

SUBSTANCE USE AT AGES 12 TO 17

Findings from the Edinburgh Study

David J. Smith

Centre for Law and Society
University of Edinburgh

Prepared for the Advisory Council on the Misuse of Drugs

February 2005

INTRODUCTION

The Edinburgh Study of Youth Transitions and Crime is a programme of studies related to a single cohort of young people who transferred to secondary schools in the City of Edinburgh at around the age of 12 in the autumn of 1998.¹ The target group was young people in the relevant school year across all types of school (including special and independent as well as mainstream local authority schools) and the aim was to include all in the target group—around 4,300—rather than a sample.² For the first six years, most data were collected annually, although now that cohort members have left school, data will be collected in every third year. Information has been collected from a number of sources: these include questionnaires normally completed by cohort members, social work and children’s hearing files, school records, teacher questionnaires (once), a survey of one parent of each cohort member (once when subjects were aged 15), and in future criminal records and prosecution files. There is an associated study of the social geography of Edinburgh and spatial patterns of recorded crime, and the study is explicitly designed to allow multilevel analysis of individual behaviour in the light of the characteristics of the neighbourhoods where people live.

The great majority of Edinburgh schools participated in the project, although a few independent schools declined; 3.2 percent of parents (the same proportion in state and independent schools) withdrew their children as part of the informed consent procedure. Response rates among the target group in participating schools were 95 percent and above for the first four years, but dropped to 90 percent at sweep 5 and to 80 percent at sweep 6 (when half of cohort members had left school). In findings presented in this report, data for sweeps 5 and 6 have been weighted to correct non-response bias in cross-sectional analyses (i.e. analyses drawing on data from either sweep 5 or 6 without reference to other sweeps).³ This weighting makes a small but appreciable difference to estimates of prevalence of substance abuse.

Analyses in this report are entirely based on information from the young person’s questionnaire. This was normally completed by cohort members in a classroom situation at sweeps 1-4, but respondents who had difficulty because of poor reading or writing were given an appropriate level of help, and were interviewed if necessary. Those not present at school after several visits were followed up elsewhere. At sweeps 5 and 6, those who had left school were in most cases initially contacted by post but if they did not return a questionnaire they were interviewed. A small group, considered unlikely to return a questionnaire, was targeted for interview from the outset. Questions on substance use and on delinquency were included at every sweep. These remained essentially the same, but some changes had to be made as noted in the commentary. For the most part these can be accommodated without getting in the way of analysis of changing behaviour over the years from age 12 to 17.

¹ Information about methods used in the Edinburgh Study can be found in D. J. Smith and S. McVie, ‘Theory and method in the Edinburgh Study of Youth Transitions and Crime’, *British Journal of Criminology* 43: 169-195; and on the study website at www.law.ed.ac.uk/cls/esytc.

² Young people who joined the target year group in Edinburgh schools up to the third study year were also included in the cohort.

³ The weighting procedure can accurately compensate for respondents absent at a later sweep because so much information is available about these same individuals at earlier sweeps. It does not attempt to compensate for sample members lost through the parental consent procedure. Different weights would be needed when dealing with longitudinal analyses across two or more sweeps, and these have not been applied in the present analysis. However, accurate estimates for the whole population are not usually the goal of longitudinal analyses.

PREVALENCE

The main measures of prevalence used here are smoking cigarettes once a week or more often, drinking alcohol once a week or more often, and using (illicit) drugs in the past year.⁴ The ‘illicit’ drugs⁵ included are: cannabis, glue or gas, ecstasy, cocaine, speed, heroin, LSD, magic mushrooms, downers, poppers (separately specified from sweep 2 onwards), and ‘something else’. As well as the last-year prevalence measure for drugs, we show the proportion that had used drugs a total of four or more times in the last year.⁶ We also provide some more specific information about use of particular drugs or groupings of drugs. At the first sweep (age 12) the reference period was ‘ever’ in contrast to ‘the past year’ at the following sweeps. This means that the prevalence estimates for sweep 1 are inflated compared with those for succeeding sweeps, although not by much since use of substances before age 11 will have been rare.

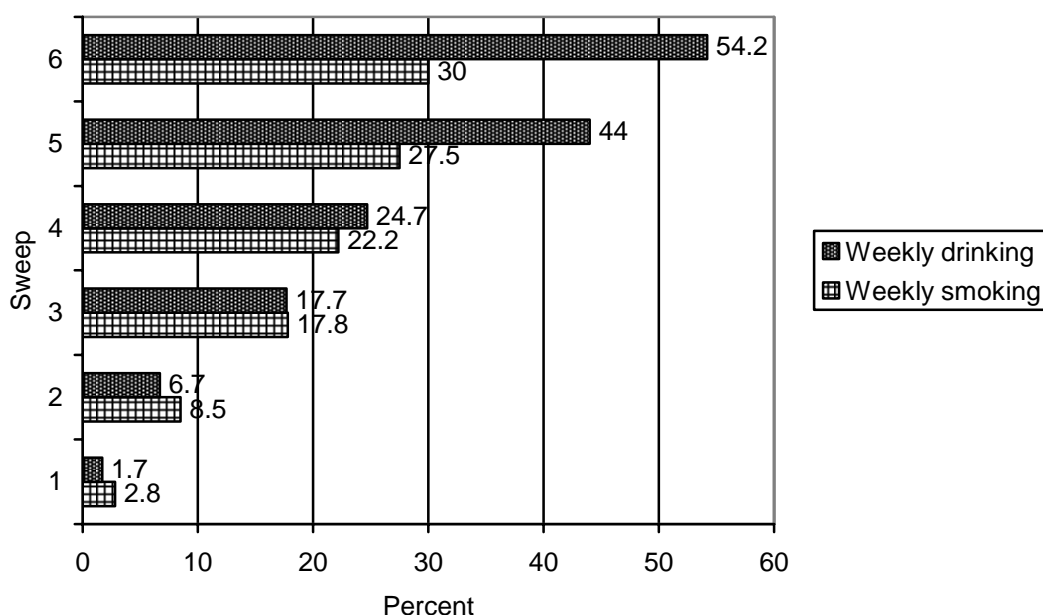


Figure 1: Prevalence of weekly smoking and drinking at sweeps 1-6 (ages 12-17)

As shown by figure 1, prevalence of weekly smoking and drinking rose in step up to sweep 4 (age 15) but thereafter the prevalence of drinking rose much more rapidly than the prevalence of smoking. As shown by figure 2, the prevalence of drug use was low at sweeps 1 and 2, but rose rapidly thereafter. It rose at a similar rate whether the criterion is any use of drugs last year, or use on 4 or more occasions. To give a more detailed account of drug use, we have divided drugs into three categories: cannabis, volatiles (principally glue or gas), and other drugs, including the hard drugs such as cocaine and heroin. Prevalence of use (last year) of drugs in each of these

⁴ The reference period was a 12-month period covering the last school year and the following summer holidays.

⁵ Not all are actually illegal.

⁶ An additional questionnaire category was added at sweep 5 for ‘more than 10 times’. At sweep 6, the answer set was changed to a frequency scale (‘daily’, ‘weekly’ etc.) from which number of times has been computed—but this results in much higher estimates, making it impossible to identify a ‘4+ times’ category, and compromising comparisons with previous sweeps.

