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The role of substance use in the development of adolescent antisocial behaviour

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The role of substance use in the development of adolescent antisocial behaviour

Adolescent substance use is associated with a wide range of difficulties in personal and social functioning, for example diminished educational attainment, mental health problems, and impaired physical health (White, Bates, and Labouvie 1998). Adolescent substance use is also strongly associated with engagement in antisocial behaviour, such as violent and property antisocial acts, in both adolescence and later in adulthood (Van Kammen, Loeber, and Stouthamer-Loeber 1998).

The role of substance use in the development of antisocial behaviour is an issue of concern for many, including policy makers, practitioners, researchers and the general community. However, the relationship between adolescent substance use and antisocial behaviour is complex. There is evidence of reciprocal connections between both behaviours, where antisocial behaviour impacts on substance use, but substance use also impacts on antisocial behaviour. In addition, some argue that adolescent substance use and antisocial behaviour share similar precursors and may therefore co-occur, rather than be causally linked (White 1997). To develop sound intervention and prevention policies and programs, a better understanding of the relationship between adolescent substance use and antisocial behaviour is required. This current investigation, which has the benefit of longitudinal data, aims to investigate the role of substance use in the development of antisocial behaviour.

There is a large and complex evidence-base concerning relationships between substance use and antisocial behaviour. A selective overview of relevant theories and findings is presented here, focusing on those which have been most salient and influential. For a comprehensive review of literature concerning the role of substance use in antisocial behaviour, see White (1997), and White, Loeber, Stouthamer-Loeber and Farrington (1999). It should be noted that theories and findings concerning adolescent antisocial behaviour have previously been reviewed in Reports One and Two (Smart et al. 2003; Vassallo et al. 2002), and thus will not be further discussed here.

Adolescent substance use

A number of studies have provided data on the prevalence of substance use among Australian adolescents (for example, Bond, Thomas, Toumbourou, Patton and Catalano 2000; the National Drug Strategy Household Survey 2001). Briefly, these studies reveal that many adolescents engage in the use of licit²⁸ substances, particularly alcohol. For instance, two-thirds of 14 to 17 year olds reported they had recently consumed alcohol, with approximately one-fifth reporting regular alcohol usage (National Drug Strategy Household Survey 2001). Furthermore, 35 per cent of adolescents aged 14-17 years and 64 per cent of those aged 18-24 years were reported to drink at risky or high-risk levels in the short term (Australian Institute of Health and Welfare 2003). However, cigarette use was less frequent, with 15 per cent of 14-17 year olds reported to be "recent smokers" and 82 per cent "non-smokers" (had smoked fewer than 100 cigarettes in their lifetime), while 3 per cent were "ex-smokers" (National Drug Strategy Household Survey 2001). Of illicit substances, marijuana is the most common substance used by adolescents, with one-fifth of 14-17 year olds reporting that they had used marijuana in the past year (National Drug Strategy Household Survey 2001). However, use of other illicit substances (heroin, hallucinogens, ecstasy, and amphetamines) appears to be considerably lower, with generally 5 per cent or fewer of 14-17 year olds reporting use of these substances within the past year (National Drug Strategy Household Survey 2001).

Studies investigating patterns of substance use across adolescence indicate that the frequency of both illicit and licit substance use rises through adolescence and peaks in the mid-twenties (Spooner, Hall and Lynskey 2001). There is also evidence that for some young people, substance use develops through a series of stages, with initiation via licit substances moving on to more frequent use, and/or initiation into illicit substances (Kandel 1989). In summary, the frequency of licit and illicit substance use increases across adolescence, and while the use of licit substances is common, fewer adolescents engage in illicit substance use.

Connections between adolescent substance use and antisocial behaviour

The co-occurrence of adolescent antisocial behaviour and substance use is well-documented (White 1997). Moffitt and Harrington (1996) report that rates of substance use (alcohol, cigarette use and marijuana) were highest among "life-course" antisocial adolescents, somewhat lower among those who displayed "adolescent-limited" antisocial behaviour, and lowest among individuals who did not engage in antisocial behaviour. Associations have also been found between specific substances and types of antisocial

²⁸ The term 'licit' is used to distinguish between substances that are legal in Australia for some members of the population (18 years of age and above) and substances, which are illegal for all members (for example, marijuana, ecstasy, amphetamines, heroin). Substances illegal for all members are termed 'illicit' here.

behaviour. Most notably, a consistent association has been found between violence and alcohol use and/or misuse. For instance, Fergusson, Lynskey and Horwood (1996) reported that 32 per cent of adolescents aged 15-16 years who misused alcohol engaged in violent offending, compared with 8 per cent of those who did not abuse alcohol. Engagement in violence and also property offences has been linked to the use of illicit drugs such as heroin and amphetamines, and use of multiple substances (White, Tice, Loeber and Stouthamer-Loeber 2002). In addition, commencement of substance use at an early age, and particularly multiple substance use, was related to later antisocial behaviour and other problem behaviours (Van Kammer et al. 1998).

There are a number of hypotheses concerning the connections and pathways between substance use and antisocial behaviour. One hypothesis is that engagement in antisocial behaviour impacts on substance use, whereby antisocial behaviour provides a context or the resources (for example, peer group, or money from crime) for engagement in substance use (White 1990). A second hypothesis is that substance use leads to antisocial behaviour. For example, substance users may resort to crime to generate income to support their substance addictions (White et al. 2002). Regular heroin users were found to commit property-related offences to fund their substance use (Anglin and Perrochet 1998). Another version of this second hypothesis is that the effects of substance use, such as dis-inhibition or cognitive-perceptual distortions, contribute to engagement in antisocial behaviour (Rajaratnam, Redman and Lenne 2000). Most notably the effects of alcohol intoxication such as reduced self-awareness, the lowering of social controls, and inaccurate assessment of risks have been linked to violence. Finally, many propose a third hypothesis: that the causal connections are bi-directional, with the relationship between substance use and antisocial behaviour being one of mutual reinforcement (White 1997).

In contrast to hypotheses that suggest there are causal relationships between substance use and antisocial behaviour, others propose that adolescent substance use and antisocial behaviour co-occur rather than are causally linked (see Elliott, Huizinga and Menard 1989; Fagan, Weis, and Cheng 1990; Jessor and Jessor 1977). According to this view, substance use and antisocial behaviour form part of cluster of adolescent problem behaviours that co-occur, and which may share a number of concurrent and prior risk factors (Mason and Windle 2002). For instance, Fergusson, Lynskey and Horwood (1996) found that, when the effects of common antecedents were taken into account, (such as a family history of alcohol or drug abuse, and affiliation with antisocial peers), the relationship between alcohol misuse and property offending was no longer apparent. On the basis of these findings, Fergusson and colleagues (1996) suggested that the relationship between alcohol misuse and engagement in property offences resulted from common influences associated with both behaviours, and was thus not causal.

Of the risk factors common to both substance use and antisocial behaviour, the influence of peers is particularly important (Dishion and Owen 2002; White 1990). For instance, as suggested by control theory (Elliot et al. 1989) and the Social Development model (Catalano and Hawkins 1996), adolescents who were weakly bonded to their parents, teachers or schools, but who were strongly attached to antisocial peers, were more likely to engage in antisocial behaviour (La Grange and White 1985; Vassallo et al. 2002) as well as substance use (Elliot et al. 1989). Other risk factors found to be common to antisocial behaviour and substance use include individual attributes (such as difficult temperament, externalising and internalising behaviour problems), family characteristics (parental harsh or erratic discipline, abuse or rejection by the family), and environmental factors (for example, peer groups, community disorganisation) (White 1997).

While some co-occurrence of antisocial behaviour and substance use is undisputed, the extent of this overlap is debated. Several studies have found that while some adolescents engage in both antisocial behaviour and substance use, others engage primarily in only one of these types of behaviour (see Fagan, Weis, Chen and Watters 1987; White and Labouvie 1994). Furthermore, the "common cause" hypothesis has been found to be inadequate, with studies reporting that particular factors seem to be related specifically to either substance use or to antisocial behaviour (for example, Kandel, Simcha-Fagan and Davies 1986; White and Labouvie 1994). For instance, White and Labouvie (1994) found that adolescents who engaged only in antisocial behaviour reported higher levels of hostility and paranoia. On the other hand, those who engaged only in substance use were less conscientious and impulsive and were less likely to use an aggressive, acting out coping style.

The "common cause" hypothesis has also been undermined by studies which have examined the influence of peers on both types of behaviour. The similarity of adolescents' behaviour and that of their peer group is promoted by two processes: selection and mutual reinforcement (Dishion, Calpaldi, Spracklen and Li 1995). Thus, initially adolescents may associate with or are drawn to those with similar attitudes and behaviours (Kandel 1978, 1986). In addition, a process of mutual reinforcement of values and behaviours occurs within the peer group, which then impacts on and influences individuals. In regards to substance use and antisocial behaviour, one interesting finding is that adolescents may adopt the behaviour (for example, substance use and/or antisocial behaviour) of peers with whom they wish to interact, or develop friendships with (Dishion et al. 1995; Dishion and Owen 2002). For instance, cigarette use may be a means of promoting relationships with cigarette using peers, especially for adolescents with poor social skills and self-esteem.

While attachment to antisocial peers has been found to predict antisocial behaviour and substance use, studies often combine peer substance use and peer antisocial behaviour in their measure of "deviant peer affiliations"²⁹, failing to differentiate between

29 The terms 'deviant peers' and 'deviant peer affiliations' have widely been used to refer to peers who engage in antisocial behaviour and/or substance use. They do not imply participation in more extremely deviant or pathological activities. While recognising that these terms are less than ideal, they will continue to be used here as they have been widely used in this field of research and no suitable alternative could be found (although the term 'antisocial peer affiliations' is also used here where appropriate).

these different types of peer behaviours as predictors. However, White (1991) found specific connections between an adolescent's involvement in marijuana use and/or antisocial behaviour and his/her peers' propensity to engage in one or both of these problem behaviours. Dishion and Owen (2002) found that early-onset substance use, particularly cigarette use, predicted the formation of friendships with other substance-using peers (although interestingly some of these groups reinforced and exacerbated the development of antisocial values and norms). These findings suggest more specific and differentiated connections beyond the simple association of antisocial peer affiliations with substance use and antisocial behaviour.

