomic status, family changes and disruption, parenting styles, and parental substance use. The third section of the report describes multivariate analysis of the impact of various family factors upon subsequent substance use behaviour. The design of the Edinburgh Study makes it possible to examine the effect of such family factors both on substance use at the same sweep and at later sweeps, thus allowing a longitudinal analysis of the impact of family functioning on young people's substance use. The final section makes some brief conclusions based on the findings presented and identifies some policy implications.

SECTION 1: PATTERNS OF ADOLESCENT SUBSTANCE USE [2]

Prevalence of weekly smoking

At each sweep of the Edinburgh Study, respondents were asked about their frequency of cigarette smoking (anyone who had not smoked a whole cigarette was treated as a non-smoker). Since the number of very frequent smokers was small, particularly at the earliest sweeps of fieldwork, those who reported that they smoked 'every day' or 'at least once a week' were combined to form a group of weekly smokers for analysis in this report.

Figure 1 shows that the prevalence of weekly cigarette smoking increased steadily from age 12 (at sweep 1) to age 17 (at sweep 6) amongst both boys and girls (table A1 in Appendix 3 presents the exact figures for this analysis)[3]. At age 12, boys were slightly more likely to be smoking weekly than girls; however, this trend reversed at age 13, and from age 14 onwards girls were far more likely than boys to be smoking on a weekly basis.

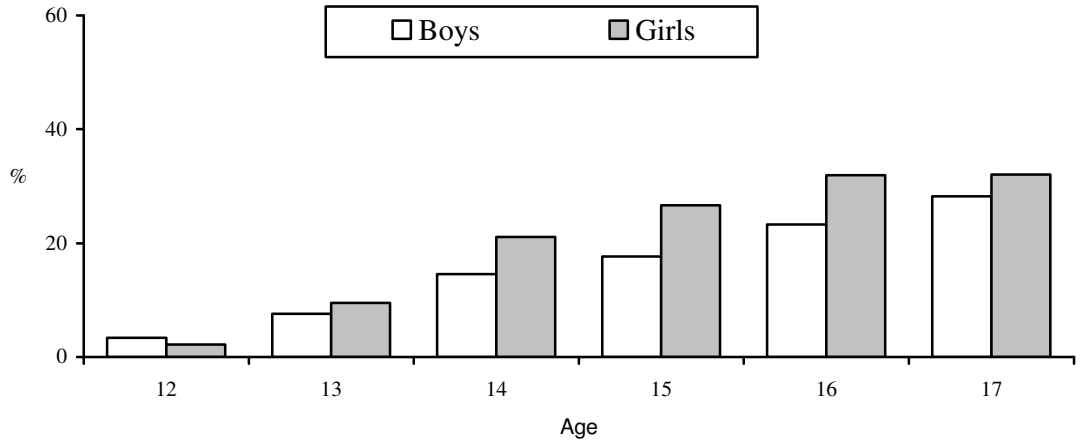

Figure 1: Prevalence of weekly smoking, by gender and age

Prevalence of weekly drinking

Cohort members were also asked about how frequently they consumed alcoholic drinks at each sweep of fieldwork (those who had not drunk a whole glass, can or bottle of alcohol were treated as non-drinkers). Analysis in this report focuses on those who said they drank alcohol at least once a week.

[2] More detailed analysis of the relationships between various substance use behaviours among the Edinburgh Study cohort can be found in *Adolescent Smoking, Drinking and Drug Use* (McVie and Bradshaw 2005).

[3] Age 12 was the average age of cohort members at the start of the sweep one fieldwork period. Although there was a broad spread of ages (from the youngest at 10.7 years to the oldest at 13.9 years), over 90% of the cohort were aged between 11.5 and 12.5 years at this time.

Weekly drinking was rarely reported by cohort members at age 12, as illustrated in figure 2 (see table A2 in Appendix 3 for precise figures). As with smoking, there was a steady increase in weekly alcohol consumption up to age 17, although from around age 15 (sweep 4) the rate of increase of weekly drinking was far greater than for weekly smoking. Overall, there was little gender difference in the extent of weekly drinking amongst the cohort. Prevalence of weekly drinking was higher amongst the boys at ages 12 and 17, and amongst the girls at age 15; otherwise, there was no difference.

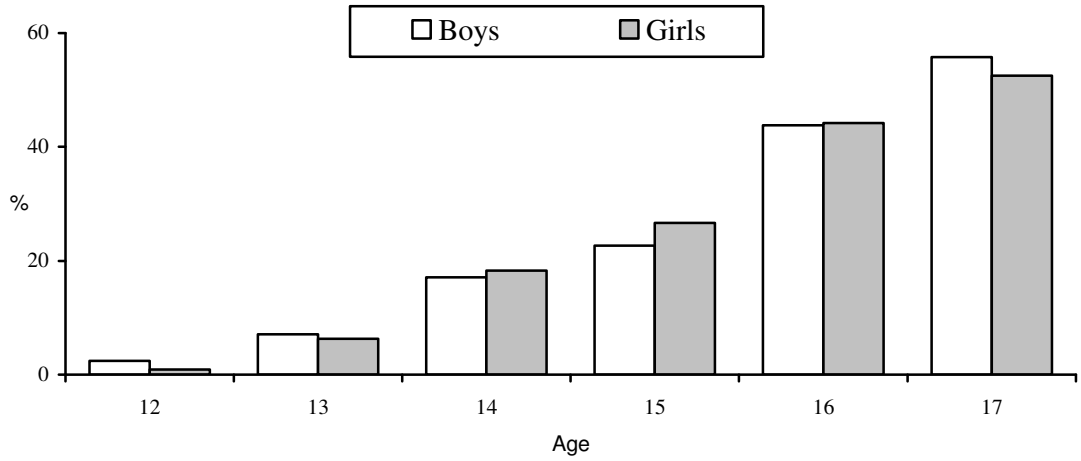

Figure 2: Prevalence of weekly drinking, by gender and age

Drug use in the last year

At each sweep of fieldwork, cohort members were asked whether they had taken or tried a drug during the last year (except at sweep one, where they were asked about drug use 'ever'). Those who said they had taken a drug were routed towards a list of specific drugs and asked how often they had used each. This list of substances included volatile substances (such as gas, glue or solvents) and poppers (amyl nitrate). From sweep 3 onwards, a bogus drug was introduced to try to identify over-reporting of drug use. For the purposes of this report, anyone who reported using the bogus drug and those who stated that they had used a drug, but then not specified which drug or how often they had used it, were excluded from the analysis.

Figure 3 cannot be compared directly with figures 1 and 2, since the reference period of use is dramatically different. Nevertheless, it presents a very similar indication of changing trends over the six sweeps from age 12 to 17 (table A3 in Appendix 3 presents precise figures). Drug use was relatively rare at ages 12 and 13 amongst both boys and girls, although boys were more likely to have taken a drug than girls at these ages. Age 14 appears to be a major point of transition in terms of prevalence of drug use, with significant increases at each sweep thereafter. Interestingly, however, from age 14 onwards there was no significant gender difference in annual drug use.