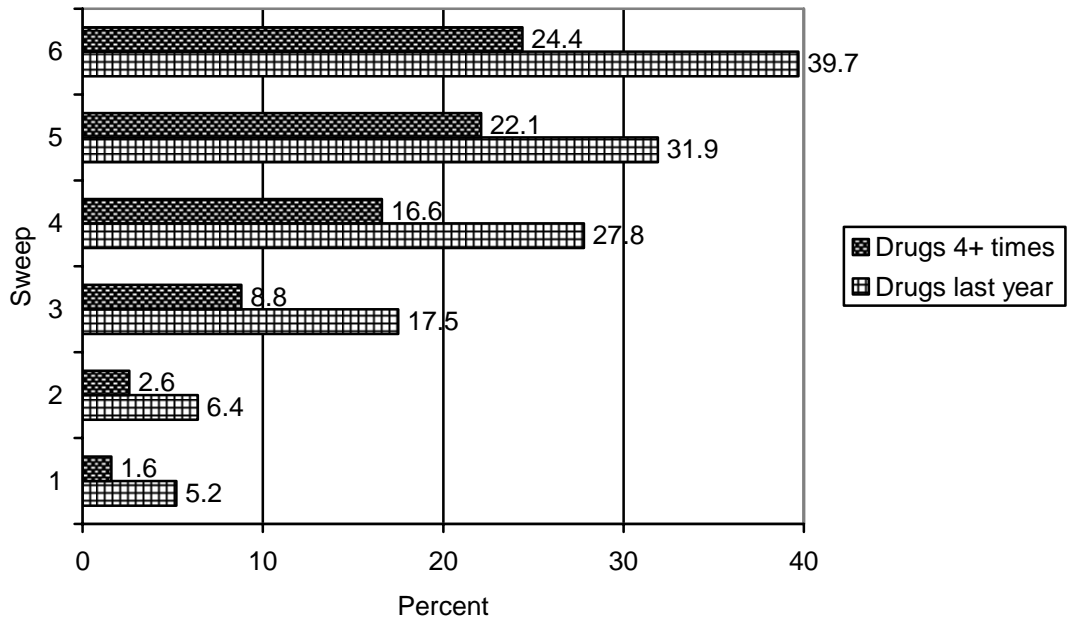


Figure 2: Prevalence of drug use at sweeps 1-6 (ages 12-17)

Note: at sweep 6 the figure shows the percentage who had used drugs 12+ times, calculated from a frequency scale (daily, weekly, etc.).

categories is shown in figure 3. Of course, there are overlaps between the categories: cannabis users may also use volatiles, etc. In general terms, cannabis is the drug that

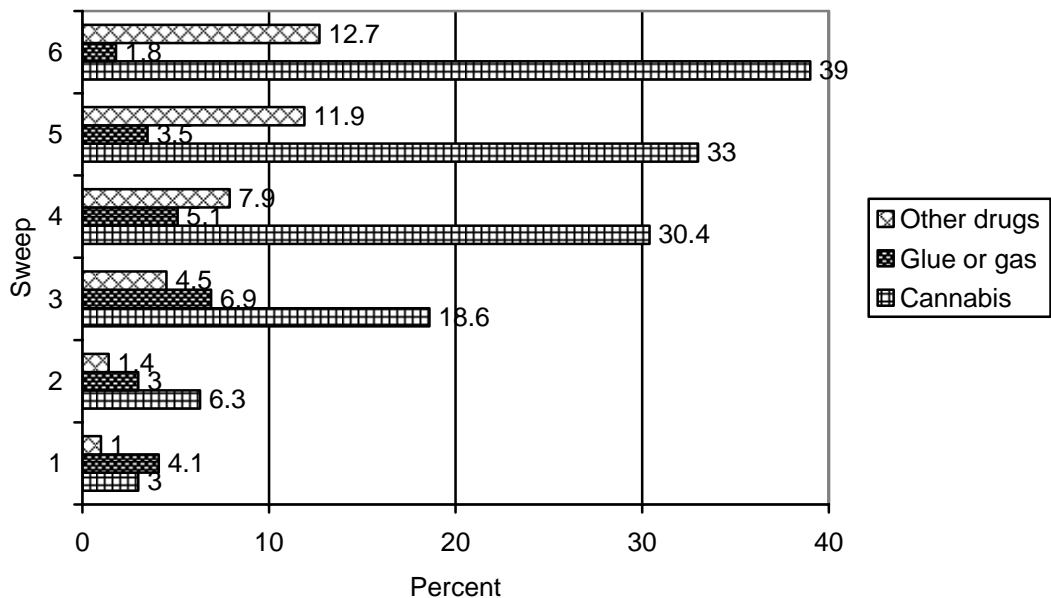


Figure 3: Prevalence of use last year of three categories of drugs at sweeps 1-6 (ages 12-17)

dominates the picture, with 39 percent of cohort members having used the drug within the last year at sweep 6 (age 17). The greatest rise in cannabis use occurred between sweeps 2 and 4 (ages 13 and 15), and the rise moderated thereafter. Prevalence of use of glue or gas peaked at sweep 3 (age 14) at 6.9 percent and fell fairly rapidly

thereafter. Use of other (predominantly hard) drugs grew most strongly between sweeps 3 and 5 (ages 14-16) then increased only slightly at sweep 6, reaching a peak of 12.7 percent.

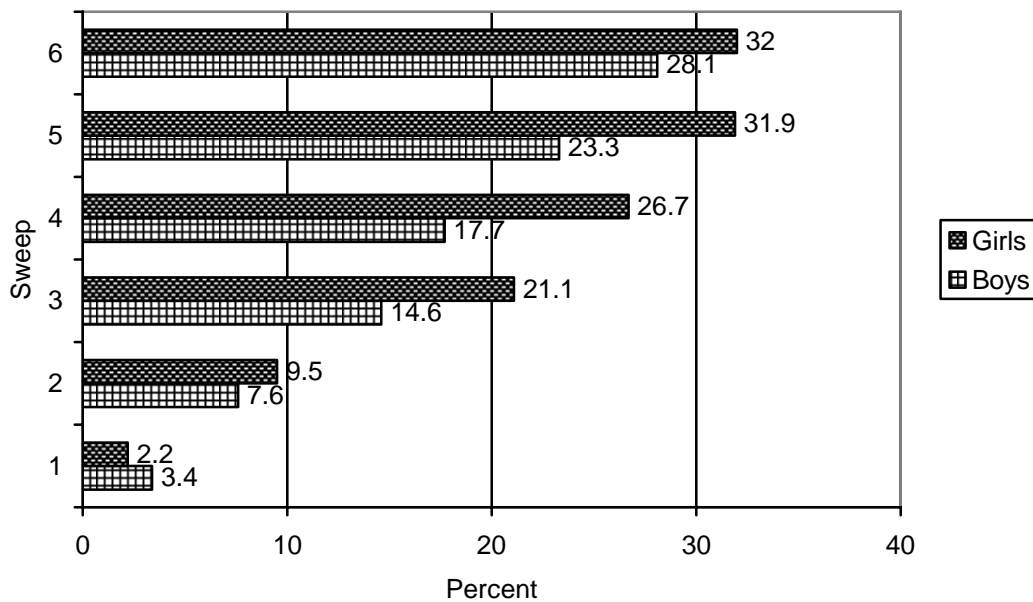


Figure 4: Prevalence of weekly smoking by sex at sweeps 1-6 (ages 12-17)

At the first sweep, prevalence of smoking was rather higher in boys than girls, but already by sweep 2 (age 13) this had reversed, and at ages 14-16, smoking was considerably more prevalent in girls than boys (figure 4). However, the difference had narrowed again at sweep 6 (age 17). Differences between girls and boys in use of alcohol and illicit drugs were much less marked (figures 5 and 6).