Thus, in summary it may be that in addition to the common risk factors shared by substance use and antisocial behaviour, there are specific risk factors for each outcome, including the possibility of each type of behaviour acting as an impetus for the other. However, the developmental sequences between different types of problem behaviours are as yet insufficiently defined or understood, with a key issue being whether one problem alters the onset and the course of other problem behaviours (Loeber, Farrington, Stouthamer-Loeber and Van Kammen 1998). Surprisingly, it seems that few studies have investigated the extent to which substance use leads to changes in patterns of antisocial behaviour over time (Mason and Windle 2002; Allen, Leadbeater and Aber 1994). The utility of longitudinal data in unravelling relationships between adolescent antisocial behaviour and substance use has been highlighted. Such data may be particularly useful in describing across-time patterns of and connections between substance use and antisocial behaviour, which may inform prevention and intervention efforts.

It is notable that there is little data about contemporaneous and across-time connections between antisocial behaviour and substance use in the Australian context, and to the authors' knowledge, the only available findings concerning developmental sequences and pathways also come from studies conducted in other countries. Yet there are important legal and cultural differences which may dilute the relevance of such studies to the Australian context. The legal age for consumption of alcohol, for example, is 18 years in Australia, but is 21 years in many parts of the United States, perhaps affecting adolescents' access to and use of alcohol, and societal tolerance of adolescent substance use.

This section investigates a number of issues regarding the role of substance use in the development of adolescent antisocial behaviour. The following questions are addressed:

- a) What is the relationship between substance use and antisocial behaviour; and between particular types of substance use (for example, alcohol) and particular types of antisocial behaviour (for example, violence)?
- b) Is substance use related to the maintenance of or desistence from adolescent antisocial behaviour?
- c) Is early substance use a risk factor for later antisocial behaviour?
- d) What are the relationships between an adolescent's antisocial behaviour and substance use and his/her friends' antisocial behaviour and substance use?

Methodology

Participants

The data reported in this section come from the three ATP survey waves conducted during adolescence at 13-14 years (1358 participating adolescents), 15-16 years (1310 adolescents), and 17-18 years (1260 adolescents).

Measures

At 13-14, 15-16 and 17-18 years, adolescents provided information on their substance use and antisocial behaviour, as well as their friends' antisocial behaviour and substance use. Details of the measures used are outlined below.

Substance use

Definitions of substance use

At each time point, adolescents answered questions about their recent use of alcohol, cigarettes, marijuana and other illicit substances. Thus, they reported the number of days in the past month in which they had used these drugs, except at 13-14 years where they reported their lifetime use of illicit substances and marijuana.

To aid interpretation, days of use were classified into 4 categories - none, low, moderate, and high. Table 25 summarises the categories developed. For alcohol and cigarettes, the categories approximated no recent use, occasional use (the "low" group), weekly use (the "moderate" group) or use several times per week (the "high" group). There were some minor across-time differences in the cut-offs developed at the three time points to take into account the normative increase in substance use that occurs over the adolescent period. For marijuana and other illicit substance use, the criteria were generally equivalent to "no" or "some" current use.

As Table 7 shows, for each substance type, frequency of use was also dichotomised for use in later analyses. For alcohol and cigarettes, frequency of use was dichotomised into "no/low use" and "moderate/high" use. For illicit substances and marijuana, frequency of use was dichotomised into "no use" and "some lifetime use" at 13-14 years, and, into "no use" and "any use in the past month" at 15-16 and 17-18 years.

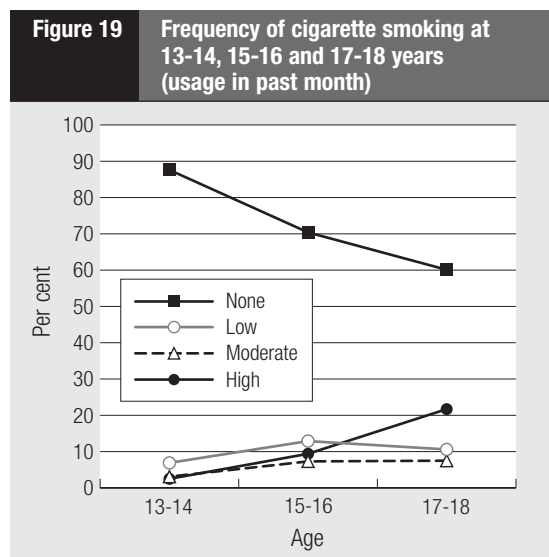
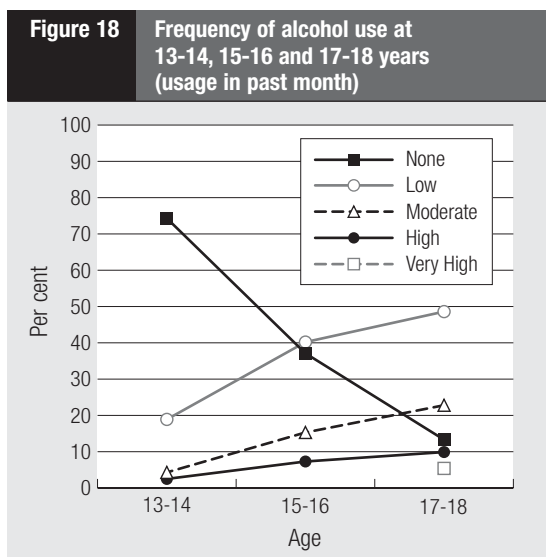
Table 7		Cut-offs used to form categories of use for each substance type			
	Time point (years of age)	Days of use (past month)	Use classification		Dichotomised classification
Alcohol	13-14 and 15-16	0	No	→	No/Low
		1 to 3	Low		
		4 to 7	Moderate	→	Moderate/High
		8 to 30	High		
Alcohol	17-18	0	No	→	No/Low
		1 to 4	Low		
		5 to 9	Moderate	→	Moderate/High
		10 to 14	High		
		15 to 30	Very high		
Cigarettes	All time points	0	No	→	No/Low
		1 to 3	Low		
		4 to 15	Moderate	→	Moderate/High
		16 to 30	High		
Marijuana	13-14	0	No	→	No
	15-16 and 17-18	Any lifetime use	Any	→	Any (lifetime)
		0	No	→	No
		1 to 4	Low	→	Any (month)
5 to 30	High	→			
Other illicit substances	13-14	0	No	→	No
	15-16 and 17-18	Any lifetime use	Any	→	Any (Lifetime)
		0	No	→	No
		Any use in past month	Any	→	Any (month)

Note: The slightly different categories developed for cigarette use are a result of the trend for such use to be primarily occasional or very frequent, with moderate use less evident.

Levels of substance use in the ATP sample

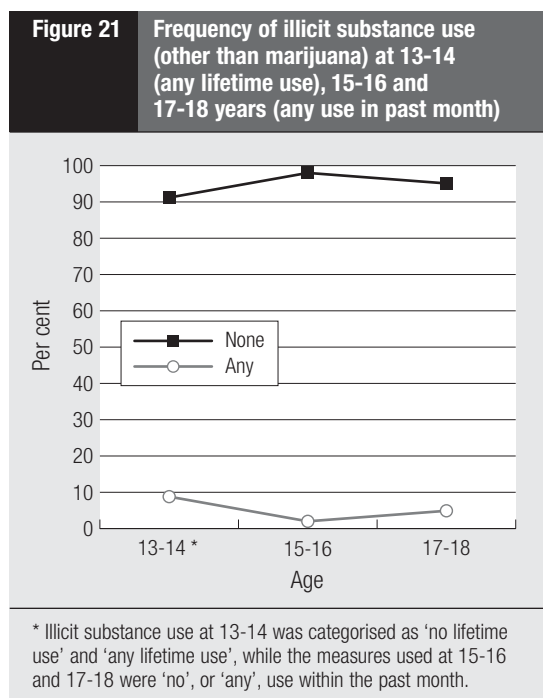
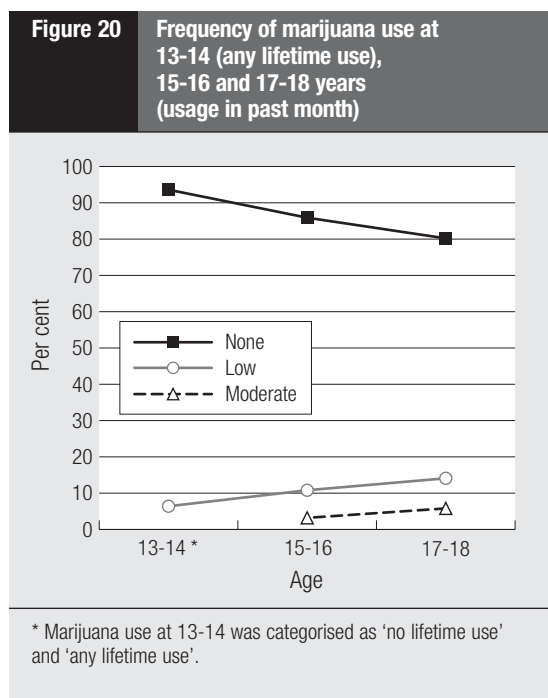
The frequency of **alcohol use** in the past month as measured at the 13-14, 15-16 and 17-18 years survey waves is shown in Figure 18. As can be seen, at 13-14 years a minority (approximately 25 per cent) of adolescents had recently consumed alcohol. Most of those using alcohol reported low levels of use. At 15-16 years the rate of alcohol use had more than doubled. Again, most reported low levels of consumption (approximately 40 per cent of adolescents), however approximately one-in-five reported moderate or high recent alcohol consumption. By 17-18 years, only 13 per cent had not used alcohol in the past month, almost half reported low consumption, while over 20 per cent had consumed at moderate levels (more than once a week) and over 15 per cent had consumed alcohol at high or very high levels.