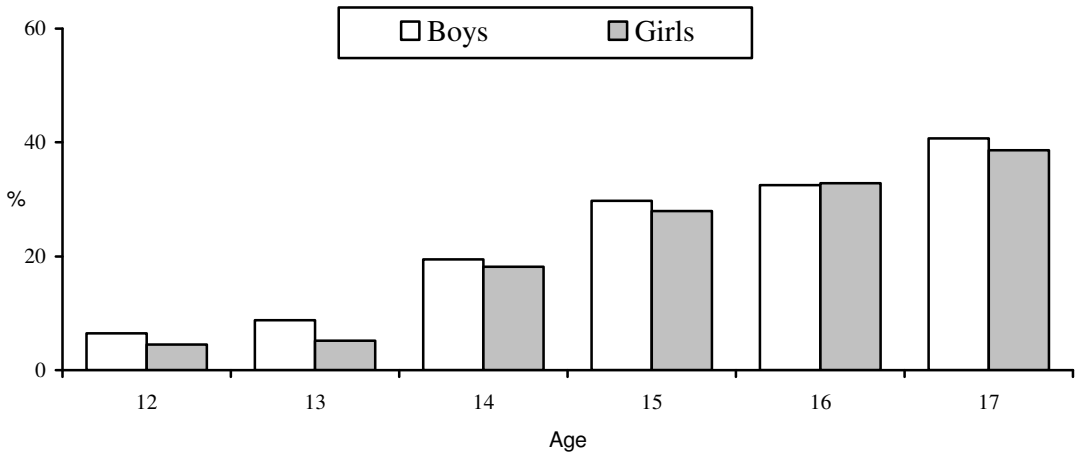

Figure 3: Prevalence of drug use in last year (ever at age 12), by gender and age

SECTION 2: FAMILY CHARACTERISTICS AND PARENTING STYLES

Family Structure

Information about family structure was collected at each sweep of the Edinburgh Study by asking respondents who they lived with. Where young people reported living in more than one household, they were asked for details of the people they lived with in the household where they resided most often, while summary details were collected about their second household. For the purposes of this analysis, family structure has been simplified into two categories: those living with two birth parents and those living in some other kind of household (either with a step-parent, a single parent or with non-parental carers).[4]

Figure 4 shows that, over the six sweeps of fieldwork, weekly smoking increased steadily amongst those within both family structure categories (for precise figures see table A4 in Appendix 3). Nevertheless, those respondents who were living with two parents were consistently far less likely ($p<.001$) to report smoking every week than those who were living in some other kind of family structure. The difference between the two groups did narrow over time, however, from a ratio of 2.4 at age 12 to 1.7 at age 17.

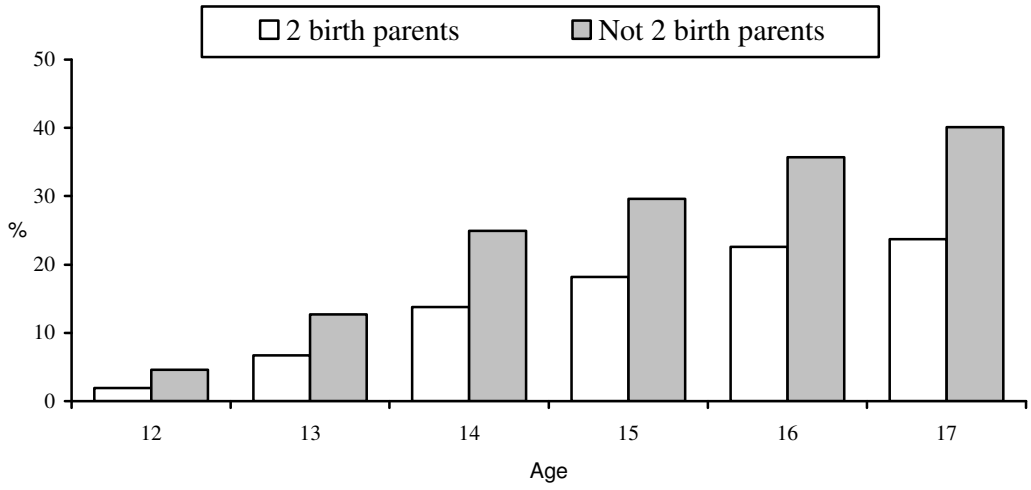

Figure 4: Weekly smoking by family structure and age

The trends in figure 5 are very similar to figure 4, with a substantial increase in prevalence of weekly drinking from age 12 to age 17 amongst both parental structure groups (see table A5 in Appendix 3 for details). However, young people who reported residing with two parents were less likely ($p<.001$) to consume alcohol on a

[4] A very small number of children were living with two adoptive parents – these have been included with the birth parents for analysis here. Analysis is restricted to those living with two birth parents and all other types of family as there was relatively little difference between single parent and step parent families; and the numbers residing with non-parental carers are too small for meaningful analysis.

weekly basis than their counterparts from other family types. The differences between the two categories were far narrower than for smoking, although they did close in a similar vein, from 1.6 at age 12 to 1.1 at age 17.

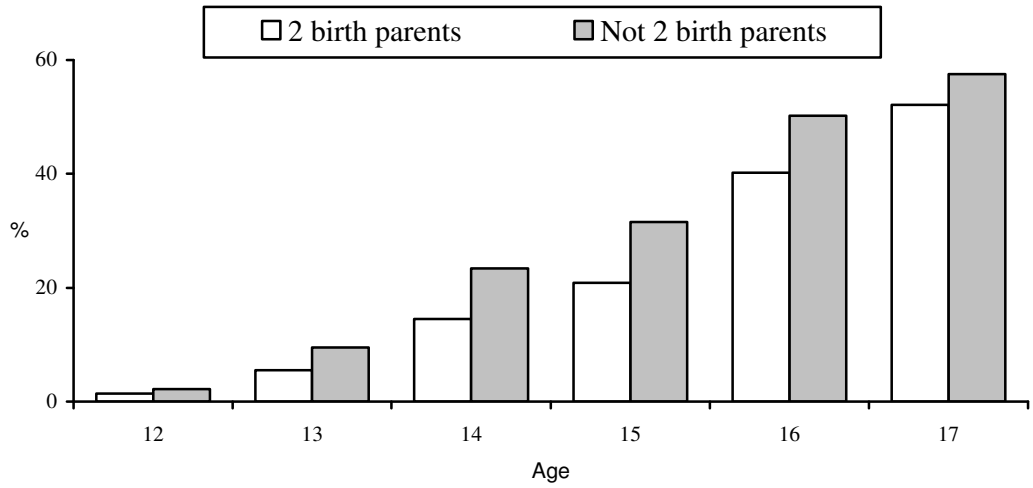

Figure 5: Weekly drinking by family structure and age

The relationship between family structure and drug use is similar to that for weekly smoking and drinking, as shown in figure 6 (see table A6 in Appendix 3 for details). While there was a slight difference in prevalence of drug use between the categories at age 12, from age 13 onwards those living with two parents were far less likely ($p<.001$) to report using drugs during the previous year than those with another type of parental structure. Excluding age 12, there was a familiar narrowing of the gap between the two family structure categories in terms of prevalence of drug use, from 1.7 at age 13 to 1.4 age 17.