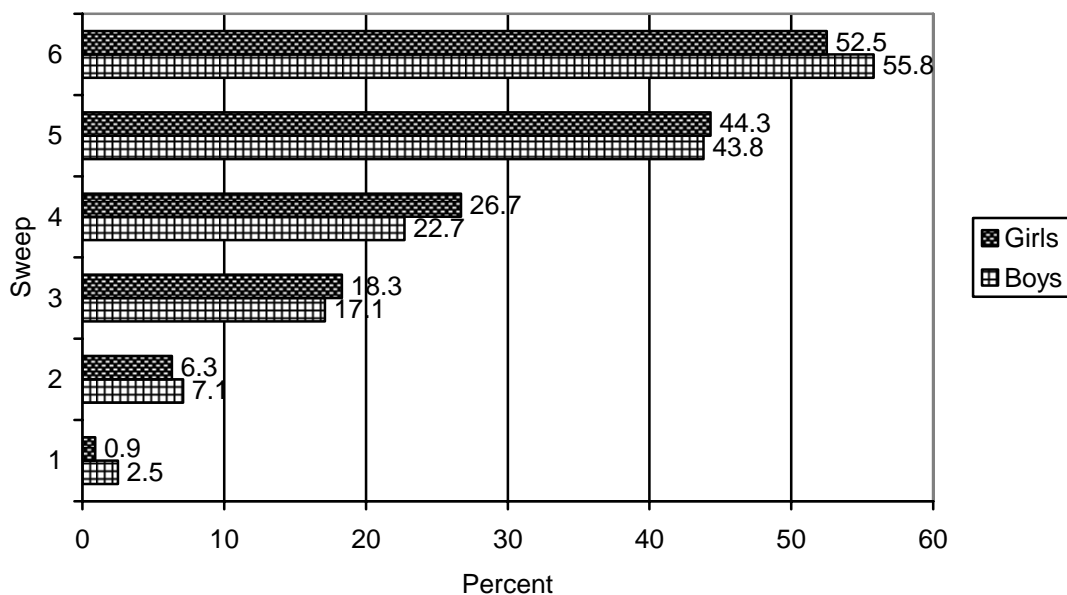


Figure 5: Prevalence of weekly drinking by sex at sweeps 1-6 (ages 12-17)

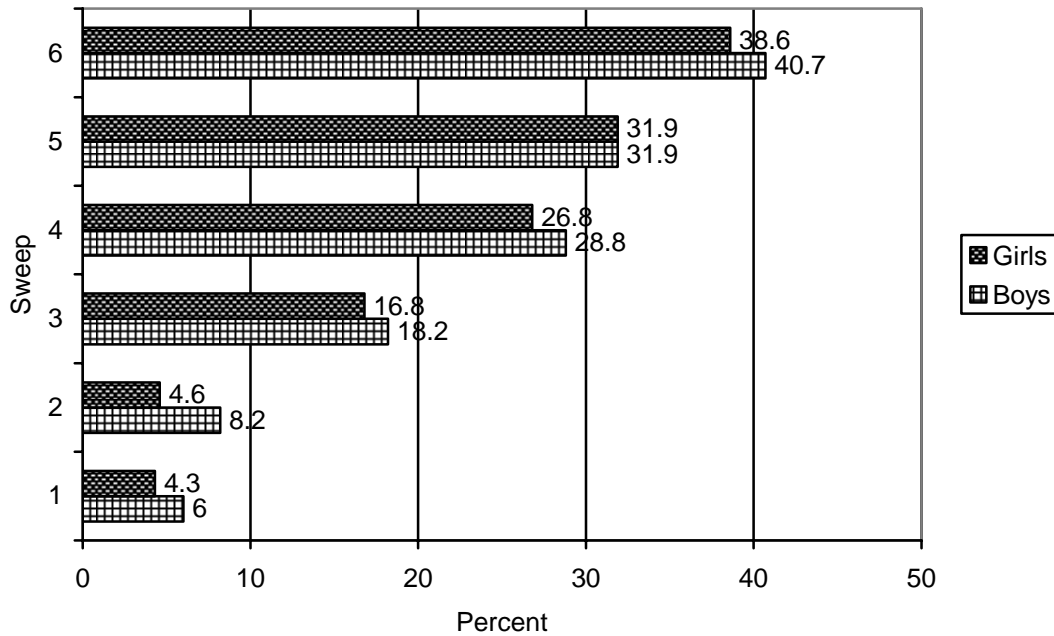


Figure 6: Prevalence of using drugs in last year by sex at sweeps 1-6 (ages 12-17)

FIRST USE

The questioning from the six successive sweeps can be used to establish the age at which each cohort member was first a weekly smoker, a weekly drinker, and a user of drugs over the past year.⁷ Those who smoked, drank alcohol, or used drugs at the first sweep (age 12) were also asked how old they were when they started, so this information can also be used in the analysis.⁸ Figures 7-9 show the findings for boys and girls separately. Note that a category not shown in the histograms is those who were not users up to the age of 17 (sweep 6), but the percentages in this category are noted below each figure. Ages shown are (roughly) those of cohort members during the reference periods covered by the questioning at each sweep.

For both boys and girls, the peak age for first becoming a weekly smoker was 13-14 (i.e. the reference period before completion of the sweep 3 questionnaire) (figure 7). After that age the proportion of new weekly smokers fell off rapidly in girls, but much less rapidly in boys, and between sweeps 5 and 6 the proportion of new smokers among boys remained the same. Very early smoking was much more common in boys than girls. The developmental phase where the girls greatly outstripped the boys in starting smoking was between the ages of 12 and 14.

In the case of drinking, the pattern was fairly similar for boys and girls (figure 8). The peak age for starting to drink weekly was 15-16, but there were substantial numbers of new drinkers every year from the age of 12-13 onwards.

⁷ This analysis has not been confined to cohort members for whom information is available at every sweep. Instead it shows the first sweep at which a cohort member is known to have been a weekly smoker, etc.

⁸ Respondents were not asked how frequently they used substances before the first sweep, so we only know when these early starters first began, not when they became frequent or regular users.

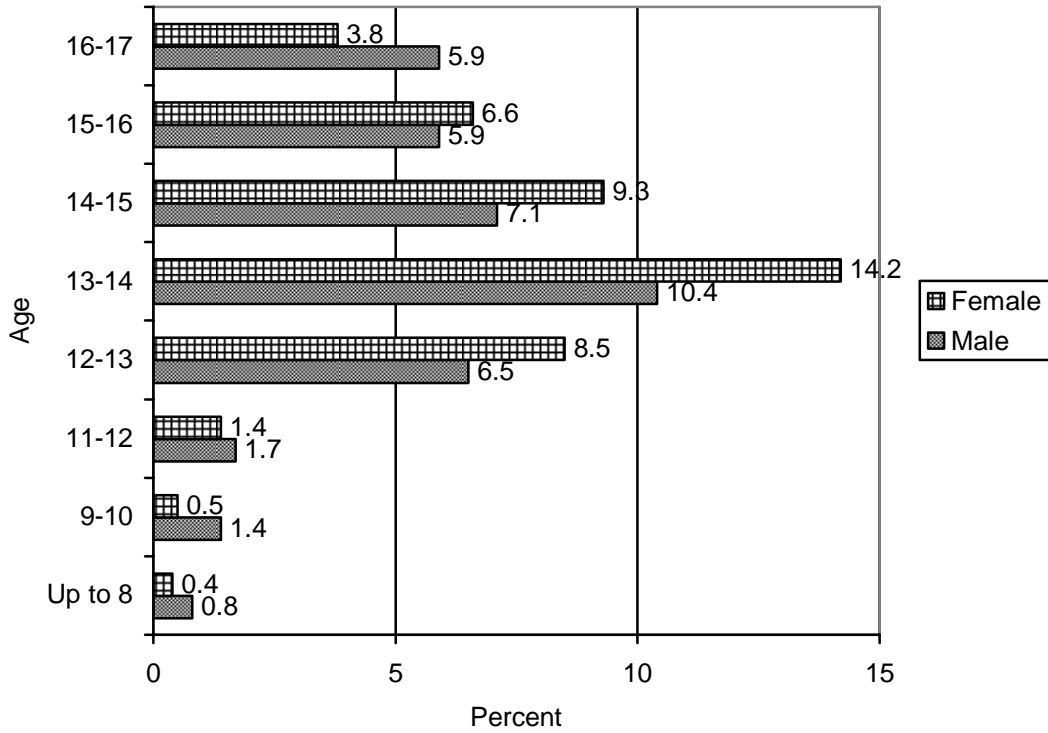


Figure 7: Age on first becoming a weekly smoker

N=3,934 First three categories were weekly smokers at age 12. 60.3% of boys and 55.3% of girls had not been weekly smokers up to age 17.