Figure 19 shows the frequency of **cigarette smoking** within the past month across the time span of 13 to 18 years. At 13-14 years, few (13 per cent) had smoked cigarettes. Cigarette use increased at 15-16 and at 17-18 years, with the rate of



recent use rising to approximately 30 per cent and 40 per cent, respectively. There was a trend for adolescents who reported cigarette use at 17-18 years to smoke at high levels, possibly reflecting the addictive nature of cigarette use.

Marijuana use at 13-14 (any lifetime usage), and at 15-16 and 17-18 years (days per month) is displayed in Figure 20. As can be seen, approximately 6 per cent of adolescents reported some lifetime marijuana use at 13-14 years. At 15-16 years, 11 per cent of adolescents reported low recent use, and just over 3 per cent a high level of use. By 17-18 years, approximately 14 per cent and almost 6 per cent reported use at low and high levels, respectively.



Illicit substance use other than marijuana, at 13-14 (lifetime use), and at 15-16 and 17-18 years (use in past month) is shown in Figure 21. Approximately 9 per cent reported some lifetime use of illicit substances at the age of 13-14 years. At 15-16 years, 2 per cent reported using an illicit substance in the past month. Because the measure at 13-14 years was lifetime usage, and the measure used at the later time points was use in the past month, the trends from 13-14 years to later ages cannot be assessed. However, a small increase in illicit substance use from 15-16 to 17-18 years is discernible. At 17-18, just under 5 per cent indicated recent illicit substance use.

Antisocial behaviour

Definitions of antisocial behaviour

Using similar criteria to that described earlier on page 10, adolescents were classified into *low/non antisocial* or *highly antisocial* groups at each time point. It should be noted that for the current analyses, marijuana and illicit substance use were not included in the definition of antisocial behaviour. As a result, the proportion of adolescents who were classified as *highly antisocial* at each time point was slightly lower than reported in the First Report. Table 8 displays the proportion of adolescents who were classified as *highly antisocial* at each time point (for comparison, the proportions reported in the First Report are also displayed).

Across-time patterns of antisocial behaviour

Next, adolescents were classified according to the pattern of antisocial behaviour displayed across the three time points from 13 to 18 years, leading to the formation of 3 groups:

- a group who were persistently antisocial from early to late adolescence (109 individuals) – the *persistent* group;

Table 8 Proportion of adolescents who were classified as <i>highly antisocial</i> at each time point for the current analyses and the First Report			
Time point (years of age)	Current investigation		First Report
13-14		11.5	12.4
15-16		18.1	19.7
17-18		16.2	20.0

Note: Rates are slightly lower in the current investigation as marijuana and other illicit drug use were excluded from the definition of antisocial behaviour

- a group who engaged in antisocial behaviour in early or mid adolescence and then desisted (90 individuals) – the *experimental* group
- a group who displayed no, or low, levels of antisocial behaviour over adolescence (844 individuals) – the *low/non antisocial* group.

As noted before, the group sizes were slightly lower than reported in the First Report because illicit drug use was excluded from the index of antisocial behaviour.

Particular types of adolescent antisocial behaviour

The criteria reported in the Second Report (Smart et al. 2003), were used to identify groups of adolescents who engaged in violent and/or non-violent antisocial behaviour at 17-18 years. Four groups of adolescents were identified³⁰:

- a *violent only* group; these individuals had on several occasions in the past year been involved in physical fighting, attacking someone with the intention of seriously harming them, or bullying or threatening others, and had engaged in fewer than three non-violent antisocial acts in this time period (N=40)
- a *non-violent only* group³¹; these had engaged in three or more different types of non-violent antisocial behaviour during the past year (for example, stealing, vandalism, graffiti drawing, running away from home overnight or longer, school suspension/expulsion, driving a car without permission, selling illegal drugs), but had not displayed repeated violent behaviour in this time period (N=80)
- a *dual problem* group; these had engaged in *both violent and non-violent* antisocial behaviour as defined above during the previous 12 months, (N=34), and
- a *comparison* group; these individuals did not display violent or non-violent behaviour during the past 12 months (N=1048).

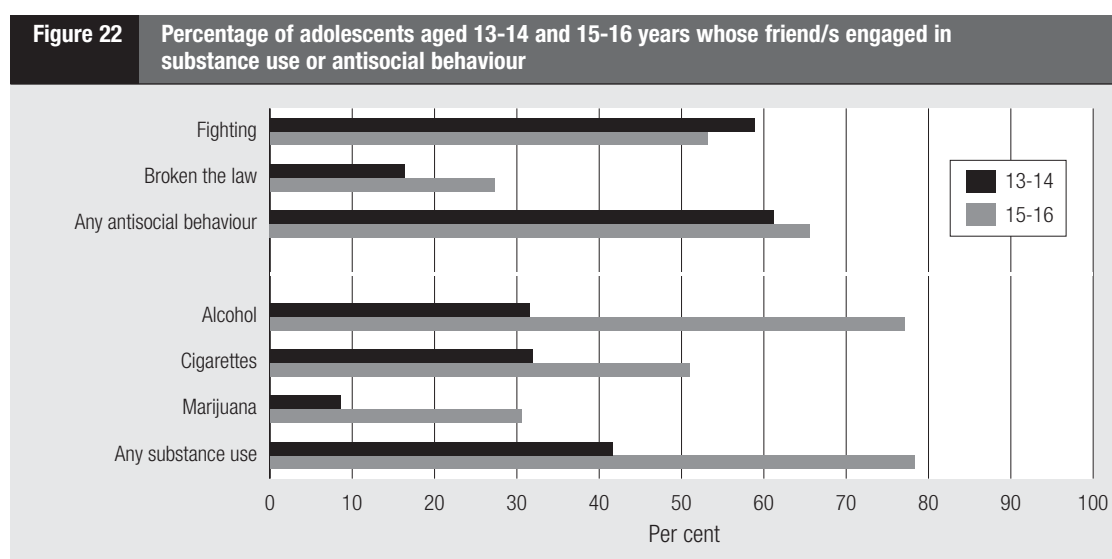
Substance use and antisocial behaviour among friends

Definitions of substance use and antisocial behaviour among friends

At 13-14 years and 15-16 years, adolescents were asked to report their three closest friends' engagement in substance use and antisocial behaviour. For substance use, three questions assessed whether each close friend "*never*" *sometimes*", or "*often*" used cigarettes, alcohol or marijuana. Friends' antisocial behaviour was assessed by two questions about whether each friend "*never*", *sometimes*", or "*often*" had been involved in lots of fights, or had broken the law (for example, shoplifted, stolen a car, engaged in vandalism).

Levels of substance use and antisocial behaviour among friends

Figure 22 shows the proportion of adolescents who at 13-14 and 15-16 years reported that at least one of their closest friends had "*sometimes*" or "*often*" engaged in antisocial behaviour (frequent fighting, breaking the law) and substance use (alcohol, cigarettes, marijuana). As can be seen, at the earlier time point, a majority (almost 60 per cent) reported that a friend had engaged in frequent fighting, while relatively few (approximately 16 per cent) reported that a friend had broken the law. Just over 30 per cent reported that a friend drank alcohol, with this figure being similar for cigarette use. Few reported that one or more best friends had used marijuana (approximately 9 per cent).



30 See *Patterns and precursors of adolescents antisocial behaviour: Types, Resiliency and environmental influences Report 2* (Smart et al. 2003) for a more detailed description of the formation of these groups

31 A small number of *non-violent* adolescents while not fitting the *violent* criteria, had reported some aggressive behaviour during the past year (N=11). These individuals were excluded as they did not clearly fit the profile for the *non-violent only* group.

At 15-16 years, fewer adolescents, but still a majority, reported that one or more friends had frequently been involved in fighting. However, more reported that a friend had broken the law. In contrast, there was a considerable increase in the numbers reporting substance use among their friends. This increase was greatest for alcohol, with 78 per cent of adolescents reporting that one or more friends had used alcohol. Half reported that one or more friends smoked cigarettes, and almost one third reported marijuana use by a friend.

FINDINGS

The following sections explore a number of questions concerning the relationship between substance use and antisocial behaviour. The first section compares *highly antisocial* and *low/non antisocial* adolescents on the frequency of substance use at the same time point; and rates of substance use among groups displaying differing across-time patterns of antisocial behaviour (*persistent*, *experimental* and *low/non antisocial* behaviour). The second section focuses on connections and pathways between adolescent substance use and antisocial behaviour from early to late adolescence. The final section investigates the relationship between adolescents' own engagement in antisocial behaviour and substance use, and their friends' engagement in these behaviours.

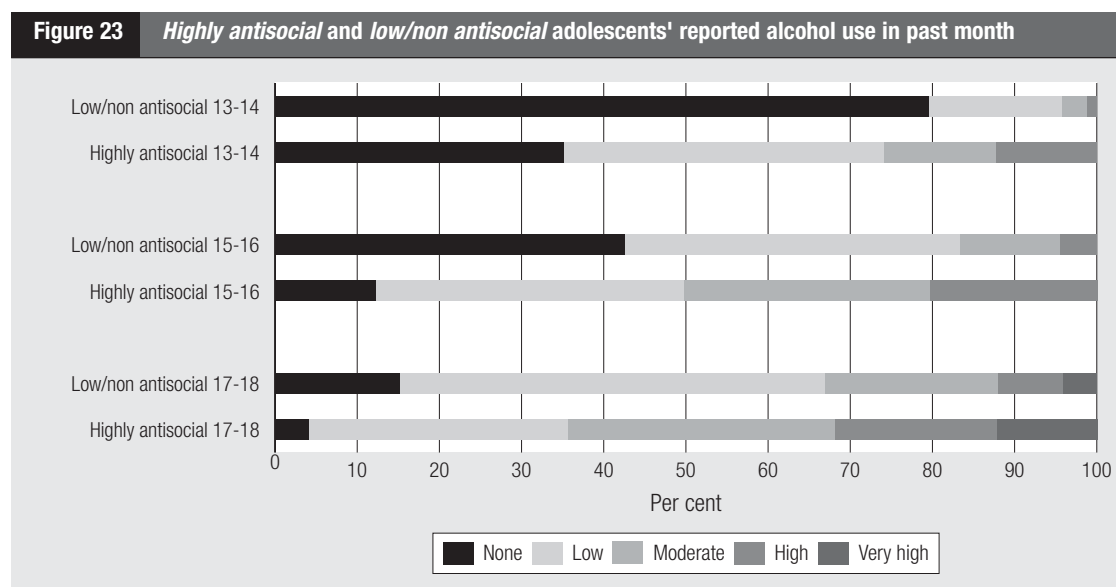
Connections between substance use and antisocial behaviour

Connections at the same point in time

This section explores differences between *highly antisocial* and *low/non antisocial* adolescents in rates of substance use at the same point in time. A later section will explore across-time connections between substance use and antisocial behaviour. In the descriptions which follow, the statistical analyses undertaken assess whether rates of substance use were significantly higher, or lower than would be expected by chance³². Effect sizes³³ were used to assess the strength of these group differences.