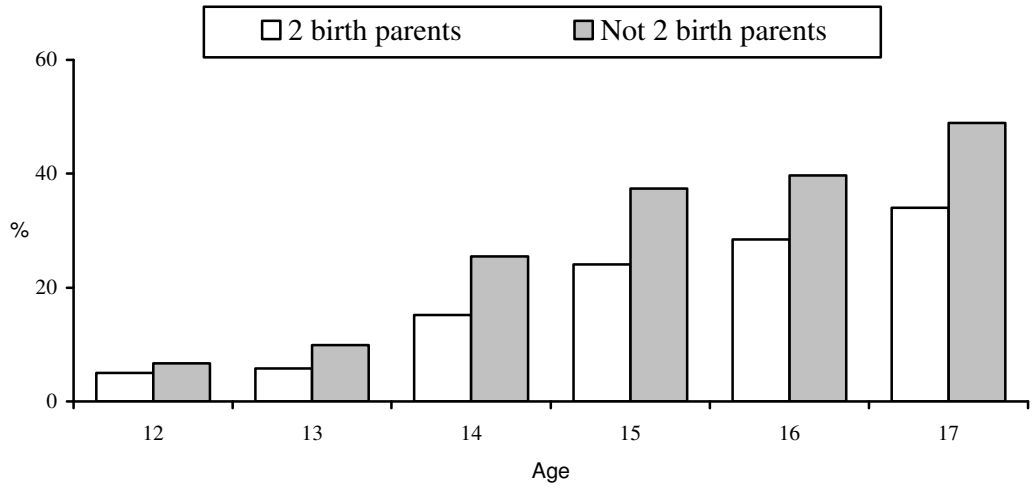

Figure 6: Drug use in the last year (ever at age 12) by family structure and age

Socio-economic status

Socio-economic status was defined according to parental occupation and simplified into those whose parents were in manual occupations or unemployed and those whose parents were in non-manual occupations (see Appendix 1 for details). Prevalence of weekly smoking, weekly drinking and annual drug use increased over time amongst both groups. However, some interesting differences emerged between the two groups in terms of their substance using behaviour. Weekly smoking was significantly more prevalent ($p<.001$ from sweep two onwards) amongst the manual/unemployed group across all six sweeps of fieldwork. Figure 7 shows that the smoking gap continued to widen between the groups with age (see table A7 in Appendix 3 for figures).

On the other hand, there was far more similarity between the groups in terms of their drinking and drug use. Figure 8 shows little difference between the groups in terms of their likelihood to drink weekly (see table A8 in Appendix 3 for figures). Those in the manual/unemployed group were more likely ($p<.05$) to drink weekly between ages 13 and 15 (sweeps two and four); however, by age 17 drinking was more common ($p<.05$) amongst the non-manual group. The relationship between annual drug use and socio-economic group (see figures in table A9, Appendix 3) was similarly weak. Drug use was more prevalent ($p<.05$) in the manual/unemployed group at ages 13 and 14 and greater in the non-manual group at age 16; otherwise there was no difference.

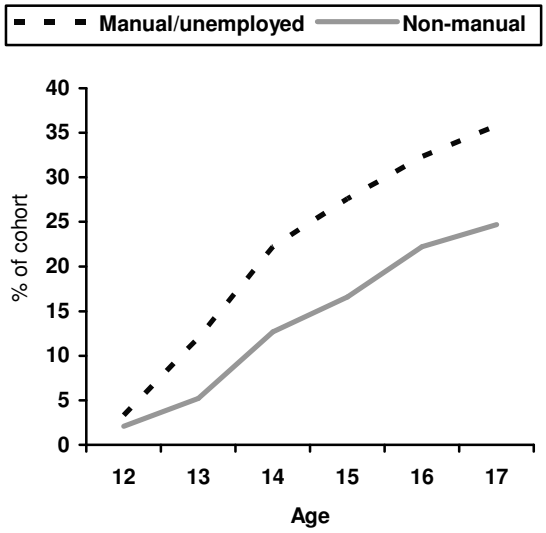

Figure 7: Weekly smoking by socio-economic status and age

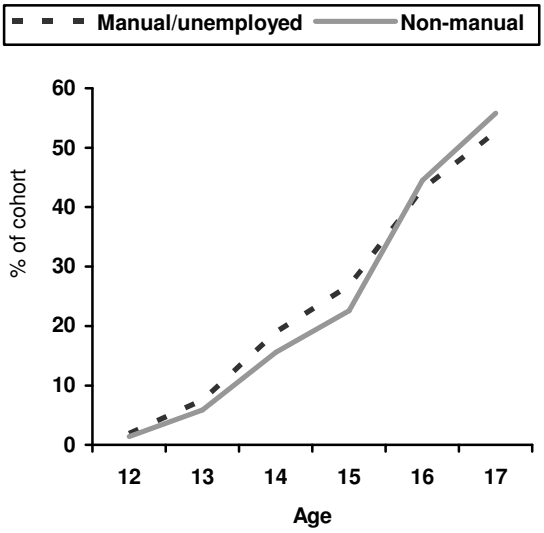

Figure 8: Weekly drinking by socio-economic status and age

Stressful life events

At age 14 (sweep 3) cohort members were asked whether they had experienced each of a number of 'stressful life events' during the course of the previous year. The panel below presents some of the items that were included in this measure of stressful life events, as they relate to family circumstances. Two of these items asked about family illness or death, which have been combined for analysis purposes into a single measure; while three further items asked about parental separation or divorce, which have also been combined into a separate measure. Since it could not be ascertained exactly when these stressful life events had occurred (i.e. a contemporaneous relationship to substance use behaviour during the same sweep was not certain), the prevalence of smoking, drinking and drug use at the subsequent sweep (sweep 4) is examined here.

During the last year, did any of these things happen to you? [Sweep 3 only]

Family illness or death:
- A close member of my family was seriously ill
- A close member of my family died

Parental separation or divorce:
- My parents split up or got divorced
- My mum stopped living with me
- My dad stopped living with me

Table 1 shows the prevalence of weekly smoking, weekly drinking and drug use within the last year at age 15 for those who did and did not report experiencing either of these two forms of stressful life event during the previous sweep of fieldwork (at age 14). As can be seen, those who had experienced either family illness/death or parental separation/divorce were significantly more likely to report drinking and smoking on a weekly basis and drug use during the last year than those who had not experienced such stressful life events.

Table 1: Prevalence of substance use at age 15 by experience of stressful life events at age 14 (%)

		Weekly smoking at age 15	Weekly drinking at age 15	'Any' drug use at age 15
Family illness or death at age 14	Yes	25	28	32
	No	19	21	26
	Significance	***	***	***
Parental separation or divorce at age 14	Yes	37	30	45
	No	20	24	27
	Significance	***	**	***

Note: Significance between groups shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.

This simple analysis suggests that parental separation or divorce may be more strongly related to subsequent substance use than family illness or death, particularly in the case of smoking and drug use. For example, those who had experienced parental separation or divorce at age 14 were 1.8 times more likely to be a weekly smoker

and 1.7 times more likely to have taken drugs at age 15 than those who had not experienced parental separation or divorce. Whereas, those who had experienced family illness or death at age 14 were only 1.3 times more likely to smoke weekly and 1.2 times more likely to have taken drugs at age 15 than those who had not suffered such trauma. Given the close relationship between substance use and delinquency, it is perhaps unsurprising that these findings mirror results from the National Survey of Health and Development, which showed that boys from "homes broken by divorce or separation had an increased likelihood of being convicted or officially cautioned up to age 21 (27 per cent) in comparison with those from homes broken by death of the mother (19 per cent), death of the father (14 per cent) or from unbroken homes (14 per cent)" (Farrington 2002).