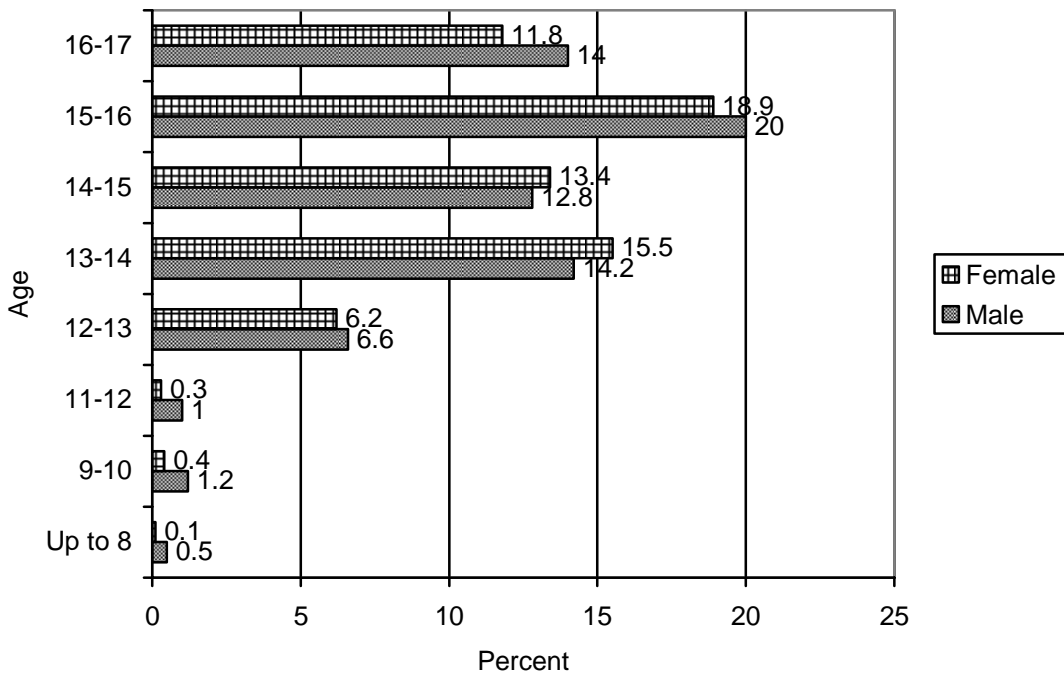


Figure 8: Age on first becoming a weekly drinker

N=3,979 First three categories were weekly smokers at age 12. 29.7% of boys and 33.2% of girls had not been weekly drinkers up to the age of 17.

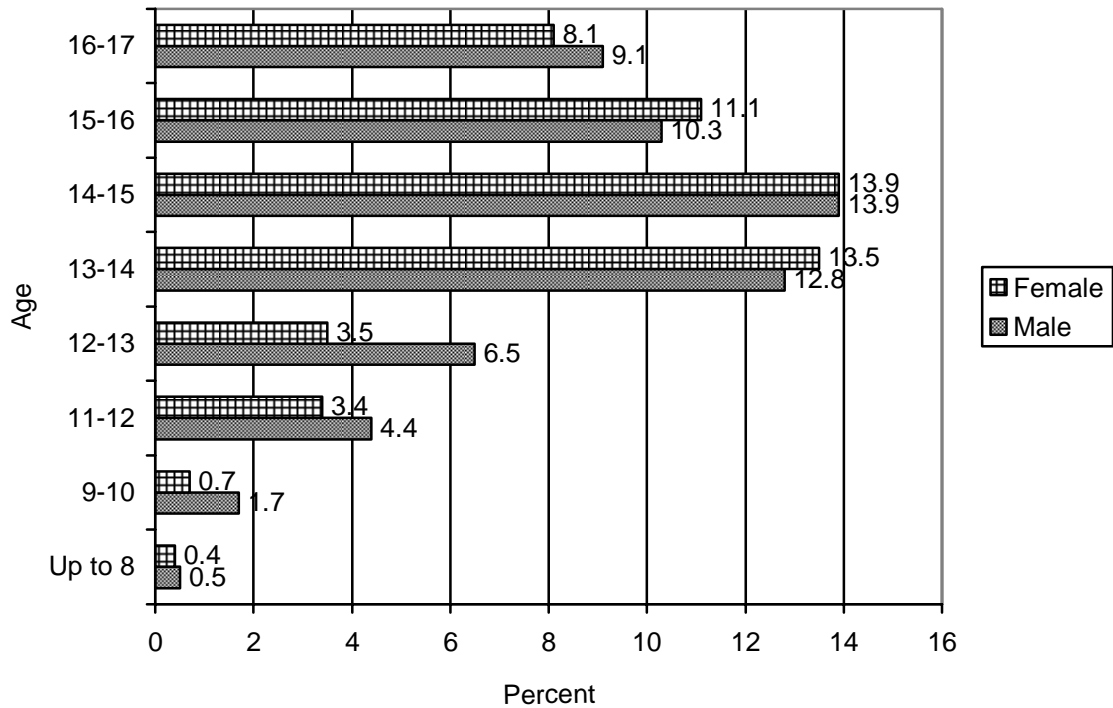


Figure 9: Age on first becoming a drug user (last year)

N=3,983 First three categories were drug users at age 12. 40.8% of boys and 45.5% of girls had not been drug users up to the age of 17.

A considerably higher proportion of boys than girls started to use drugs very young, but from ages 13-14 the proportion of boys and girls using drugs for the first time was about the same each year (figure 9). The peak ages for starting to use drugs were 13-14 and 14-15, with a fairly sharp fall in the proportion of new entrants in the two succeeding years.

Table 1: Relative timing of first use of cigarettes, alcohol, and drugs
[weekly for cigarettes and alcohol, last year for drugs]

Years	Column percentages		
	Smoking (A) and drinking (B)	Smoking (A) and drugs (B)	Drinking (A) and drugs (B)
-3 to -5 B before A	2.3	1.7	2.1
-2	4.2	3.0	3.1
-1	7.9	6.8	8.5
0 A and B together	13.8	14.3	16.3
1	4.9	5.6	8.9
2	2.2	2.7	5.0
3 to 5 A before B	1.2	1.7	3.8
Neither A nor B up to sweep 6	29.0	39.9	24.7
Not A up to sweep 6, but B at some point	30.6	19.4	7.9
Not B up to sweep 6, but A at some point	3.8	4.9	19.9
N	3,791	3,812	3,833

Table 1 shows the relationships between the timing of the first use of each of the three substances. Definitions are as before (weekly smoking, weekly drinking, using drugs in the last year). The substances are taken in pairs (smoking and drinking, smoking and drugs, drinking and drugs). For each pair of substances, the table shows the proportion of cohort members who started using both in the same year, and the proportion that first used one substance one, two, and three or more years before and after the other. Looking at the first column, the striking point is that nearly all smokers were drinkers, whereas many drinkers were not smokers. Thus, a substantial proportion of cohort members (30.6 percent) had not started smoking but had started drinking by the age of 17; whereas very few (3.8 percent) had started smoking but not drinking by the same age. Cohort members did tend to start smoking and drinking in the same year (13.8 per cent). Among those who had started both smoking and drinking, it was slightly more common for drinking to come first, but the difference was not striking.