Highly antisocial and *low/non antisocial* adolescents' current alcohol use at different ages across the time span of 13 to 18 years is displayed in Figure 23³⁴. As can be seen, at 13-14 years, almost two-thirds of adolescents who were *highly antisocial* at that age reported some recent alcohol use, although most (40 per cent), reported low levels of use. In contrast, far fewer *low/non antisocial* adolescents (approximately 20 per cent) had recently consumed alcohol.

At 15-16 years, almost all adolescents who were *highly antisocial* at that age had also used alcohol during the past month (88 per cent). Approximately half reported moderate or high levels of use and a further 40 per cent reported low level use. In comparison, over 40 per cent of *low/non antisocial* adolescents reported no recent alcohol use and another 40 per cent reported low levels of use. Few (17 per cent) *low/non antisocial* adolescents reported moderate or high levels of use.



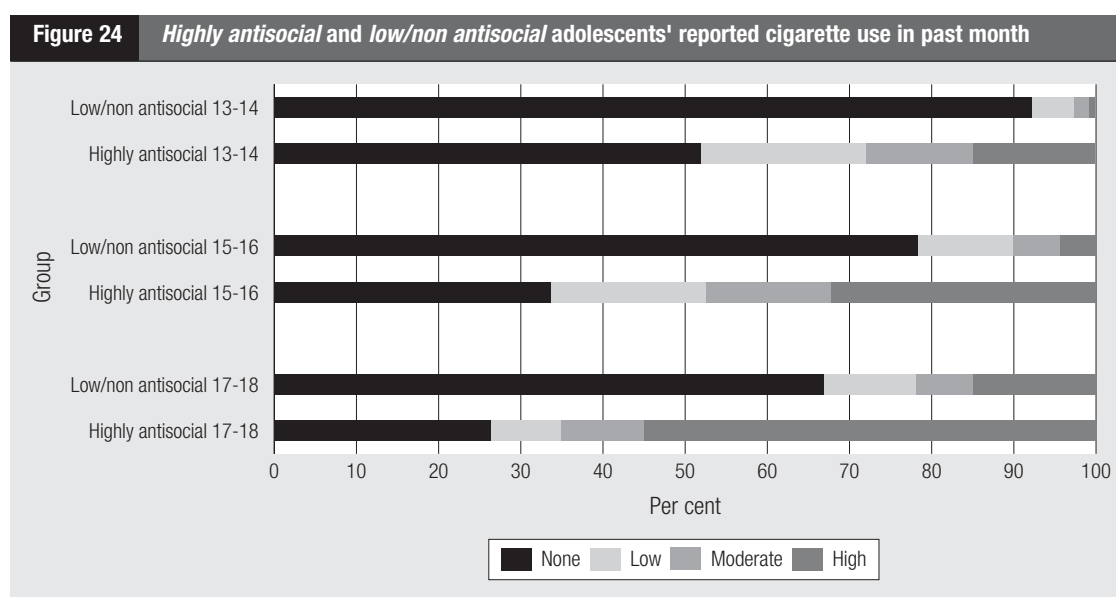
32 Chi-square tests were used to investigate whether the proportion of *highly antisocial* or *low/non antisocial* individuals who reported using a particular substance was significantly different to that which would be expected by chance. Each cell's standardised residual was examined to identify more specifically where the significant departures from chance occurred.

33 Cohen's (1988) effect size criteria were used to assess the strength of group differences across the various domains. For a chi-square test of independence, an effect size over .10 represents a small effect over .20 a medium effect, and over .40 a large effect. Effect sizes under .10 reflect differences that are significant but not very substantive.

34 Statistical differences between *antisocial* and *non-antisocial* groups for alcohol use: at 13-14 years, Chi-square (3) = 175.45 $p < 0.001$; at 15-16 years, Chi-square (3) = 144.91 $p < 0.001$; and at 17-18 years, Chi-square (4) = 82.24 $p < 0.001$.

Patterns of alcohol use at 17-18 years were similar to those at 15-16 years, although there was a shift from “no” to “low” use, particularly among *low/non antisocial* adolescents. Approximately 30 per cent of those who were highly antisocial at this age consumed alcohol at high levels (20 per cent at high and 10 per cent at very high levels), whereas the rate of high use, 12 per cent, was much lower among *low/non antisocial* adolescents (with 8 per cent drinking at high and 4 per cent at very high levels). Just over half of *low/non antisocial* adolescents reported low level recent alcohol use compared with approximately 30 per cent of highly antisocial adolescents, while around one third of highly antisocial and one fifth of *low/non antisocial* adolescents reported moderate levels of alcohol use.

Turning now to cigarette use, sizeable differences between *highly antisocial* and *low/non antisocial* adolescents were evident (Figure 24)³⁵. Thus, at 13-14 years, almost 50 per cent of those who were *highly antisocial* at this age had smoked cigarettes in the past month, compared with 8 per cent of *low/non antisocial* adolescents. Moreover, over one quarter of *highly antisocial* adolescents reported moderate or high cigarette use at this age. At 15-16 years, two-thirds of *highly antisocial* individuals reported recent cigarette use (and for most, use at high levels), by comparison with approximately 20 per cent of *low/non antisocial* adolescents. At 17-18 years, there was a further increase in cigarette smoking, with 75 per cent and 33 per cent of those who were *highly antisocial* and *low/non antisocial* at this age, respectively, reporting smoking in past month.



In terms of **marijuana use** (see Figure 25)³⁶, one-third of adolescents who were *highly antisocial* at 13-14 years reported some lifetime use of marijuana, whereas only 3 per cent of their *low/non antisocial* counterparts reported any lifetime use. At 15-16 years, close to half of the individuals who were *highly antisocial* at this age had used marijuana in the past month, compared with 7 per cent of *low/non antisocial* adolescents. At 17-18 years, one half of those who were highly engaged in *antisocial* behaviour reported recent marijuana use, by comparison with 12 per cent of those who were not involved in antisocial behaviour. Notably, almost one-quarter of *highly antisocial* adolescents reported high levels of marijuana use at this age.

Rates of other **illicit substance use** (such as ecstasy, amphetamines, and heroin) were lower overall, although significant group differences were still evident (Figure 26)³⁷. Thus, 25 per cent of those who were *highly antisocial* at 13-14 years of age reported some lifetime illicit substance use, while this figure was 7 per cent for *low/non antisocial* adolescents. At 15-16 years, approximately 9 per cent of those who were *highly antisocial* at this age reported illicit substance use in the past month compared with less than one per cent of *low/non antisocial* adolescents. An increase in the frequency of illicit substance use at 17-18 years was found, with approximately 15 per cent of individuals who were *highly antisocial* at this age and 3 per cent of *low/non antisocial* adolescents reporting recent illicit substance use.

Across-time connections between antisocial behaviour and substance use

The previous section investigated the association between antisocial behaviour and substance use at the same point in time, and demonstrated a strong relationship between the two behaviours. Connections between antisocial behaviour and substance

35 Statistical differences between highly *antisocial* and *low/non antisocial* groups for cigarette use: at 13-14 years, Chi-square (3) = 236.04 $p < 0.001$; at 15-16 years, Chi-square (3) = 227.01 $p < 0.001$; and at 17-18 years, Chi-square (3) = 170.65 $p < 0.001$

36 Statistical differences between *antisocial* and *non-antisocial* groups for marijuana use: at 13-14 years, Chi-square (1) = 228.19 $p < 0.001$; at 15-16 years, Chi-square (2) = 240.01 $p < 0.001$; and at 17-18 years, Chi-square (2) = 185.76 $p < 0.001$

37 Statistical differences between *antisocial* and *non-antisocial* groups for illicit substance use: at 13-14 years, Chi-square (1) = 51.46 $p < 0.001$; at 15-16 years, Chi-square (1) = 70.32 $p < 0.001$; and at 17-18 years, Chi-square (3) = 58.28 $p < 0.001$

Figure 25 *Highly antisocial and low/non antisocial adolescents' reported marijuana use in past month**