Parenting styles

At sweep four of the study, when the cohort members were aged 15, a survey of their main parent or care-giver was carried out simultaneously with the youth survey. Eight different aspects of parenting style were measured at this sweep, with similar questions asked in both the young people's questionnaire and the parents' survey. There were some minor differences because certain items were not applicable to parents in the same way as they were to their children. Three of the measures (parental monitoring, parental autonomy and parent/child conflict) had been included in the young people's questionnaire at earlier sweeps. Five of the measures were completely new (shared leisure time, child disclosure, parental punishment, conflict resolution and consistency of parental control). Full details of the questions that were used to construct these measures and further information about the parents' survey are included in Appendix 1.

A summary of the eight parenting style variables is presented in the panel below. For each aspect of parenting, two continuous measures were constructed: one based on the report of the child and another based on the report of the parent. A composite measure was, therefore, constructed by equally balancing the reports of the young person and the parent. Each of the eight measures was then standardised so as to be comparable in multivariate analysis (see section 3).

Parenting style items included in youth and parent questionnaires [Sweep 4 only]

- **Parental monitoring** or supervision of the child's activities while they were outwith the home.
- **Parental autonomy** or lack of constraint afforded to the young person in certain aspects of their decision making.
- **Parent/child conflict** in the form of verbal arguments.
- Amount of time spent by the parent and child doing activities together (**shared leisure time**)
- Propensity of the child to share information with the parents or keep secrets from them (**child disclosure**).
- Frequency of **parental punishment.**
- Extent to which **negotiation** is to resolve conflict by both parents and child.
- **Consistency of parental control** over the child.

Table 2 presents correlation coefficients which measure the strength of association between each of the eight parenting styles described above and the three measures of

substance use which are the focus of this report.[5] All eight of the parenting style variables were significantly correlated with weekly smoking, weekly drinking and last years' drug use amongst the cohort members at age 15 (sweep 4). Those parenting styles which exhibited the closest relationship to all three forms of substance use were parental monitoring, parent/child conflict and the child's willingness to disclose information to their parents. The relationship between lack of parental monitoring and drug use at age 15 was particularly strong. Time spent engaging in shared leisure activities, consistency of parental control and level of parental punishment were also moderately associated with substance use. However, the level of autonomy in decision making afforded by parents to their children and the level of negotiation used to resolve conflict had the weakest association to substance use in this analysis.

Table 2: Correlation coefficients for parenting style and substance use at age 15

	Weekly Smoking at age 15	Weekly Drinking at age 15	Any drug use at age 15
Parental monitoring	-.363 **	-.366 **	-.427 **
Parental autonomy afforded	-.155 *	-.036 *	.007 *
Parent/child conflict	.346 **	.295 **	.274 **
Shared leisure time	-.242 *	-.236 *	-.258 *
Child disclosure	-.337 **	-.330 **	-.363 **
Parental punishment	.230 *	.195 *	.175 *
Negotiation to resolve conflict	-.154 *	-.161 *	-.153 *
Consistency of parental control	-.296 *	-.317 **	-.224 *

Note: Significance of correlation coefficients * = p<.05, ** = p<.01.

Parental substance use

In the survey of parents carried out at sweep 4, some limited information was collected from each of the main parent or care givers about aspects of their own and (where appropriate) their partners' substance use. The panel below shows the specific questions that were asked about alcohol consumption and drug use.[6]

Parental questions on alcohol and drug use [Sweep 4 only]

- How many units of alcohol do you drink in an average week?
- How many units of alcohol does your partner drink in an average week?
- During the past 12 months, did you take cannabis or another illegal drug?
- During the past 12 months, did your partner take cannabis or another illegal drug?

[5] Since the measures for smoking, drinking and drug use are binary measures, polychoric correlation coefficients were computed in Stata and levels of significance calculated from the standard errors. A correlation coefficient of 0 denotes no association, whereas a correlation coefficient of 1 indicates a perfect association.

[6] A limitation of the analysis here is that it was not possible within the context of the parental survey to ask more detailed questions such as frequency, type or location of drug use, which would have allowed a more thorough analysis of the relationship between child and parental drug use.

Not surprisingly, alcohol consumption was more prevalent amongst parents than illicit drug use. Four out of five adult respondents (82 per cent) reported that they or their partner drank at least some alcohol in an average week; whereas only 4 per cent stated that they or their partner had used cannabis or another illegal drug in the last year. For the purposes of analysis in this report, 'excessive' drinking is defined as more than 21 units of alcohol per week as this compares with the UK recommended weekly limit of 21 units for men.[7] (A unit equates to half a pint of beer, a 125ml glass of wine or a 25ml measure of spirits). Using this definition, 6 per cent of respondents reported that they or their partner drank excessively in an average week.

Table 3 shows the prevalence of weekly smoking and drinking and last years' drug use amongst cohort members by their parents' excessive alcohol consumption and drug use. Parental drug use was far more strongly associated with cohort members' substance use than parental drinking, particularly in relation to their likelihood to smoke or drink weekly. In fact, those who had a parent who drank over the weekly alcohol limit (21 units) were no more likely to drink weekly themselves at age 15 and only slightly more likely to smoke weekly than those who hadn't. There was a much stronger relationship between parental drinking and individual drug use. The most striking findings are in relation to parental drug use, however. At age 15, those who had a parent who had used drugs during the previous year were more than twice as likely to have used a drug themselves in the same time period as those whose parents had not used a drug. They were also around twice as likely to be weekly smokers or weekly drinkers.

Table 3: Individual substance use by parental drinking and drug use at age 15 (%)

		Weekly smoking at age 15	Weekly smoking at age 15	'Any' drug use at age 15
Parents drink excessively in an average week	Yes	26	27	38
	No	20	24	26
	Significance	*	ns	***
Parents used drugs in the last year	Yes	40	39	55
	No	19	23	26
	Significance	***	***	***

Note: Significance between groups shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.

[7] Although the weekly limit for women is 14 units, it was decided to use the higher limit of 21 units to define 'excessive' alcohol use for both parents.

SECTION 3: MULTIVARIATE ANALYSIS OF FAMILY FACTORS AND SUBSTANCE USE AT AGES 15 AND 17

The analyses described so far have shown that a number of family-related factors, including some related to family functioning and others to major disruptions such as divorce and bereavement, are each individually associated with smoking, drinking and drug use amongst young people. It is necessary to take the analysis one step further in order to establish which of these family factors are still associated with adolescent substance use even after controlling for the effect of all of the others. For this purpose, a series of multivariate analyses were carried out using binary logistic regression.[8] Each regression model focused on one form of substance use behaviour (weekly smoking, weekly drinking or drug use during the previous year). Each model examined a range of factors as possible predictors of these three forms of substance use: family structure, parental socio-economic status, stressful life events (monitored at sweep 3) and the eight forms of parenting style discussed in section two of this report. Gender is also included as a potential explanatory factor, given the gender differences in substance use highlighted in section one of this report.

Two models are presented for each form of substance use. The first presents odds ratios for those factors that significantly predicted smoking, drinking and drug use at age 15 (the same sweep at which most of the independent variables were measured). The second model presents the odds ratios for those factors measured at age 15 that significantly predicted smoking, drinking and drug use two years later, at age 17.[9] The purpose of specifying these two models was to see which aspects of family structure and functioning included in the analysis would provide some causal explanation for substance use in both the immediate and the longer term.