Looking at the second and third columns, it must be remembered that the measure used for smoking and drinking is weekly use, as distinct from usage last year in the case of drugs. This helps to explain why the proportion that had used drugs but were not smokers was higher than the proportion that were smokers but had not used drugs (19.4 compared with 4.9 percent). As for all three combinations, smoking and using drugs tended to start at the same time. Roughly equal proportions had started smoking and using drugs first. Looking at the last column, the proportion that had started drinking but had not used drugs was considerably higher than the proportion that had used drugs but were not weekly drinkers (19.9 percent compared with 7.9 percent). Also, it was rather more common for drinking to start before drug taking than the other way round. There was a fairly strong tendency for drinking and drug taking to start in the same year.

CONTEMPORANEOUS LINKAGE BETWEEN USE OF DIFFERENT SUBSTANCES

We have also examined links between use of the three substances in the same year. The definitions of users were the same as before (weekly for smoking and drinking, last year for drugs). The substances were again considered in pairs (smoking and drinking, smoking and drugs, drinking and drugs), generating three two by two tables at each sweep (e.g. whether or not a weekly smoker at sweep 1 by whether or not a weekly drinker at the same sweep). Each of these tables was used to generate an odds ratio which expresses the strength of the relationship between use of the two substances (e.g. the number of times the odds that someone is a weekly drinker are increased if that person is a weekly smoker). Results for sweeps 5 and 6 are based on the weighted data.

The resulting odds ratios are illustrated in figure 10. These show that in general links between use of different substances at the same time were very strong. These links were strongest at sweep 1 when cohort members were aged 12, and decreased as they grew older. A likely interpretation is that when cohort members were young, use of all three substances was rare and a sign of serious deviance. At the youngest age covered, therefore, use of any of the substances was an indicator that a young person belonged to a highly deviant group, and members of this group were likely to use all substances (and to be delinquent also, see below). As cohort members grew older, use of all three substances became more common, and therefore more normal. Because

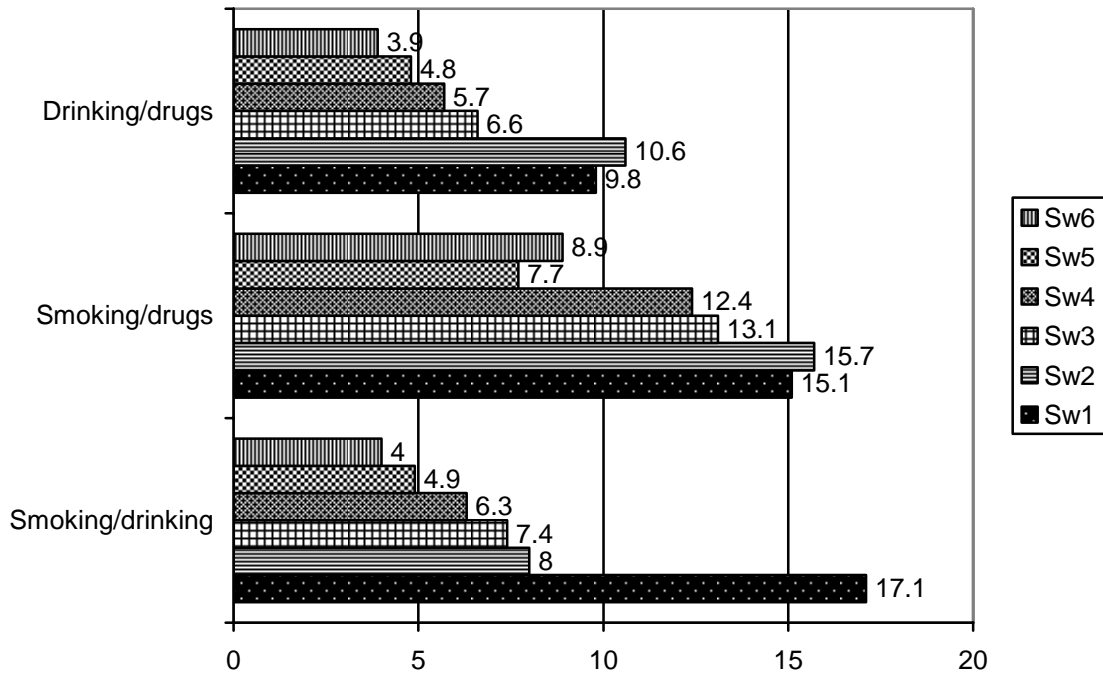


Figure 10: Odds ratios linking use of pairs of substances at the same sweep (weekly smoking and drinking, use of drugs last year)

use of a substance had become a less clear indicator of deviance, it was more likely to indicate a taste for that particular substance and an associated way of life, and less likely to be linked with use of other substances.

The link between smoking and drinking was particularly strong at sweep 1, but halved at sweep 2. Setting that sweep 1 result on one side, the strongest links were those between smoking and use of drugs. The probable explanation is that the most commonly used drug was cannabis, which is smoked. By sweep 6, the linkage between smoking and drugs was more than twice as strong as the links between the other two pairs of substances.

CONTINUITY OVER TIME IN SUBSTANCE USE

Here we consider the likelihood that someone who uses a substance at one sweep will continue to use the same substance at subsequent sweeps. For example, we consider the proportion of weekly smokers at sweep 1 (age 12) who were again weekly smokers at sweep 2, at sweep 3, etc. Similarly, we consider the proportion of weekly smokers at sweep 2 who were again weekly smokers at sweep 3, at sweep 4, etc. The findings are set out in that form in table 2 overleaf. The diagonals, highlighted by the shading, show that continuity in substance use from one sweep to the next tends to increase as cohort members grow older: for example, 48.4 percent of weekly drinkers at sweep 1 were still weekly drinkers a year later, whereas 82.3 percent of weekly drinkers at sweep 5 were still weekly drinkers a year later. This reflects the general increase in the prevalence of substance use with age. A weekly drinker at age 16 is more likely to continue than one at age 12 because at age 16 drinking is becoming a normal behaviour for the age group.

Looking down the columns of table 2 illustrates the substantial degree of continuity that exists over longer periods in people’s lives. For example, 68.9 percent

Table 2: Continuity of substance use over the six sweeps

Weekly smokers at sweep	% of weekly smokers at sweep				
	1	2	3	4	5
2	63.8				
3	71.7	76.9			
4	68.1	77.0	80.8		
5	74.0	76.7	78.8	82.9	
6	68.9	77.0	77.7	81.2	85.1
Weekly drinkers at sweep	% of weekly drinkers at sweep				
	1	2	3	4	5
2	48.4				
3	56.5	56.8			
4	50.9	55.8	61.3		
5	68.1	69.7	71.2	78.7	
6	76.6	76.6	76.9	83.0	82.3
Used drugs in last year at sweep	% of those using drugs last year at sweep				
	1	2	3	4	5
2	40.2				
3	56.9	67.8			
4	60.1	76.9	80.2		
5	61.6	63.5	66.1	69.7	
6	62.6	70.6	70.6	62.1	80.3

of weekly smokers at sweep 1 (age 12) were still weekly smokers at sweep 6 (age 17). Similarly, a high proportion (62.6 percent) of the small number of drug users at sweep 1 was still using drugs at sweep 6. At the same time, these findings do illustrate that there is a considerable degree of discontinuity, and that young people who start using substances early may often desist: in fact, well over half of those who had started using drugs by age 12 desisted a year later, although some then started using again two or three years later (see the first column of table 2).