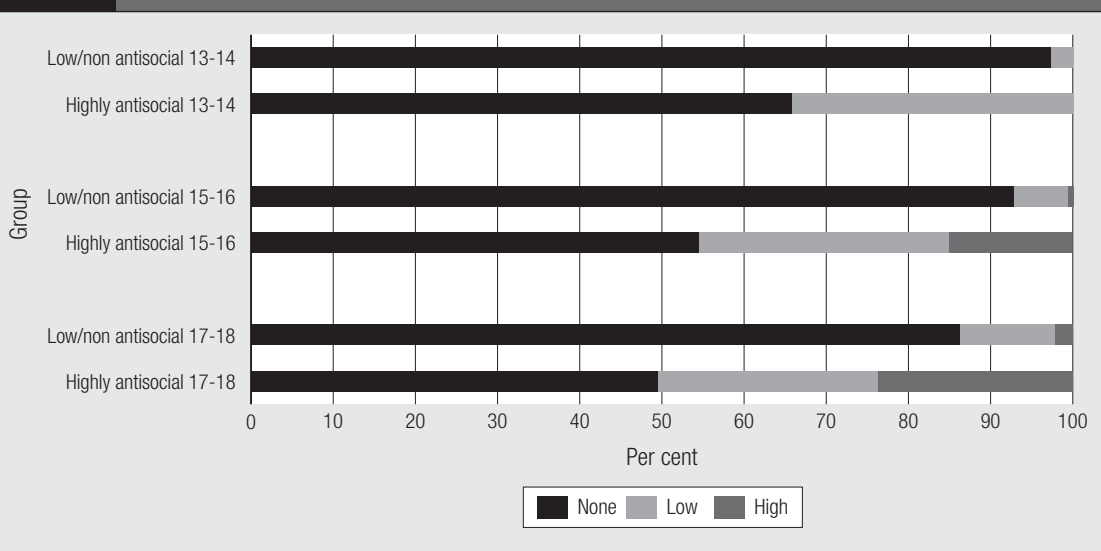
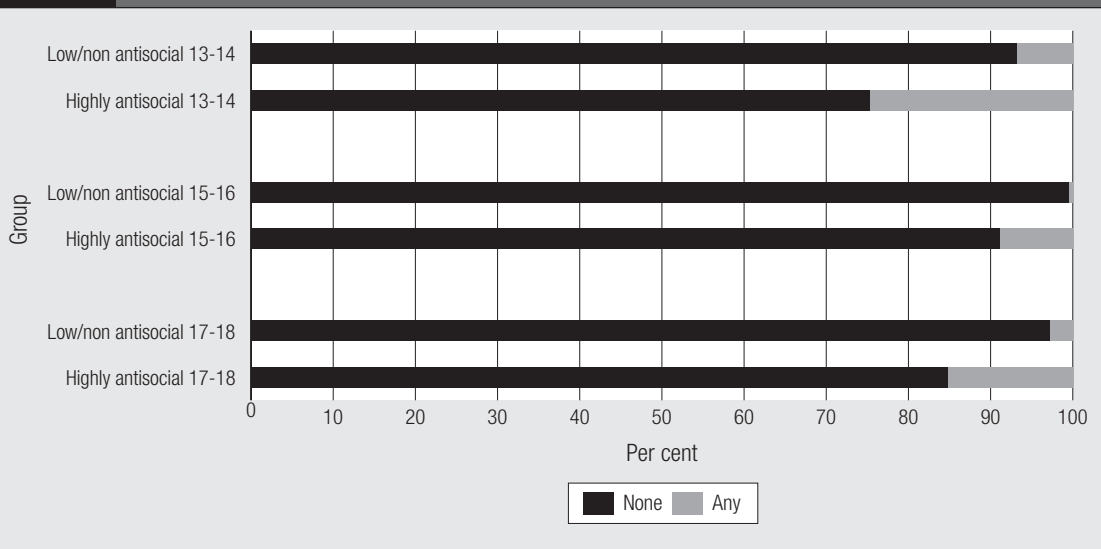


Figure 26 *Highly antisocial and low/non antisocial adolescents' reported illicit substance use (excluding marijuana) in past month**



* Illicit substance use at 13-14 years was measured as 'no' or 'any' lifetime use.

use are further explored by investigating rates of substance use among groups displaying *persistent*, *experimental* or *low/non* across-time patterns of antisocial behaviour (from 13 to 18 years of age)³⁸.

Multinomial logistic regression analyses were undertaken which compared the *low/non antisocial* group in turn to the *experimental* and *persistent* antisocial groups. For these analyses, the dichotomous substance use variables were used (i.e. *no* and *low* use were combined, as were moderate and high use, see Table 7, page 46 for further details)

Table 9 shows the percentage of the *persistent*, *experimental* and *low/non* antisocial groups who were moderate/high users of each type of substance, and the Relative Risk Ratios³⁹ (RRR) obtained from the statistical analyses comparing the *low/non antisocial* group to the *experimental* or *persistent* antisocial groups. The RRRs are similar to odds ratios, and indicate how powerful the difference is between the groups.

38 The *persistent antisocial* group had engaged in high levels of antisocial behaviour at 2 or more time points from 13 to 18 years, including the last time point. The *experimental antisocial* group had engaged in high levels of antisocial behaviour at one time point in early or mid adolescence only, while the *low/non antisocial* group had never engaged in high levels of adolescent antisocial behaviour (see page 10 for further details).

39 The relative risk ratio for a variable is the change in the odds of being in the target group (for example, being a moderate/high substance user) for each unit change in the variable. A relative risk of 1 for a variable represents no change in risk (odds are the same) at any level of that variable. Relative risk ratios significantly greater than 1 indicate an increased risk at increased levels of that variable, whilst relative risk ratios less than one indicate a reduced risk at higher levels of the variable.

For example, at 13-14 years, the RRR of 5.00 obtained for the comparison of the *experimental* and *low/non* antisocial groups' alcohol use indicates that the *experimental* group was 5 times more likely than *low/non* group to be moderate/high alcohol users. Similarly, the RRR of 9.78 obtained from the comparison of the *persistent* and *low/non* antisocial groups' alcohol use at 13-14 years indicates that the *persistent* group was almost 10 times more likely to be moderate/high alcohol users. Details of statistical analyses are included in Appendix 4.

Table 9 Percentage of the <i>low/non antisocial</i> , <i>experimental</i> and <i>persistent</i> groups who were moderate/high substance users at each time point, and the Relative Risk Ratios obtained from the multinomial logistic regression analyses					
	Low/Non group: % who were moderate/high users	Experimental group: % who were moderate/high users	Low/Non vs Experimental RRR	Persistent group: % who were moderate/high users	Low/Non vs. Persistent RRR
Alcohol use					
13-14 years	2.3	10.6	5.00***	18.8	9.78***
15-16 years	14.1	41.2	4.28***	51.2	6.51***
17-18 years	30.5	44.3	1.82**	68.5	4.97***
Cigarette use					
13-14 years	1.1	11.4	11.35***	28.0	34.44***
15-16 years	7.9	40.7	8.05***	46.7	10.29***
17-18 years	19.1	39.1	2.83***	70.4	10.08***
Marijuana use¹					
13-14 years	1.5	13.3	10.10***	25.7	22.76***
15-16 years	5.4	34.5	9.15***	49.5	17.03***
17-18 years	10.0	40.5	6.13***	56.5	11.71***
Other illicit substance use¹					
13-14 years	5.6	14.9	2.97**	17.5	3.59***
15-16 years	0.4	3.3	9.52***	10.9	33.73***
17-18 years	1.8	10.0	5.97***	17.4	11.35***

¹ Marijuana and illicit substance use were dichotomised into "no" use and "any" use. At 13-14 years, this denoted "no" and "any" lifetime use, while at 15-16 and 17-18 years, this referred to "no" and "any" use within the past month.
** p<0.01; *** p<0.001

As Table 9 shows, there were significant differences between the *low/non antisocial* group, and the *experimental* and *persistent* groups, on rates of moderate/high use of all types of substances and at all time points. The *persistent* group consistently reported the highest rates of substance use, the *experimental* group reported lower, but still elevated, rates of use, while the *low/non antisocial* group reported relatively low rates of use. The high RRR values indicate that group differences were very powerful, particularly for cigarette and marijuana use. In addition, although rates of illicit substance use were much lower overall, strong group differences were found for this type of substance use, most notably at 15-16 years.

Generally, for all substances, each group's rate of moderate/high use increased across adolescence. The trends at 17-18 years are of particular interest. While there was a substantial increase in rates of moderate/high use among *low/non antisocial* and *persistent antisocial* adolescents at this age, the increase in moderate/high use among *experimental* adolescents was marginal. It is noteworthy that the criteria developed to identify *experimental* antisocial behaviour specified that adolescents did not engage in high levels of antisocial behaviour at 17-18 years. Therefore the marginal increase in rates of moderate/high substance use among *experimental* adolescents coincided with their desistance from antisocial behaviour. Nevertheless, despite this marginal increase, rates of moderate/high use among this group remained high compared to the *low/non antisocial* group.

Particularly striking were the very high rates of substance use found among *persistent* adolescents, and, to a lesser extent, *experimental* adolescents. At 17-18 years, two-thirds of *persistent* adolescents were moderate/high users of alcohol and cigarettes, over half had used marijuana in the past month, while almost one in five had used other illicit substances in the past month. Even at 13-14 years, those who went on to be persistently antisocial engaged in greater moderate/high substance use, as did *experimental* adolescents.

Connections between substance use and violent and non-violent antisocial behaviour at 17-18 years of age

Next, findings relating to the question of whether there were distinct connections between specific types of antisocial behaviour, such as violent or non-violent behaviour, and substance use are reported. Groups identified at 17-18 years of age as displaying *violent-only*, *non-violent only*, and both violent and non-violent behaviour (the *dual problem* group), were compared to a *comparison* group

who did not engage in either type of antisocial behaviour at 17-18 years) on their patterns of substance use. Multinomial logistic regression analyses were again undertaken which compared the *comparison* group in turn to the *violent-only*, *non-violent only*, or *dual problem* (both violent and non-violent behaviour) antisocial groups. Details of statistical analyses are included in Appendix 5.

For these analyses, the dichotomised substance use variables (no/low use and moderate /high use) were again used. As the groups were defined according to *violent* and *non-violent* antisocial behaviour displayed at 17-18 years, only substance use at this age point was considered.

Rates of moderate/high use of each substance among *comparison*, *violent-only*, *non-violent only*, and *dual problem* individuals are shown in Table 10. As can be seen, the *dual problem* group followed by the *non-violent only* group displayed the highest levels of moderate/high use, significantly higher than that of the *comparison* group for all types of substances. Interestingly, with the exception of alcohol, rates of substance use among *violent-only* adolescents were considerably lower than those of the *dual problem* and *non-violent only* groups and not significantly different to the *comparison* group. These results suggest that *non-violent* antisocial behaviour at 17-18 years, whether or not accompanied by *violent* antisocial behaviour, was associated with substantially higher substance use.