The results of the regression analyses are presented as standardised odds ratios, rather than coefficients, to make them more readily understandable. The odds ratio is a value that measures the strength of effect of each independent variable (i.e. predictor) in the model on the dependent variable (i.e. smoking, drinking or drug use). Odds ratios above one indicate a positive relationship between the independent variable and the dependent variable, while those less than one indicate a negative relationship. The higher the odds ratio, the stronger the relationship. Odds ratios for categorical variables can be understood in the normal sense; for example people in the observed group (e.g. males) have a certain odds of being a weekly smoker over people in the non-observed group (e.g. females). Odds ratios for continuous variables (or scales) are more difficult to interpret as they have to be interpreted in relation to the scale of measurement specific to each variable. All the continuous variables in these models have been standardised, so the odds ratios relate to the likelihood of people moving one standard deviation away from the mean. This means it is possible to compare the continuous variables against each other to see which are more important in explanatory terms, but direct comparison of the odds ratios for categorical and continuous variables is not possible.

[8] The dependent variable in each case was weekly smoker or not; weekly drinker or not; and drug user in the last year or not. A forward stepwise procedure was used for entering the explanatory variables.
[9] These were binary logistic regression models specified in exactly the same way as before. The only difference was that the dependent variable in each case was use of one of the substances at sweep 6 rather than sweep 4.

Weekly smoking

Table 4 presents the logistic regression analyses for the dependent variable 'weekly smoker or not' at ages 15 and 17 (sweeps 4 and 6), using a range of independent variables measured at around age 15. Looking first at model 1, gender is the strongest of the categorical variables, with girls being 2.4 times more likely to smoke weekly at age 15 than boys, even after controlling for all the family-related factors in the model. The substance using behaviour of parents also has a significant role to play in influencing the behaviour of children, since parental drug use within the last year and excessive parental drinking are both predictive of smoking. Although current family structure does not predict smoking within model 1, those who had recently experienced parental separation or divorce were almost twice as likely to smoke every week as those who had not. The socio-economic status of the family, based on parental occupation, also has some impact on smoking behaviour, with those from less affluent backgrounds being more likely to smoke every week.

Table 4: Binary logistic regression for weekly smoking at ages 15 and 17

Independent variables (at age 15)	**Model 1: What predicts weekly smoking at age 15 (sweep 4)?**		**Model 2: What predicts weekly smoking at age 17 (sweep 6)?**	
	Odds ratio	Sig.	Odds ratio	Sig.
Gender: female[1]	2.4	***	1.4	***
Socio-economic status: manual/unemployed[1]	1.6	***	1.3	**
Family structure: not living with two parents[1]	-	-	1.4	***
Experienced parental separation/ divorce (age 14): yes[1]	1.8	**	-	-
Experienced family illness/ bereavement (age 14): yes[1]	-	-	-	-
Parent reported excessive alcohol use: yes[1]	1.6	*	1.6	**
Parent reported illicit drug use: yes[1]	2.0	**	1.8	**
Low parental monitoring [2]	1.7	***	1.6	***
High parental trust/autonomy [2]	-	-	-	-
High parent/child conflict [2]	1.6	***	1.4	***
Little leisure time together [2]	1.2	**	1.2	**
Low child disclosure [2]	1.4	***	1.3	**
High parental punishment [2]	1.2	**	1.2	**
High parent/child negotiation [2]	1.4	***	1.2	***
Low parental consistency [2]	1.2	*	-	-

Notes: [1]Categorical variable, odds ratio applies to the indicated category.
[2] Continuous variables are standardised scales, the direction of which is indicated.
Significance of result shown as *=p<.05, **=p<.01, ***=p<.001. Sweep 6 odds ratios are weighted.

Amongst the parenting style variables, lack of parental monitoring or supervision and high levels of conflict between the parent and child proved to be the strongest predictors of weekly smoking at age 15. Interestingly, those who smoked every week were more likely to engage in positive conflict resolution with their parents; however, they were also less likely to disclose information about their behaviour and social activities. The style of parenting amongst those who smoked was also characterised by more harsh parental punishment, lack of parental consistency and little leisure time spent together.

The findings for model 2, which examine the effect of the independent variables measured at age 15 on smoking behaviour at age 17, are broadly similar to those of model 1. The effect of gender and socio-economic status is diminished over time, although being female and from a less affluent social background at age 15 continue to predict weekly smoking two years later. Family structure at age 15 is more important in predicting later smoking than the experience of parental separation or divorce, although arguably these variables are effectively measuring a similar facet of family life. The strength of the odds ratios for the continuous variables diminish slightly in model 2; however, the picture is largely consistent with model 1 and suggests that the same family functioning variables (with the exception of parental consistency) are important in predicting smoking behaviour at ages 15 and 17.

Weekly drinking

The regression models for 'weekly drinker or not' reveal a smaller number of significant predictors and a lower range of odds ratios at both ages 15 and 17 than the models for weekly smoking, as shown in table 5. This may be reflective of the high level of prevalence of drinking within the cohort and suggests that weekly drinkers are not too dissimilar from less frequent or non-drinkers at this age. Model 3 indicates that only two of the categorical variables are significant in predicting weekly drinking at age 15: being female and not living with two parents. Interestingly, excessive drinking by a parent is not important in terms of predicting individual alcohol use at age 15. In terms of family functioning, weekly drinking at age 15 is predicted by poor parental monitoring, high levels of parent/child conflict, lack of parenting consistency and an unwillingness amongst children to disclose information to their parents. Nevertheless, weekly drinkers are afforded higher levels of autonomy or decision making by parents and are more likely to engage in positive negotiation with parents. These findings suggest that adolescent drinking may in part by mediated by a greater degree of freedom offered on the basis of parental trust, yet a lack of effort on the part of parents to supervise the child's activities or deal with problems uniformly.

The longitudinal analysis presented in model 4 shows some similar findings to model 3, and yet some important differences. Weekly drinking at age 17 is higher amongst those who are not living with two parents at age 15, albeit the odds ratio is weaker than in model 3. However, at age 17 it is males rather than females who are more likely to be drinking on a weekly basis; and those from more affluent backgrounds are also more frequent drinkers. Importantly, however, excessive drinking by a parent or care-giver at age 15 is predictive of more frequent drinking amongst cohort members at age 17, suggesting that parental drinking has a longer term effect on their children's behaviour. Fewer family functioning variables are predictive of weekly drinking in

model 4 than model 3; however, a broadly similar pattern emerges in that weekly drinkers at age 17 were subject to a high level of trust, but were poorly monitored by their parents, spent little leisure time with them, engaged in frequent arguments with them and were reluctant to disclose information about their activities outwith the home.

Table 5: Binary logistic regression for weekly drinking at ages 15 and 17

Independent variables (age 15)	**Model 3: What predicts weekly drinking at age 15 (sweep 4)?**		**Model 4: What predicts weekly drinking at age 17 (sweep 6)?**	
	Odds ratio	Sig.	Odds ratio	Sig.
Gender: female[1]	1.3	**	0.8	*
Socio-economic status: manual/unemployed[1]	-	-	0.8	**
Family structure: not living with two parents[1]	1.5	***	1.3	**
Experienced parental separation/ divorce: yes[1]	-	-	-	-
Experienced family illness/ bereavement: yes[1]	-	-	-	-
Parent reported excessive alcohol use: yes[1]	-	-	1.6	**
Parent reported illicit drug use: yes[1]	-	-	-	-
Low parental monitoring [2]	1.5	***	1.5	***
High parental trust/autonomy [2]	1.3	***	1.4	***
High parent/child conflict [2]	1.5	***	1.4	***
Little leisure time together [2]	1.1	*	-	-
Low child disclosure [2]	1.5	***	1.2	*
High parental punishment [2]	-	-	-	-
High parent/child negotiation [2]	1.2	*	-	-
Low parental consistency [2]	1.3	***	-	-

Notes: [1]Categorical variable, odds ratio applies to the indicated category.
[2] Continuous variables are standardised scales, the direction of which is indicated.
Significance of result shown as *=p<.05, **=p<.01, ***=p<.001. Sweep 6 odds ratios are weighted.