On the other hand, if the focus is on the underlying tendency towards continuity in behaviour over several years of the individual's life, table 2 is not very helpful, because as already mentioned the percentages are strongly influenced by changes in overall prevalence of substance use at different ages. It is the increase in prevalence with age that explains the general increase in the percentages along the diagonals and down the columns. For example, column 1 shows that of drug users at sweep 1 the percentage still using was considerably higher at sweep 6 than at sweep 2, but contrary to a first impression, this does not imply that usage at sweep 1 had a stronger influence on use five years later than on use the following year. Instead this pattern indicates that early users, like everyone else, are more likely to use drugs at later than at earlier ages.

A better indication of the underlying level of continuity in behaviour from one year to the next is given by the odds ratios, which express the odds that someone will use a substance at a later sweep, given that they used it at a previous sweep. These provide a measure that is independent of changes in prevalence of use of the substances from one sweep to another. The findings shown in table 2 have been used to compute the odds ratios presented in table 3 overleaf.

Table 3: Odds ratios linking use of the same substances at different sweeps

Weekly smokers at sweep	Weekly smokers at sweep				
	1	2	3	4	5
2	23.2				
3	13.1	23.6			
4	8.1	16.1	37.7		
5	8.9	12.4	20.9	45.2	
6	6.2	10.9	15.4	26.2	60.9
Weekly drinkers at sweep	Weekly drinkers at sweep				
	1	2	3	4	5
2	14.9				
3	6.4	7.4			
4	3.2	4.4	7.8		
5	2.8	3.3	4.1	7.8	
6	2.9	3.0	3.5	6.0	9.7
Used drugs in last year at sweep	Using drugs last year at sweep				
	1	2	3	4	5
2	14.2				
3	7.6	13.4			
4	4.3	10.4	21.2		
5	3.8	4.3	6.4	12.6	
6	2.9	4.2	5.3	7.8	17.5

In general, these odds ratios are extremely high for smoking, very high for drugs, and lower (but still substantial) for drinking. These findings mean that there was an extremely strong tendency for young people who started smoking (weekly) to continue; that this tendency although very strong in the case of drugs was considerably less strong than for smoking; and that it was less strong again in the case of drinking alcohol. These findings fit with the theory that smoking cigarettes (for whatever reason) is the most addictive form of substance use.

In the case of smoking, the degree of continuity increased very markedly with age, as can be seen from examining the diagonals in the table. The effect was strongest for one-year continuity between smoking at one sweep and the next. The odds ratio for smoking between sweeps 1 and 2 was 23.2, rising to 60.9 between sweeps 5 and 6. This suggests that prevention programmes should *not* focus primarily on young people who start smoking very early, since those who start at ages 15-16 are particularly likely to continue.

Looking down the columns of table 3, it is clear that the influence of early substance use on later behaviour diminishes very markedly over time. As mentioned earlier, these odds ratios are independent of the general rise in prevalence of substance use that occurs over the teenage years. They show that early use increases the risk of later use, but that this effect fades: in other words, early use does not set a course from which escape is impossible.

LINKS BETWEEN SUBSTANCE USE AND DELINQUENCY

Use of most of the drugs considered in this report is actually illegal, and buying cigarettes and alcohol is illegal for children under the age of 18. Some drinking and

smoking is sanctioned by adults, and some takes place in a mixed age setting with adult supervision. Still, most smoking, drinking, and use of drugs by young people is clearly deviant and involves illegal acts. Hence it is effectively a form of delinquency, and we should expect it to be closely associated with other forms such as stealing, vandalism, and assault. Partly for different reasons, we should expect teenage drinking to be associated with rowdy behaviour in public, which is one of the forms of delinquency covered by the Edinburgh Study. As expected, these links are fairly strong. Table 4 shows mean delinquency scores based on 15 questionnaire items at sweeps 1 to 4, but on a partly different set of 14 items at sweeps 5 and 6.⁹ These scores reflect the total number of times that the respondent had engaged in any of the delinquent acts. The table compares these delinquency scores between users and non-users of the substances, defined as elsewhere in this report.

Table 4: Self-reported delinquency by substance use at the same sweep

<i>Smoking</i>	Mean self-reported delinquency (volume) at sweep					
	1	2	3	4	5	6
Weekly	35.28	28.65	32.24	26.08	10.36	7.57
Not weekly	7.59	7.67	9.78	8.47	3.21	1.92
<i>Drinking</i>						
Weekly	33.46	28.51	32.16	25.39	8.51	5.14
Not weekly	7.97	8.13	9.78	8.23	2.66	1.91
<i>Drugs</i>						
Used last year	27.05	34.09	30.39	23.44	9.79	6.51
Not used last year	7.22	7.42	8.72	6.80	2.57	1.31
<i>Drugs</i>						
4+ times last year	36.88	44.54	37.77	29.33	12.32	8.02
Not 4+ times last year	7.78	8.20	10.10	7.88	3.15	1.89

Note: Delinquency items for sweeps 5 and 6 are different, see footnote 9. Data for sweeps 5 and 6 are weighted. At sweep 6, '4+ times last year' became '12+ times' and was computed from answers to a different (frequency) scale, see earlier in this report.

Use of all three substances was strongly associated with delinquency over the same time period. At the early sweeps, the strength of this association was similar for the three substances, especially if the criterion chosen for drug use is four or more times. At the later sweeps, the association with delinquency became definitely weaker for drinking alcohol than for smoking or using drugs.

There are a number of possible explanations for the close association between delinquency and substance use, for example:

1. The meaning of the two types of behaviour may be closely similar, both for the actors and for the audience.

⁹ Items included at sweeps 1-4 were: fare-dodging, shoplifting, rowdy in public, joyriding, stealing from school, carrying a weapon, vandalism, housebreaking, graffiti, robbery, stealing from home, fire-setting, assault, car-breaking, and truancy. Items included at sweeps 5 and 6 were: shoplifting, vandalism, racial abuse, car-breaking, joyriding, selling drugs, housebreaking, assault, selling stolen goods, robbery, harming animals, fire-setting, carrying a weapon, and rowdy in public.

2. The behaviours may spring from common causes.
3. They may arise in the same social contexts (e.g. late night, clubs, amusement arcades).
4. Substance use may lead to delinquency and vice versa (for example, people steal or sell drugs to finance their habit, stigmatization of drug users draws them into crime).

Regression analyses with delinquency as the outcome

We have tried to cast light on alternative explanations by conducting regression analyses of results from sweep 4, when cohort members were aged 15, and when substance use had become fairly common. In the first set of these analyses, self-reported delinquency was the dependent variable, and explanatory variables were added in four steps.

1. Basic model

Gender

Frequency of smoking (4-point scale)

Frequency of drinking alcohol (4-point scale)

Number of times drugs taken last year

2. Add structural factors

Social class (manual (including parents unemployed, not with parents), non-manual

Family type (two-parent, other)

3. Add personality and relations with parents [measures balance the assessments of parent and child]

Risk-taking

Impulsivity

Parental supervision/knowledge

Level of parental punishment

Conflict with parents

Disclosure to parents

4. Add moral values and spare time activities

Moral values/moral disengagement

Number of evenings out with friends

Hanging about

Risky spare-time activities (cinemas, arcades, discos)

Because the delinquency variable is highly skewed (with a substantial proportion of zeros, and a small number of very high values), ordinal regression was used. The delinquency variable is a measure of the number of times during the 12-month reference period that cohort members engaged in any of 18 types of delinquent act.¹⁰ It was used to divide respondents into five ordered categories from high to low delinquency.