Table 10 Percentage of the <i>comparison</i> , <i>non-violent only</i> , <i>violent-only</i> , and <i>dual problem</i> groups who were moderate/high substance users at 17-18 years, and the Relative Risk Ratios obtained from the multinomial logistic regression analyses							
	Comparison group %	Dual Problem group %	Comparison vs. Dual Problem RRR	Violent-only group %	Comparison vs. Violent-only RRR	Non-Violent-only group %	Comparison vs. Non-Violent-only RRR
Alcohol use							
17-18 years	33	78	6.90***	59	2.89**	62	3.18***
Cigarette use							
17-18 years	10	52	14.32***	16	n.s.	41	7.71***
Marijuana use¹							
17-18 years	23	71	6.50***	38	n.s.	70	9.42***
Other illicit substance use¹							
17-18 years	4	27	11.44***	6	n.s.	16	5.61***

¹ Marijuana and illicit substance use were dichotomised into 'no' and 'any' use within the past month.
 ** p<0.01; *** p<0.001

In summary, there were substantial connections between adolescents' tendency to engage in antisocial behaviour and in substance use at the same point in time. Connections between antisocial behaviour and alcohol and cigarette use were particularly evident. *Highly antisocial* adolescents consistently reported greater use of all substances, and much lower rates of non-use than *low/non antisocial* adolescents. Additionally, across all ages and substances, more *highly antisocial* adolescents reported moderate and high levels of use. Notably, a majority of the adolescents who were *highly antisocial* at 17-18 years of age reported using almost all types of the substances assessed. Overall then, there was a strong contemporaneous association between engagement in antisocial behaviour and use of substances.

Adolescents who were persistently highly antisocial across adolescence as well as adolescents who engaged in high levels of antisocial behaviour in early adolescence and then desisted, also consistently engaged in greater use of all types of substances from 13 to 18 years, by comparison with adolescents who were never involved in highly antisocial behaviour. Generally, rates of moderate/high substance use increased across adolescence, so that by 17-18 years a considerable majority of *persistent* adolescents also engaged in substance use.

Thus, at each time point and across all substance types, significant differences in the rates of moderate/high use were evident between the *low/non antisocial* group and the two antisocial groups. *Persistent* adolescents reported the highest rate of moderate/high use, followed by *experimental* adolescents, with a relatively low proportion of *low/non antisocial* adolescents engaging in moderate/high use.

Interestingly, at 17-18 years there was only a slight increase in the proportion of *experimental* adolescents engaging in moderate/high use, coinciding with their desistance from antisocial behaviour. It was also noteworthy that *persistent* antisocial behaviour was strongly associated with moderate/high substance use, and that moderate/high use became increasingly common among these individuals over adolescence. Thus, consistent moderate-high substance use appeared to be associated with the continuation of antisocial behaviour over adolescence.

Groups of 17-18 year old adolescents who engaged in *violent-only*, *non-violent only*, both violent and non-violent antisocial behaviour (*dual problem* group) and neither type of antisocial behaviour (*comparison* group) were compared on all types of moderate/high substance use at 17-18 years of age. The *dual problem* and *non-violent only* reported significantly greater use of all substances, while the *violent-only* group reported significantly higher alcohol use than the *comparison* group. Thus, it seemed that that *non-violent* antisocial behaviour, whether or not accompanied by *violent* antisocial behaviour, was associated with substantially higher involvement in all types of substance use, while there may be a more specific association between alcohol use and violence.

Early substance use as risk factor for later antisocial behaviour

A second important question concerns whether early substance use in the absence of antisocial behaviour is a risk factor for the later development of antisocial behaviour. This next section examines the links between substance use at age 13-14 years and antisocial behaviour at 15-16 and 17-18 years.

Preliminary investigations of moderate/high substance use patterns at each time point revealed that few adolescents used a single substance only, i.e. most were multi-substance users (see Appendix 6 for further details). For example, at 13-14 years, over 75 per cent of those who used cigarettes at moderate/high levels were also using another substance at these levels. For this reason, the next section, which investigates early substance use as a risk factor for antisocial behaviour, focuses on multi-substance use, rather than specific substances. Thus, the findings regarding multi-substance use are reported here, and those pertaining to specific substance types⁴⁰ are contained in Appendix 7.

Multi-substance use was defined as the use of 2 or more substances at moderate/high levels at 13-14 years. High levels of antisocial behaviour at 13-14 years were defined as engagement in 3 or more different types of antisocial behaviour in the past 12 months (see page 10 for further details). Adolescents were categorised into four groups (see Table 11):

- multi-substance users who were not highly antisocial (*multi-substance use only*),
- highly antisocial but not multi-substance users (*antisocial-only*),
- a *co-occurring* group who were multi-substance users and also highly antisocial, and
- a *neither* group who were not multi-substance users and were not highly antisocial.

Antisocial and substance use behaviour	13-14 years	
	N	%
Neither	1175	86.5
Multi-substance use only	28	2.1
Antisocial-only	103	7.7
Co-occurring	52	3.8

Pathways between substance use and antisocial behaviour were investigated by examining the four groups' subsequent patterns of substance use and antisocial behaviour at 15-16 years and 17-18 years, to establish whether problem behaviours persisted, desisted or diversified. To do this, the same criteria were used to form groups displaying differing combinations of multi-substance use and antisocial behaviour at these later ages. Then, across-time patterns were charted, and stability and change in patterns of multi-substance use and antisocial behaviour investigated, allowing questions such as the following to be answered: did the *multi-substance use only* group maintain or cease multi-substance use, and did they begin involvement in antisocial behaviour? The focus is particularly on the *multi-substance use only* group, to investigate the possibility of across-time connections between early substance use at 13-14 years and antisocial behaviour at 15-16 or 17-18 years.

However, as shown in Table 11, it is important to note that there were very few multi-substance using adolescents who were not also involved in antisocial behaviour in early adolescence (13-14 years), suggesting that the pathway from early multi-substance use only to later antisocial behaviour would be quite uncommon. Given the small group sizes, investigations of the personal and environmental risk factors that might be associated with progression along particular pathways (for example, from early multi-substance use to later antisocial behaviour) were not possible, as had originally been intended.

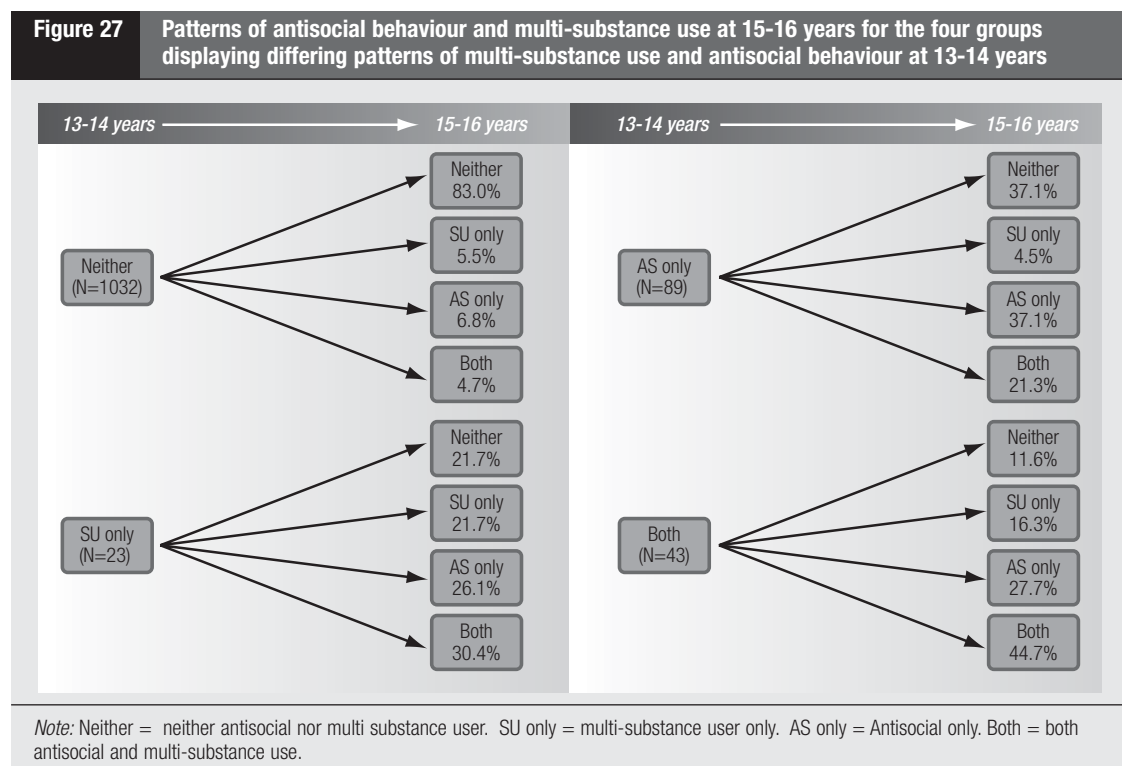
⁴⁰ The analyses of connections between early use of particular substances and later antisocial behaviour revealed very similar findings to those found for multi-substance use.

Patterns of antisocial behaviour and substance use at 15-16 years for the four multi-substance use/antisocial behaviour groups formed at 13-14 years are displayed in Figure 27. As can be seen, the great majority (83 per cent) of adolescents who were *neither antisocial nor multi-substance users* at 13-14 years continued not to engage in either problem behaviour at 15-16 years. Approximately 6 per cent had engaged in multi-substance use only, while 11.5 per cent engaged in antisocial behaviour (approximately 7 per cent were antisocial only and 5 per cent were antisocial and multi-substance users).

Of those who were *antisocial-only* at 13-14 years, approximately one-third (37 per cent) were problem-free at 15-16 years. Almost 60 per cent continued to engage in antisocial behaviour, with about one-third of these adolescents also commencing multi-substance use at 15-16 years. Interestingly, very few (only 4.5 per cent) had desisted from antisocial behaviour and taken up multi-substance use. Thus, while approximately one quarter of adolescents who were *antisocial-only* in early adolescence were multi-substance users at 15-16 years, most of these individuals continued to be involved in antisocial behaviour.

As mentioned above, the group of particular interest, those who were *multi-substance users-only* at 13-14 years, was a small group (N=28, just over 2 per cent overall). Over half (52 per cent) progressed to antisocial behaviour at 15-16 years, with the majority doing so in association with continued multi-substance use. On the other hand, one fifth were problem-free and a similar proportion continued to be multi-substance users but did not progress to antisocial behaviour at 15-16 years.