Drug use in the last year

The logistic regression analyses for the dependent variable 'drug user in the last year or not' are presented in table 6, which indicates some interesting similarities with the models for smoking and drinking and yet some specific differences. Looking first at model 5, by far the strongest categorical predictor of drug use at age 15 is the drug using behaviour of the parents. Individuals with a parent who reported drug use within the previous year were 2.4 times more likely to report contemporaneous drug

use themselves than individuals with non-drug using parents. The influence of parental substance using behaviour extended beyond just their drug use, however, as excessive parental drinking was also predictive of individual drug use. Instability within the family structure also proved to be predictive of drug use, with recent experience of parental separation/divorce and not living with two parents both producing significant odds ratios. The pattern amongst the continuous variables is very similar to the models for smoking and drinking, however. Drug use is predicted by poor parental monitoring, high levels of parent/child conflict, lack of constraint by parents, reluctance amongst children to share information with their parents and little time spent doing activities together with parents. And yet positive negotiation in terms of conflict resolution is reportedly higher amongst the drug users than the non-drug users.

Table 6: Binary logistic regression for drug use in last year at ages 15 and 17

Independent variables (age 15)	**Model 5: What predicts drug use in last year at age 15 (sweep 4)?**		**Model 6: What predicts drug use in last year at age 17 (sweep 6)?**	
	Odds ratio	Sig.	Odds ratio	Sig.
Gender: female[1]	-	-	-	-
Socio-economic status: manual/unemployed[1]	-	-	0.8	*
Family structure: not living with two parents[1]	1.4	**	1.5	***
Experienced parental separation/ divorce: yes[1]	1.6	**	-	-
Experienced family illness/ bereavement: yes[1]	-	-	-	-
Parent reported excessive alcohol use: yes[1]	1.6	**	1.4	*
Parent reported illicit drug use: yes[1]	2.4	***	3.5	***
Low parental monitoring [2]	1.9	***	1.5	***
High parental trust/autonomy [2]	1.4	***	1.2	***
High parent/child conflict [2]	1.5	***	1.2	***
Little leisure time together [2]	1.2	**	1.1	*
Low child disclosure [2]	1.4	***	1.2	*
High parental punishment [2]	-	-	-	-
High parent/child negotiation [2]	1.1	*	-	-
Low parental consistency [2]	-	-	-	-

Notes: [1]Categorical variable, odds ratio applies to the indicated category.
[2] Continuous variables are standardised scales, the direction of which is indicated.
Significance of result shown as *=p<.05, **=p<.01, ***=p<.001. Sweep 6 odds ratios are weighted.

Finally, model 6 presents those factors measured at age 15 which continued to significantly predict drug use at age 17. The most important finding from this model is that the influence of parental drug use, as measured at age 15, on individual drug use was

actually greater two years later, with an odds ratio of 3.5 as opposed to 2.4 in model 5. Parental drinking also proved to be predictive of later drug use, albeit more weakly than in the contemporaneous model. Family structure at age 15 had as strong an effect on drug using behaviour at age 17 as it had at age 15, although the experience of parental separation or divorce at age 14 apparently had no long term effect. In the longitudinal model, unlike the contemporaneous model 5, higher socio-economic status predicted drug use at age 17. The impact of the family functioning variables was weaker at age 17 than at age 15, although they indicated a similar pattern in that drug use was associated with poor supervision, higher levels of conflict, little shared leisure time, inhibited disclosure by the child and yet greater levels of autonomy.

In summary, the analyses presented in this section of the report show quite clearly that certain family characteristics, parental behaviours and parenting styles do have a significant impact on behavioural outcomes such as smoking, drinking and drug use. Of course, the analysis here could be developed further to examine a broader range of independent variables or to explore more deeply the interdependent nature of substance use; however, within the scope of this report several important findings emerge. First, parental drug use has a strong impact on the smoking and, especially, the drug using behaviour of children, both in the short and the longer term. Parental alcohol use is also influential, but less so than drug use. Second, the effect of gender is mixed, but smoking is particularly associated with being female, even when controlling for a range of other factors.

Third, family structure is a significant predictor of all forms of substance use which indicates the potentially detrimental effect of family disruption and break-up, although it is impossible from this analysis to disentangle the effect of break-up from any accompanying parental acrimony. Fourth, the impact of family functioning is complex but particular forms of parenting are identified which, when combined, predict all three forms of substance using behaviour. The least effective form of parenting in terms of preventing substance use appears to involve little parental monitoring or supervision of the child's activities outside the home and little constraint over aspects of the child's decision making. Substance users tend to engage in frequent conflict with their parents, although they also report involvement in positive forms of negotiation to resolve conflict. Less effective parents fail to engage with their child sufficient for them to disclose details of their behaviour and social activities. These forms of poor parental tutelage have a significant impact on young people's behaviour over time, although the effect does diminish to a certain extent.

CONCLUSIONS

This analysis of the data from the Edinburgh Study has shown that substance use is a common form of adolescent behaviour, starting early in the teenage years and increasing steadily up to age 17 amongst this cohort. We have also established that family characteristics, parental behaviour and parenting styles play a significant role in the substance using behaviour of young people. Not only have we shown a contemporaneous link between family factors and adolescent substance use, we have also indicated a causal direction since aspects of characteristics and functioning measured at age 15 continue to predict substance use two years later.

Despite the limited information we had about parental drug and alcohol use, we have shown that there is evidence of both an immediate and a longer term effect of parental substance use on the behaviour of their children. The influence of a parental role model was strongest in relation to drug use, although it appears that parental influence is not entirely substance specific i.e. parental drinking has a greater impact on adolescent smoking than on adolescent drinking. It is possible that wider cultural influence is more important in the case of drinking. The mechanisms by which parental influence works are unclear. Youngsters might simply imitate the behaviour they see around them. Alternatively, parental attitudes and values about substance use may have a more general influence on children's views about smoking, drinking and drug use and, perhaps, more widely about unconventional behaviour. Whatever the explanation, these findings are indicative of a cycle of behaviour that may perpetuate problems of substance misuse from generation to generation. These results demonstrate the importance of designing future research that combines data from both young people and their parents in order to investigate potential causal pathways.

The dimensions of parenting that influence substance using behaviour have proved to be very similar for smoking, drinking and drug use. Family structure and stability are clearly important aspects in preventing problematic behaviours, since not living with two birth parents and/or parental separation or divorce emerged as significant predictors of smoking, drinking and drug use. The stress of experiencing family illness or death did not, however, have any impact on substance use when controlling for other aspects of family life. Of the eight styles of parenting studied, five consistently emerged within the models for smoking, drinking and drug use. These indicated that substance use was predicted by parent/child relationships characterised by high levels of conflict and yet mediated, to an extent, by positive aspects of negotiated conflict resolution. In addition, the parents of substance using youngsters appeared to pay little attention to monitoring the activities of their child, spent little time engaging in leisure activities together and exercised a low level of constraint over their decision making. This lack of interest in the child's activities was compounded by a lack of willingness on the part of the child to disclose information about their actual conduct while outside the home. This form of weakened parental tutelage may just offer young people the degree of freedom they need to engage in problematic behaviours due to a lack of effort on the part of parents to adequately involve or interest themselves in the social activities of their children.