¹⁰ Three additional items were used here, compared with the measure used for the sweep 4 analyses shown in table 4: selling drugs, racial abuse, harming animals.

Table 5: Ordinal regression model: outcome, self-reported delinquency (volume) at sweep 4

	Standardized estimates			Step 4 model	
	Step 1	Step 2	Step 3	Estimates	Sig.
Male	0.667	0.671	0.463	0.250	0.000
Smoking	0.420	0.361	0.235	0.215	0.000
Drinking	0.718	0.744	0.526	0.393	0.000
Taking drugs	0.739	0.753	0.635	0.594	0.000
Manual social class		0.499	0.427	0.361	0.000
Lives with both parents		-0.347	-0.296	-0.295	0.000
Parental supervision			-0.461	-0.378	0.000
Conflict with parents			0.125	0.114	0.000
Disclosure to parents			0.165	*-0.057	0.235
Parental punishment			0.144	0.112	0.011
Risk taking			0.443	0.341	0.000
Impulsivity			0.270	0.219	0.000
Moral beliefs				0.732	0.000
Evenings out				*0.071	0.069
Hanging about				0.119	0.003
Risky spare-time activities				0.151	0.000

*Non-significant at 95% level of confidence.

The four regression models are summarized in Table 5 above. The basic model (step 1) confirms that smoking, drinking and taking drugs each had a large effect on delinquency after taking account of the effect of the others. However, the effects of drinking and taking drugs on delinquency were greater than that of smoking. The step two model shows that these effects of substance use on delinquency remained almost unchanged when social class and family structure were added to the model. At the third step, two personality variables were added (risk taking and impulsivity) together with a range of four variables describing relationships with parents. All of these variables were significantly related to delinquency, and for some (parental supervision and risk taking) this relationship was strong. In this context, the effects of substance use on delinquency were reduced somewhat, but they remained strong: in fact, drinking and taking drugs had a stronger effect on delinquency than any of the other variables included at step 3. At step 4 the added variables described the strength of cohort members' moral beliefs and their spare-time activities, especially risky activities that are often connected with offending. In this larger model, just two variables were non-significant (disclosure of information to parents, and number of evenings spent out with friends). As shown in the last column of the table, most of the variables were significant at better than the 99.9 percent level of confidence. The effects of substance use on delinquency

remained highly significant in this context. Of the three substances, using drugs had the strongest effect, followed by drinking then smoking. The effect of using drugs on delinquency was the second highest of all of the variables, after the strength of moral beliefs.

These findings confirm that substance use is closely related to delinquency independently of a range of other factors covered by the Edinburgh Study. They do not immediately cast light on the mechanisms connecting substance use with delinquency, but they do show that the association cannot easily be 'explained away'. They suggest that although there is a strong association between use of all three substances and delinquency, it is use of drugs that has the most direct effect on delinquency after allowing for a range of other factors.

Regression analyses with substance use as the outcome

A further set of regression analyses used an alternative approach. This time the outcome (dependent) variable in each model was substance use at sweep 4 (age 15). There were four models, with the following outcome variables: weekly smoking, weekly drinking, use of any illicit drug last year, use of any drug other than cannabis or glue last year. In each case, the dependent variable was binary (either a weekly drinker or not, etc.). Accordingly, binary logistic regression models were specified. The focus was not on the inter-relationships between use of different substances, but rather on how far delinquency helps to explain use of each substance individually, after taking account of a wide range of other factors. Hence, explanatory (independent) variables did not include use of the other substances: for example, the model with smoking as the outcome did not include drinking and use of drugs as explanatory variables. The explanatory variables were entered one by one, starting with the one that was most strongly associated with the outcome variable (a forward stepwise procedure). Tables 6 and 7 below show the final model in each case. All of the variables included in the original specification of the model are listed, although some were not included in the final model because they did not significantly add to its predictive power. Estimates of the effect of each variable are shown as odds ratios. Most of the variables are continuous (in this case, scale scores) so the odds ratios refer to the change in the odds associated with a change of one standard deviation on the score for the explanatory variable.

The four models show that the level of self-reported delinquency at sweep 4 was a fairly strong predictor of substance use, after taking account of a wide range of other variables. The odds ratios for the effect of self-reported delinquency ranged from 1.708 in the case of alcohol to 2.336 in the case of drugs other than cannabis or glue. The effect of delinquency on substance use was considerably stronger than that of any other variable, except that female gender had a stronger effect on smoking (odds ratio 3.087). Without controlling for the other explanatory variables, the effect of delinquency on substance use was greater, but inclusion of the other variables did not reduce the effect of delinquency by much. For example, the simple odds ratio for the effect of delinquency on use of any drug, without taking account of any other variable, was 2.401. This was reduced to 1.914 in the final model, which included 10 other explanatory variables. These findings mean that there is a direct and close relationship between delinquency and substance use, and that substance use is more closely and directly related to delinquency than to any other factor that has been identified in this study.

Table 6: Binary logistic regression models: outcome, weekly smoking and weekly drinking at sweep 4

	Outcome: weekly smoking		Outcome: weekly drinking	
	Odds ratio	Significance	Odds ratio	Significance
Volume of delinquency (SRD) at sweep 4	1.944	.000	1.708	.000
Female (C)	3.087	.000	1.659	.000
Manual/other social class (C)	1.324	.005	§	§
Not living with both parents (C)	§	§	1.237	.029
Conflict with parents	1.026	.006	§	§
Parental punishment	1.021	.013	§	§
Low parental supervision	1.025	.044	§	§
Low trust/autonomy	1.038	.019	§	§
High trust/autonomy	§	§	1.042	.002
Little parental time with teenager	§	§	§	§
Little disclosure to parents	1.040	.004	1.038	.001
Parent/child negotiation to solve conflicts	1.080	.000	§	§
Low parental consistency	§	§	1.067	.000
Risk taking	§	§	1.036	.003
Impulsivity	1.033	.004	§	§
Permissive moral beliefs	§	§	§	§
Evenings out with friends	1.330	.000	1.176	.000
High hanging about score	§	§	1.049	.043
Low hanging about score	1.052	.047	§	§
Risky spare-time activities	1.240	.000	1.417	.000

§Non-significant and therefore not included in the model

(C) Categorical variable

As already mentioned, being female was strongly related to smoking in the context of the model. It is interesting that female gender was also related (although less strongly) to drinking alcohol in the context of the model at age 15 (odds ratio 1.659). However, gender was not significantly related to use of any drug, or to use of harder drugs other than cannabis or glue.