Finally, most individuals in the *co-occurring* group (88 per cent) continued to engage in some type of problem behaviour at 15-16 years. Over 70 per cent engaged in antisocial behaviour, with the majority of these adolescents continuing also to be multi-substance users. Relatively few were only multi-substance users in mid adolescence (16 per cent). Notably, in comparison to the single problem groups (*antisocial-only* and *multi-substance use only*), few had entirely desisted from these types of problem behaviours (12 per cent).



Patterns of antisocial behaviour and substance use at 17-18 years for the four multi-substance use/antisocial behaviour groups formed at 13-14 years are displayed below in Figure 28. While it would be interesting to track patterns of stability and change from 13-14 to 15-16, then from 15-16 to 17-18 years, the small group sizes precluded these more detailed analyses (for example, there were only 4 individuals on the trajectory of multi-substance use only at 13-14 to multi-substance use only at 15-16, too few to examine diverging trends from 15-16 to 17-18 years).

Three-quarters of adolescents who were *neither antisocial nor multi-substance users* at 13-14 years continued to not engage in either problem behaviour at 17-18 years. This is a slight decrease compared to the trends found at 15-16 years. Approximately 14 per cent were *multi-substance users only* at 17-18 years (more than double the rate found at 15-16 years), while approximately 11 per cent engaged in antisocial behaviour (approximately 5 per cent were *antisocial-only* and 6 per cent were both *antisocial and multi-substance users*).

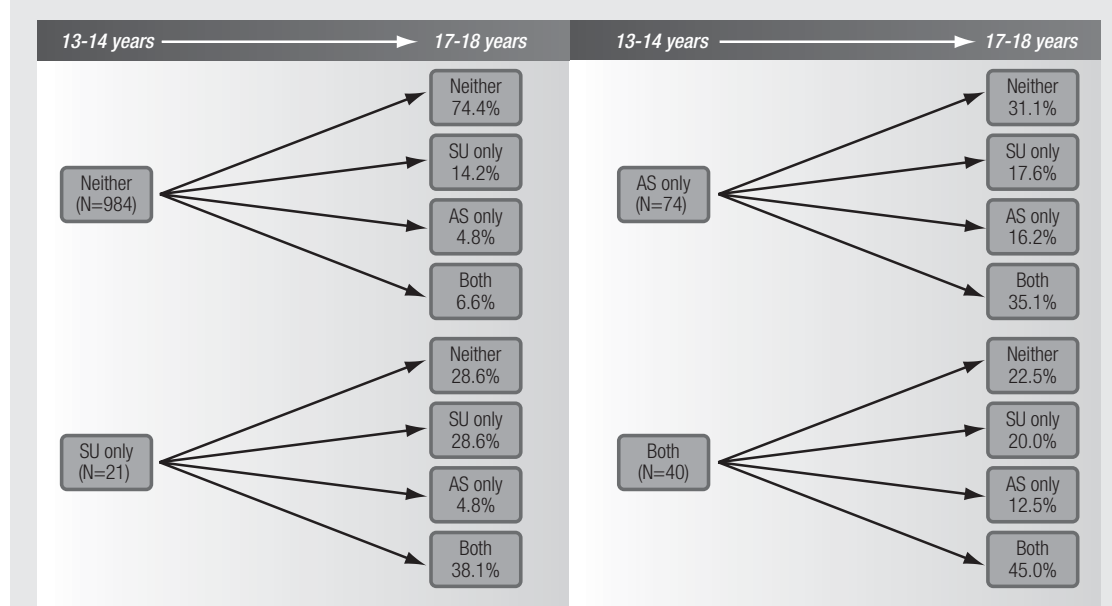
Approximately 30 per cent of the *antisocial-only* group did not engage in multi-substance use or antisocial behaviour at 17-18 years. Almost one fifth (18 per cent) were no longer involved in antisocial behaviour at 17-18 years, but reported engaging

in multi-substance use (a higher rate than found at 15-16 years). About half continued to engage in antisocial behaviour at 17-18 years, with a third of those who continued to engage in antisocial behaviour also now engaging in multi-substance use.

Of the small *substance use-only group*, the group of particular interest, over one-quarter displayed neither problem behaviour at 17-18 years, which was slightly higher than at 15-16 years. Close to 30 per cent continued to be *multi-substance users only* at 17-18 years, a marginally stronger trend than found at 15-16 years. Over 40 per cent were involved in antisocial behaviour, a substantial but slightly less powerful trend to that found at 15-16 years. Almost all of those who were involved in antisocial behaviour at 17-18 years also engaged in multi-substance use, with only 5 per cent found to engage in antisocial behaviour alone.

Less than a quarter (22.5 per cent) of the *co-occurring group* were problem-free at 17-18 years. Few (12.5 per cent) engaged only in antisocial behaviour at 17-18 years, half the rate found at 15-16 years. Close to half (45 per cent) continued to engage in both problem behaviours at 17-18 years. One-fifth had desisted from antisocial behaviour but were still involved in multi-substance use. While fewer of the *co-occurring group* had entirely desisted from these types of problem behaviours than the single problem groups (*antisocial-only* or *substance use-only*), this trend was less powerful than at 15-16 years.

Figure 28 Patterns of antisocial behaviour and multi-substance use at 17-18 years for the four groups displaying differing patterns of multi-substance use and antisocial behaviour at 13-14 years



Note: Neither = neither antisocial nor multi substance user. SU only = multi-substance user only. AS only = Antisocial only. Both = both antisocial and multi-substance use.

In summary, close to half of the adolescents who were *multi-substance users only* at 13-14 years engaged in antisocial behaviour at 15-16 and 17-18 years (52 and 43 per cent respectively), suggesting that multi-substance use was a strong risk factor for the development of antisocial behaviour. However, the *multi-substance use only* group was small in size (N=28), suggesting that while this pathway was powerful, it was uncommon. Additionally, the majority of these individuals continued to engage in multi-substance use in later adolescence, confirming that early adolescent multi-substance use was a powerful risk factor for later substance use. It was also notable that over half of those who progressed to antisocial behaviour maintained involvement in multi-substance use, a trend that was particularly marked at 17-18 years, indicating that the development of antisocial behaviour occurred in association with continued substance use.

A substantial proportion of individuals who were *antisocial-only* at 13-14 years were multi-substance users at the later time points, suggesting that there was also a pathway from antisocial behaviour to substance use. This trend was particularly noticeable at 17-18 years (26 per cent of this group were multi-substance users at 15-16 years and 53 per cent at 17-18 years). The uptake of multi-substance use among these individuals tended to occur alongside the continuation of antisocial behaviour, with few found to have switched to multi-substance use only. The size of the *antisocial-only* group (N=103) was larger than the *substance-use only* group, suggesting that this pathway was more common than the pathway from substance use to antisocial behaviour.

Adolescents who engaged in both multi-substance use and antisocial behaviour at 13-14 years (N=52) had a very high continuity of problem behaviour, with only 12 per cent at 15-16 years and 22.5 per cent at 17-18 years found to have desisted

from both types of problem behaviours. Close to half of this group continued to be involved in both antisocial behaviour and multi-substance use at 15-16 and 17-18 years. At 15-16 years, slightly more had desisted from substance use than antisocial behaviour (28 per cent were antisocial only and 16 per cent were multi-substance users only). This trend was reversed at 17-18 years, with more (20 per cent) engaging in substance use only than antisocial behaviour only (12.5 per cent).

The *neither problem* group (N=1175) showed strong stability of behaviour at 15-16 and 17-18 years, with close to 80 per cent reporting no engagement in antisocial behaviour or substance use.

At 15-16 and 17-18 years, approximately one third of the single problem groups (*antisocial-only* and *substance use-only*) appeared to have desisted and were problem-free. However, fewer in the *co-occurring* group (both highly antisocial and multi-substance users at 13-14 years) were problem-free in mid or late adolescence, indicating a higher stability of problem behaviour when substance use and antisocial behaviour co-occurred in early adolescence.

Relationship between adolescents' antisocial behaviour and substance use and their friends' antisocial behaviour and substance use

The final issue addressed is the relationship between an individual's pattern of antisocial behaviour and substance use and the prevalence of these behaviours among his/her close friends. As described earlier, adolescent substance use and antisocial behaviour are strongly influenced by the behaviour of peers (Dishion et al. 1995; Dishion and Owen 2002). However, whether there are particular connections between an individual's substance use and/or antisocial behaviour and that of his/her close friends remains unclear. As in previous sections, similarities between adolescents' own substance use and antisocial behaviour, and their friends' engagement in these behaviours at the same point in time are first described. Next, the frequency of friends' substance use and/or antisocial behaviour among groups displaying differing across-time patterns of antisocial behaviour (from 13 to 18 years) is investigated.

Relationship between friends' antisocial behaviour and substance use and adolescents' antisocial behaviour and substance use behaviour at the same point in time

To investigate the relationship between friends' antisocial behaviour and substance use and adolescents' engagement in these behaviours at the same point in time, the groups formed for the investigation of early substance use as a risk factor of antisocial behaviour were used (described on page 54). Thus, at 13-14 and 15-16 years, four groups were identified:

- multi-substance users but not highly antisocial (*multi-substance use only*),
- highly antisocial but not multi-substance users (*antisocial only*),
- multi-substance users and also highly antisocial (*co-occurring*), and
- neither multi-substance users nor highly antisocial (*neither*).

Next, groups were formed to describe the levels of substance use and antisocial behaviour among adolescents' close friends at 13-14 and 15-16 years. The following four groups were formed:

- one or more friends had "sometimes" or "often" engaged in substance use (alcohol, cigarette or marijuana use), and no friends had "sometimes" or "often" engaged in antisocial behaviour (*substance using friends only*),
- one or more friends had "sometimes" or "often" engaged in antisocial behaviour (frequent fighting, or breaking the law), but no friends had "sometimes" or "often" engaged in substance use (*antisocial friends only*),
- one or more friends had "sometimes" or "often" engaged in both antisocial behaviour and substance use (*both AS and SU friends*),
- no friends had "sometimes" or "often" engaged in antisocial behaviour or substance use (*problem-free friends*).

The frequency of differing patterns of substance use and/or antisocial behaviour among adolescents' close friends is shown below in Table 12.