Of course, the influence of family characteristics and parenting methods is complex and it is impossible within the analysis presented here to capture the intricate dynamics of familial relationships or sequences of interaction which determine the behav-

ioural patterns of adolescents. However, these findings are broadly supportive of Smith's (2004) conclusions about the relationship between parenting and delinquency, and further support the general framework of Bandura's (1977) social learning theory. This theory asserts that much learnt behaviour is acquired by observing and modelling the behaviour of others, in this case parents, and that positive reinforcement is achieved by both lack of punishment and receipt of a short term reward. It would appear that the existence of a parental role model who drinks excessively or takes drugs has a huge degree of influence over their child's behaviour. In the case of drug use, this may occur through pure imitation or through communicating ideas about what is acceptable and what is deviant. In the case of drinking alcohol, parental substance use has a weaker effect, perhaps due to the less deviant image of alcohol consumption and the more widespread acceptance of this form of behaviour in Scottish culture. The findings are also consistent with aspects of Patterson *et al*'s (1992) theoretical perspective that ineffective parenting is characterised by aspects of neglect (for example, lack of involvement or interest in the child's activities), excessive authoritativeness (such as that exercised through conflict) and permissiveness (for example, allowing the child too much autonomy).

This report has highlighted some interesting demographic findings that deserve further investigation. For example, where criminological research has consistently shown that delinquency is more prevalent amongst males at all ages (including the Edinburgh Study, see Smith and McAra 2004), the findings presented here show that girls were more likely to smoke than boys from age 14 onwards, while there was little or no gender difference from this age in terms of drinking or drug use. We have also shown that those living with parents who are manually employed or unemployed are more likely to smoke, although again not necessarily more likely to drink or take drugs. The multivariate analysis supports this assertion that smokers have a different demographic profile to drinkers or drug users. Smoking, both in the immediate and the longer term, was predicted by being female and coming from a less affluent family background. Conversely, drinking and drug use (at age 17 only) were predicted by a more affluent family background. The existence of such demographic differences has important policy implications for the targeting and design of prevention strategies.

The findings contained within this report reflect some ambiguity, in that substance users were more likely to engage in conflict with their parents and yet also reported participating in positive forms of conflict resolution. Clearly, there is much more to be learned about the intricacies of family dynamics to understand how these different dimensions fit together and impact on adolescent behaviour. Nevertheless, the overall emphasis of the report is that family functioning is hugely influential in the development of substance using behaviour and this highlights the need for educational initiatives targeted at parents to help them tackle these problems.

The practical and ethical difficulties of implementing parenting programmes are discussed in Smith (2004) and so will not be rehearsed here. There has been no explicit attempt in policy terms to address the issue of parenting in relation to substance use which is overwhelmingly treated as an individual problem. The children's hearing system is one forum in which the involvement of parents is instrumental in helping children to resolve problems such as delinquency and substance use, and yet from other evidence from the Edinburgh Study (McAra 2005) it is clear that very few drug and alcohol users come to the attention of the children's Reporter, therefore this is not

a viable way of dealing with the problem of substance use more generally. In addition, it seems unlikely that initiatives such as parenting orders, which are predominantly used for anti-social behaviour, are likely to have an impact on these problematic behaviours unless those with significant substance use problems can be identified and parents given the tools to help them. At a more general level, there does appear to be a genuine need to provide parents with information or education on appropriate and effective methods of parenting that could have a positive effect on young people's substance use.

APPENDIX 1: VARIABLES USED IN ANALYSIS

Socio-economic group

At sweep one, respondents' descriptions of their parents' occupations were coded using the Registrar General Social Classification Scheme (RGSC). The socio-economic group (SEG) of the parent in the highest class grouping (with full time workers taking precedence over part time workers) was assigned to the child. Unfortunately, SEG could be assigned to only 61.4% of the cohort. At sweep four, a survey of parents' provided more precise and up to date information on SEG for 69.5% of the cohort. Despite the three year gap between the two sources of data, they were strongly correlated (0.637) showing considerable stability over time. Therefore, the sweep four SEG was used and, where this data was missing, sweep one data was substituted. This process produced a socio-economic group code for 88.3% of all cohort members. To make analysis simpler, and to allow reasonable leeway for error, the respondents were divided into two broad social class groupings according to whether their parents' occupation was classed as 'non-manual' (i.e. SEG groupings I, II and IIIa) or 'manual or unemployed' (i.e. SEG groupings IIIb, IV, V and unemployed). Those young people who could not be classified because they were in care were put in the category 'manual or unemployed'.

Parenting Style

The items on each scale were assigned scores (e.g. from 0 to 3) and the scores summed to produce separate values for parents and young people. A composite score was then computed, which equally balanced the scores of parent and young person. Where the parent's responses were not available, the composite measure was based on the young person's responses alone. Although the response rate was high on the survey of parents, there were for example 3,255 valid responses on parental monitoring for parents, compared with 4,098 for young people.

Parental monitoring
When you went out during the last year, how often did your parents know:
- Where you were going
- Who you were going out with
- What you were doing
- What time you would be home

Verbal scale: always, usually, sometimes, never
(Wording adapted for the parents' survey.)

Parental autonomy afforded to the child
How often do your parents:
- Tell you that you shouldn't argue with adults
- Let you make your own decisions about what films and TV programmes to watch
- Trust you to do what you say you will do
- Let you decide what clothes to buy and wear.

Verbal scale: always, usually, sometimes, never
(Wording adapted for the parents' survey.)

Parent/child conflict
How often do you argue with your parents/child about:
- How tidy your room is
- What you do when you go out
- What time you come home
- Who you hang about with
- Your clothes and appearance
- Other things

Verbal scale: always, usually, sometimes, never

Time spent by parents and child doing things together (shared leisure time)
Examples given were talking, playing sports, going out.
A separate question was asked for weekdays and weekends, and the total number of hours computed from the two questions.

Child disclosure
How often do you tell your parents about:
- Things that happen at school
- What you have been doing when you are out

How often do you keep secrets from your parents about
- Who you have been spending time with
- Where you have been when you are out

Verbal scale: often; sometimes; hardly ever or never.
(The same items, with wording adapted, was used in the parents' survey, but with a four-point verbal scale, separating 'hardly ever' and 'never'.)

Parental punishment
How often do your parents punish you in these ways:
- Tell you off or give you a row
- Ground you or stop you going out
- Stop your pocket money
- Stop you from seeing your friends
- Punish you in some other way

Verbal scale: always, usually, sometimes, never.
(The wording was adapted for the parents' survey, and three additional items were included)
- Shout at him/her
- Hit or slap him/her
- Tell him/her to get out or lock him/her out of the house

The 'other' item was, however, omitted.
The verbal scale was extended for parents because they were reluctant to admit to doing most of these things. The five-point scale used was: most days; at least once a week; less than once a week; hardly ever; never.

Negotiation to resolve conflict
When you disagree about things with your parents, how often:
- Do you and your parents discuss it calmly
- Do you listen to your parents' point of view

- Do your parents listen to your point of view
- Do your parents just tell you to accept what they say

Verbal scale: always, usually, sometimes, never.
(The wording was adapted for the parents' survey.)