Teenagers from the manual social classes were more likely to smoke and to use any drug than those from the non-manual classes, whereas there was no significant relationship between class and drinking alcohol or using harder drugs. Smoking and drinking were more strongly related to spare-time activities than to other factors, such as relationships with parents, personality (risk-taking and impulsivity) or moral

Table 7: Binary logistic regression models: outcome (a) used any drug last year, (b) used drug other than cannabis or glue last year

	Outcome: any drug		Outcome: other drug	
	Odds ratio	Significance	Odds ratio	Significance
Volume of delinquency (SRD) at sweep 4	1.914	.000	2.336	.000
Female (C)	§	§	§	§
Manual/other social class (C)	1.343	.002	§	§
Not living with both parents (C)	1.294	.007	§	§
Conflict with parents	§	§	§	§
Parental punishment	1.020	.010	§	§
Low parental supervision	1.053	.000	1.041	.021
High trust/autonomy	1.091	.000	§	§
Little parental time with teenager	§	§	§	§
Little disclosure to parents	1.038	.003	1.048	.015
Parent/child negotiation to solve conflicts	1.027	.042	1.052	.011
Low parental consistency	§	§	1.087	.001
Risk taking	1.051	.000	§	§
Impulsivity	§	§	§	§
Permissive moral beliefs	§	§	§	§
Evenings out with friends	1.135	.001	1.149	.051
High hanging about score	§	§	§	§
Risky spare-time activities	1.133	.000	1.219	.000

§Non-significant and therefore not included in the model

(C) Categorical variable

beliefs.

Both smoking and use of any drug were associated (although not strongly) with many different aspects of relationships between parents and teenagers. Drinking alcohol and, especially, using harder drugs were associated with fewer aspects of the parent/child relationship. Nevertheless, the teenager holding back information from parents about what they were doing and who they were with was associated with use of all of the substances. Negotiation as a means of resolving conflicts between parents and children is advocated by many experts on parenting, especially those who base their advice on learning theory, yet these models show that negotiation was associated with an increase in the likelihood that the teenager would smoke, use any illicit drug, and use one of the harder drugs. Perhaps closely related to negotiation is the concept of trust or autonomy—whether or not the teenager is allowed the space to

take decisions about some things. This was inconsistently related to substance use. Low autonomy was related to smoking, whereas high autonomy was related to drinking and to using any drug. However, other aspects of the findings are broadly in line with social learning theory as a framework for understanding parenting. For example, low parental supervision was associated with smoking, with using any drug, and with using harder drugs, an low parental consistency was associated with drinking and with using harder drugs.

Risk-taking and impulsivity are closely related personality constructs, and one or other of them was mildly related to each type of substance use. Other analyses have shown that these personality characteristics are more closely related to delinquency than to substance use.

The findings of these models with substance use as the dependent variable are broadly consistent with those of the earlier models with delinquency as the dependent variable, in that both sets of models show that substance use is more strongly linked to delinquency than to other variables covered by the study. Also, both models show that the strongest link of all is between delinquency and use of illicit drugs—not a surprising finding, given that use of illicit drugs, especially harder ones, is a more serious crime than underage smoking or drinking. A difference between the findings from the two sets of models is that where delinquency is the outcome, and where smoking, drinking, and using illicit drugs are included together among the explanatory variables, taking drugs is most strongly related to delinquency, followed by drinking, then smoking; but where substance use is the outcome, with use of each substance modelled separately, delinquency is most closely related to using harder drugs, followed by smoking and use of any drug (with odds ratios that are not significantly different from each other), then drinking. This is not a major difference in the findings from the two modelling methods. It probably arises because the second modelling method considers the substances one at a time, so that, for example, the model explaining smoking does not control for drinking and use of illicit drugs. It can be concluded that of the types of substance use, smoking rather than drinking is the one least strongly related to delinquency after controlling for use of the other substances. On the other hand, the second set of models highlights the fact that the male/female difference in smoking specifically is very large compared with the effect of any other variable.

SUMMARY

Prevalence of weekly smoking and drinking started to increase rapidly from the age of 12-13, to reach about one quarter of young people by the age of 14-15. Thereafter, the increase in smoking levelled off, whereas the prevalence of drinking continued to rise, so that about 54 percent of 17 year-olds were weekly drinkers, whereas 30 per cent were weekly smokers. Prevalence of using illicit drugs started to rise a year later, around the age of 13, and it grew steadily thereafter. By the age of 17, 40 percent of young people had used any illicit drug in the past year, and 24 per cent had used drugs 4 or more times in the last year. Cannabis is the drug that dominates the picture, with 39 percent of young people having used the drug within the past year at age 17. At the same age, 13 percent had used harder drugs (that is, illicit drugs other than cannabis or glue) in the past year.

Smoking was considerably more prevalent in girls than boys, the gap being widest at the ages of 14-15 and 15-16. Drinking was rather more common in girls than boys at the age of 15, but this difference had reversed by the age of 16-17. Use

of illicit drugs was if anything slightly more common in boys than girls. In part these differences reflect earlier maturity in girls than boys, but there is a major difference in the prevalence of smoking persisting beyond puberty. Combined with other findings, this suggests that smoking is part of the affirmation of femininity for some working class girls.

The peak age for first becoming a weekly smoker was 13-14. Very early smoking (age 11 and earlier) was much more common in boys than girls, whereas the developmental phase where the girls greatly outstripped the boys in starting smoking was between the ages of 12 and 14. The peak age for starting to drink weekly was 15-16, but there were substantial numbers of new drinkers every year from the age of 12-13 onwards. The peak ages for starting to use drugs were 13-14 and 14-15, with a fairly sharp fall in the proportion of new entrants in the two succeeding years.

Where they had used more than one substance, young people tended to start using different substances in the same year. There was a slight tendency for drinking to precede smoking, but no consistent tendency for smoking to precede drugs, or for drinking to precede drugs.

Links between use of different substances at the same time were very strong: for example, at sweep 4 (age 14-15) the odds ratio linking smoking and use of drugs was 12.4. These links were strongest at age 11-12, and decreased as respondents grew older. A likely interpretation is that the three substances are strongly linked at the youngest ages because all are a sign of deviance; as use of the substances becomes more normal with age, so they become less closely linked. The strongest of these links is that between smoking and drugs. The probable explanation is that the most commonly used drug is cannabis, which is smoked.

There was substantial continuity in young people's use of substances between the ages of 12 and 17: for example, 69 percent of weekly smokers at age 11-12 were still weekly smokers at age 16-17. At the same time, there was considerable discontinuity too. For example, well over half of those who had started using drugs by age 12 desisted a year later, although some then started using again two or three years later. To investigate this further, we have calculated odds ratios linking use of a substance at one sweep with use of the same substance at subsequent sweeps. In general, these odds ratios were extremely high for smoking, very high for drugs, and lower (but still substantial) for drinking. These findings fit with the theory that smoking cigarettes (for whatever reason) is the most addictive form of substance use.

In the case of smoking, the degree of continuity increased very markedly with age: the odds ratio for smoking between sweeps 1 and 2 was 23.2 rising to 60.9 between sweeps 5 and 6. This suggests that prevention programmes should *not* focus primarily on young people who start smoking very early, since those who start at ages 15-16 are particularly likely to continue. Although continuity from one sweep to the next increased with age, the influence of earlier substance use diminished very markedly with the lapse of time. These findings show that early use increases the risk of later use, but that this effect fades: in other words, early use does not set a course from which escape is impossible.

Smoking, drinking alcohol, and using illicit drugs were all strongly associated with delinquency over the same time period. At early ages, the strength of this association was similar for the three substances. At later ages (16-17), the association with delinquency became definitely weaker for drinking alcohol than for smoking or using drugs. A set of regression models explored how far use of the three substances along with a range of other variables could explain delinquency at sweep 4 (age 15). The effect of using drugs on delinquency was the second highest of all the variables,

after the strength of moral beliefs. Of the three substances, using drugs had the largest effect on delinquency, followed by drinking, then smoking. These findings confirm that substance use is closely related to delinquency independently of a range of other factors covered by the Edinburgh Study, and that use of drugs is more directly related to delinquency than use of the other substances.

A second set of regression models showed that delinquency at age 15 could to a considerable extent explain use of each substance separately at the same age. The same analysis showed, however, that female gender was more powerful than delinquency as a predictor of smoking at the age of 15.