Consistency of parental control

- How often do your parents let you get away with things you have done wrong?
- How often do your parents give up when they ask you to do something and you don't do it?
- When your parents decide to punish you a certain way, how often do you go on arguing about it?

Verbal scale: always, usually, sometimes, never.
(The wording was adapted for the parents' survey.)

APPENDIX 2: WEIGHTING FOR NON-RESPONSE

Weighting is a commonly used method for dealing with missing survey data (whether due to unequal selection probability or non-response) where such missing data causes systematic bias in the survey estimates of interest. Weighting is a standard quasi-randomization approach which aims to adjust the parameters obtained for the achieved sample to bring them in line with the parameters what would have been expected for the complete population. Since the Edinburgh Study used a City-based population sample design, there was no need to incorporate weighting correcting for bias based on unequal selection probability using random sampling methods. However, due to declining participation rates at consecutive sweeps, weighting was required to address the problem of non-response.

Levels of non-response in the Edinburgh Study were low up to and including sweep four (7% or less) and analysis of the data revealed little if any systematic bias in terms of those who had not responded. Non-response rates increased at sweeps 5 (11%) and 6 (19%) and this time analysis suggested that offending levels amongst these individuals were likely to be systematically different from those of the respondents. Two cross-sectional weights were, therefore, constructed for sweeps 5 and 6 using all respondents eligible to have participated at that sweep as the base sample (n=4328).

The base sample was divided into two groups: responders and non-responders. The two groups were then compared on the basis of as many relevant variables as possible that were known for both groups. There were two main criteria for the selection of these variables: 1) they were associated with the outcome variables of interest (i.e. offending) and 2) they were associated with response rate propensity. The variables that were used for this exercise were:

- Age
- Gender
- Ethnic group (white or non-white).
- School leaver status (whether left school at or before eligible leaving age)
- Deprivation status (composite measure based on parental socio-economic status and neighbour-hood deprivation)
- Offending status (whether offended more than five times in any one year).
- Reporter status (whether known to children's reporter)
- Police status (whether charged with a crime or offence)
- School status (whether recorded as truanting up to age 16)

Logistic regression modelling was used to estimate the probability of response at each sweep, with response as the dependent variable and the various independent variables (listed above) as potential predictors. The predicted values were saved as a new variable within the dataset. The reciprocal of the overall model-predicted probability of responding (1/p) was observed, but it was decided not to use this as the weighting factor since it would have resulted in more variation in weights and produced a small number of larger outliers which would have significantly influenced design effects. Instead, weighting classes were created by clustering together groupings of individuals with a similar response probability in an attempt to produce a smaller number of smoother weights (having less impact on standard errors and confidence intervals).

Four main criteria were adhered to in choosing the weighting classes:

1) Variation in response rates between classes.
2) Heterogeneity in survey outcomes of interest between classes.
2) Homogeneity in survey outcomes of interest within classes.
4) Minimum sample size of 100 in each class.

To select weighting classes, the distribution of the predicted values was observed and individuals were divided into groups with similar values. The number of groups depended on the distribution of the predicted values – which was larger in the higher sweeps since the non-response rates were higher. The maximum number of classes possible was produced, while adhering to criterion 1 (above) about variation between classes and criterion 4 about sample size. Simple analysis was carried out to check whether the classes met criterion 2 (between-class discrimination by survey outcomes) and criterion 3 (within-class correlation with survey outcomes). Various stages of iteration were required before the optimum weighting classes were selected.

Once the weighting classes were finalised, the weighting factor for each class was calculated by dividing the total number of cases in each weighting class by the number of people who responded. This provided a single weight for everyone in the same class. At this point sensitivity analysis was carried out using an excel spreadsheet to determine the impact of the weights on standard errors and the design effect arising from unequal probability of participation (deffp). No capping of large weights was required to balance bias reduction with increased precision (maximum weight was 2.45). Since the response rate was relatively high, even at sweep six, and a good range of weighting variables were used, the weights had little impact on the deffp. [10]

[10] For more information on the weighting strategy and the weights produced, contact the study team at Edinburgh.Study@ed.ac.uk.

APPENDIX 3: ADDITIONAL TABLES

Table A1: Weekly smoking by gender, ages 12 to 17

Weekly Smoking	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Male	3.4	7.6	14.6	17.7	23.3	28.2
Female	2.2	9.5	21.1	26.7	31.9	32.0
Significance	*	*	***	***	***	***

Notes:
1. Significance between boys and girls shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

Table A2: Weekly drinking by gender, ages 12 to 17

Weekly Drinking	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Male	2.4	7.1	17.1	22.7	43.8	55.8
Female	0.9	6.3	18.3	26.7	44.2	52.5
Significance	***	ns	ns	**	ns	*

Notes:
1. Significance between boys and girls shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

Table A3: Drug use in the last year by gender, ages 12 to 17

Any drug use in the last year	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Male	6.5	8.8	19.5	29.7	32.5	40.7
Female	4.5	5.2	18.2	27.9	32.8	38.6
Significance	**	***	ns	ns	ns	ns

Notes:
1. Significance between boys and girls shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

Table A4: Weekly smoking by family structure, ages 12 to 17

Weekly Smoking	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Living with 2 parents	1.9	6.7	13.8	18.2	22.6	23.7
Not living with 2 parents	4.6	12.7	24.9	29.6	35.7	40.1
Significance	***	***	***	***	***	***

Notes:
1. Significance between groups shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

Table A5: Weekly drinking by family structure, ages 12 to 17

Weekly Drinking	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Living with 2 parents	1.4	5.5	14.5	20.9	40.2	52.1
Not living with 2 parents	2.2	9.5	23.4	31.5	50.2	57.5
Significance	ns	***	***	***	***	**

Notes:
1. Significance between groups shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

Table A6: Drug use in the last year by family structure, ages 12 to 17

Any drug use in the last year	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Living with 2 parents	5.0	5.8	15.2	24.1	28.4	34.0
Not living with 2 parents	6.7	9.9	25.5	37.4	39.7	48.9
Significance	*	***	***	***	***	***

Notes:
1. Significance between groups shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

Table A7: Weekly smoking by socio-economic status, ages 12 to 17

Weekly Smoking	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Manual/unemployed	3.3	12.0	22.2	27.6	32.3	25.8
Non-manual	2.1	5.2	12.7	16.6	22.2	24.7
Significance	*	***	***	***	***	***

Notes:
1. Significance between groups shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

Table A8: Weekly drinking by socio-economic status, ages 12 to 17

Weekly Drinking	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Manual/unemployed	1.9	7.5	19.0	26.8	43.0	52.6
Non-manual	1.4	5.9	15.6	22.6	44.5	55.8
Significance	ns	*	**	**	ns	*

Notes:
1. Significance between groups shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

Table A9: Drug use in the last year by socio-economic status, ages 12 to 17

Any drug use in the last year	Sweep 1 (up to age 12)	Sweep 2 (age 13)	Sweep 3 (age 14)	Sweep 4 (age 15)	Sweep 5 (age 16)	Sweep 6 (age 17)
Manual/unemployed	5.9	7.8	19.4	29.0	29.6	39.0
Non-manual	5.0	6.1	16.7	27.7	34.4	39.9
Significance	ns	*	*	ns	**	ns

Notes:
1. Significance between groups shown as ns=non significant, *=p<.05, **=p<.01, ***=p<.001.
2. Analysis at sweeps 5 and 6 based on weighted data.

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