Finally, the relationship between adolescents' own substance use and antisocial behaviour and their friends' engagement in these behaviours at the same point in time was investigated. Findings are first presented for 13-14 years of age (Table 13).

Friends' substance use and antisocial behaviour	13-14 years	15-16 years
Problem-free friends	29.9	12.9
Substance use only friends	8.9	21.6
Antisocial only friends	28.5	8.8
Both antisocial and substance using friends	32.7	56.7

As is shown, one third of adolescents who did not engage in antisocial behaviour or substance use (the *neither problem* group) reported that their friends also did not engage in these behaviours, a considerably higher proportion than found for the other three groups. In contrast, approximately two thirds of *antisocial only* and *multi-substance use only* adolescents, and over 90 per cent of adolescents who were involved in both types of behaviour (the *co-occurring* group) reported that their friends engaged in both substance use and antisocial behaviour.

It is also interesting that more *multi-substance use only* than *antisocial only* adolescents reported that their friends engaged only in substance-use, while more *antisocial only* than *multi-substance use only* adolescents reported that their friends engaged only in antisocial behaviour. However, both these single problem groups had similar rates of friends who engaged in both types of problem behaviours. These trends suggest that the two single problem groups could be partially differentiated by their friends' behaviour.

Table 13		Relationship between ATP adolescent's substance use and/or antisocial behaviour and friends' substance use and/or antisocial behaviour at 13-14 years (per cent)			
		Friends' substance use and antisocial behaviour			
		Problem-free	Substance use only	Antisocial only	Both antisocial and substance users
ATP adolescent's substance use and antisocial behaviour	Neither (N = 1112)	33.9	9.6	30.4	26.1
	Multi-substance use only (N = 27)	3.7	11.1	14.8	70.4
	Antisocial only (N = 99)	6.1	3.0	25.3	65.7
	Co-occurring (N = 50)	2.0	4.0	0	94.0

At 15-16 years, as shown in Table 14, over four fifths of *neither problem* adolescents (84 per cent) reported that one or more friends had engaged in at least one of these problem behaviours, a sizeable increase from the rate found at 13-14 years. More strikingly, almost no individuals in the *multi-substance use only*, *antisocial only*, or *co-occurring* groups had friends who were problem-free.

While all four groups reported quite high rates of friendships with adolescents who were involved in both antisocial behaviour and substance use, sizeable differences between the groups were still evident. Thus, while close to half of the *neither problem* group reported that their friends had engaged in both antisocial behaviour and substance use, approximately three-quarters of *multi-substance use only* and *antisocial only* adolescents and almost all *co-occurring* adolescents reported that their friends engaged in both types of behaviours.

More *multi-substance use only* adolescents reported that friends were only involved in substance use at this age (rising from 11 per cent at 13-14 years to 24 per cent at 15-16 years). In contrast, fewer *antisocial only* adolescents reported that their friends engaged only in antisocial behaviour at this age (decreasing from 25 per cent to 5 per cent over the two time points), with more reporting that friends engaged in both types of problem behaviours (increasing from 66 per cent to 82 per cent). Notably, almost all *co-occurring* adolescents had one or more friends who were involved in both substance use and antisocial behaviour in early and mid adolescence.

Table 14		Relationship between ATP adolescent's substance use and/or antisocial behaviour and friends' substance use and/or antisocial behaviour at 15-16 years (per cent)			
		Friends' substance use and antisocial behaviour			
		Problem-free	Substance use only	Antisocial only	Both antisocial and substance users
ATP adolescent's substance use and antisocial behaviour	Neither (N = 924)	16.2	25.5	11.0	47.2
	Multi-substance use only (N = 80)	0	23.8	1.3	75.0
	Antisocial only (N = 134)	6.7	6.7	4.5	82.1
	Co-occurring (N = 96)	0	2.1	0	97.9

Connections between persistent, experimental and low/non adolescent antisocial behaviour and friends' substance use and antisocial behaviour.

Whether individuals who displayed differing across-time patterns of *persistent*, *experimental*, and *low/non antisocial* behaviour (from 13 to 18 years) also had friends who differed in their propensity to engage in antisocial behaviour or use substances is next investigated. As before, the statistical analyses undertaken assess whether the frequency of such friendships was significant higher, or lower, than would be expected by chance.

The trends revealed in Table 15 show that there were consistent and significant differences between the *persistent*, *experimental*, and *low/non antisocial* groups in their reports of one or more friends' involvement in each type of antisocial behaviour and substance

use during early adolescence (13-14 years)⁴¹. Rates of friends' engagement in such behaviours were highest among *persistent* adolescents, somewhat lower among *experimental* adolescents, and lowest among *low/non antisocial* adolescents. There were some aspects that appeared to occur quite frequently among friends of individuals from all three groups. For example, a majority of those from all three groups reported at 13-14 years that one or more of their friends frequently engaged in fights, while friends' alcohol and cigarette use were also quite common at this age, especially among individuals from the *persistent* groups.

Table 15		Percentage of <i>low/non, experimental</i> and <i>persistent antisocial</i> adolescents who at 13-14 years reported that their friends engaged in substance use or antisocial behaviour	
Group	Percentage whose friends were involved in this type of antisocial behaviour	Percentage whose friends used this substance	
Low/non	Frequent Fighting	51.9	Alcohol 24.1
Experimental		76.5	48.2
Persistent		83.3	64.2
Low/non	Broken the law	9.8	Cigarettes 26.3
Experimental		31.0	48.8
Persistent		47.8	61.1
Low/non			Marijuana 5.7
Experimental			17.9
Persistent			31.2
Low/non	Either type of antisocial behaviour	54.0	Any type of substance use 34.9
Experimental		81.2	58.3
Persistent		87.5	73.7

Powerful differences were again found between the three groups in friends' involvement in all types of antisocial behaviour and substance use during mid adolescence (15-16 years), as shown in Table 16.⁴² Generally, the pattern of group differences was comparable to that found at 13-14 years. Many more individuals from all three groups reported that one or more close friends engaged in substance use, particularly alcohol use, at this age. It was also noteworthy that at this time point, considerable numbers of individuals from the *experimental* and *persistent* groups reported that one or more friends had "sometimes" or "often" broken the law and engaged in fighting, in addition to each type of substance use.

Table 16		Percentage of <i>low/non, experimental</i> and <i>persistent antisocial</i> adolescents who at 15-16 years reported that their friends engaged in substance use or antisocial behaviour	
Group	Percentage whose friends were involved in this type of antisocial behaviour	Percentage whose friends used this substance	
Low/non	Frequent Fighting	45.4	Alcohol 72.5
Experimental		71.9	88.6
Persistent		77.9	93.6
Low/non	Broken the law	17.2	Cigarettes 42.1
Experimental		50.0	70.5
Persistent		70.2	81.1
Low/non			Marijuana 21.4
Experimental			59.1
Persistent			58.9
Low/non	Either type of antisocial behaviour	57.5	Any type of substance use 73.2
Experimental		85.4	89.8
Persistent		89.5	95.8

41 Statistical differences between the *Low/non, Experimental*, and *Persistent* groups in the proportion who **at 13-14 years** reported that their friends broke the law, Chi-square (2) = 109.13 $p < 0.001$; friends frequently engaged in fighting, Chi-square (2) = 48.74 $p < 0.001$; friends engaged in any antisocial behaviour, Chi-square (2) = 57.53 $p < 0.001$; friends consumed alcohol, Chi-square (2) = 78.89 $p < 0.001$; friends used cigarettes, Chi-square (2) = 59.81 $p < 0.001$; friends used marijuana Chi-square (2) = 72.93 $p < 0.001$; friends used any substance Chi-square (2) = 64.51 $p < 0.001$.

42 Statistical differences between the *Low/non, Experimental*, and *Persistent* groups in the proportion who **at 15-16 years** reported that their friends broke the law, Chi-square (2) = 155.74 $p < 0.001$; friends engaged in fighting, Chi-square (2) = 53.03 $p < 0.001$; friends engaged in any antisocial behaviour, Chi-square (2) = 58.08 $p < 0.001$; friends consumed alcohol, Chi-square (2) = 28.95 $p < 0.001$; friends used cigarettes, Chi-square (2) = 70.13 $p < 0.001$; friends used marijuana Chi-square (2) = 103.52 $p < 0.001$; friends used any substance Chi-square (2) = 33.48 $p < 0.001$.

In summary, clear relationships were evident between adolescents' own engagement in antisocial behaviour and/or substance use, and their friends' engagement in such behaviours at the same point in time. At 13-14 years, as well as at 15-16 years, almost all of those who engaged in both antisocial behaviour and multi-substance use reported that their friends likewise engaged in both types of behaviour. Conversely, individuals who were not involved in either type of problem behaviour had the highest proportion of friends who also did not engage in either behaviour at the two time points.

At both time points, more *multi-substance use only* adolescents than *antisocial only* adolescents reported that their friends engaged only in substance use, suggesting some specificity in the relationship between these adolescents' behaviour and that of their friends. Additionally at 13-14 years, more *antisocial only* adolescents than *multi-substance use only* adolescents reported that friends engaged in only antisocial behaviour. However, the two single problem groups (*antisocial behaviour only* and *multi-substance use only*) were quite similar in their rate of friendships with youth who engaged in both types of problem behaviour. These findings thus suggest that the two single problem groups could be partially differentiated by their friends' behaviour.

It was also noteworthy that individuals from all four groups quite frequently had friendships with youth who engaged in both types of problem behaviours. Thus, approximately one quarter of *neither problem* 13-14 year old adolescents reported that friends had been involved in both types of behaviour, as did 47 per cent of *neither problem* 15-16 year old adolescents. Rates of such friendships were much higher among adolescents who had engaged in one or both types of problem behaviours themselves, and increased considerably over the two time points (from 13-14 to 15-16 years).

There were also powerful differences between the *low/non*, *experimental* and *persistent antisocial* groups in their reports of their close friends' involvement in each type of antisocial behaviour and substance use at 13-14 and 15-16 years. In general, rates of friends' engagement in such behaviour were highest among *persistent* adolescents, somewhat lower among *experimental* adolescents, and lowest among *low/non antisocial* adolescents. Notably, by 15-16 years, the majority of individuals from the *experimental* and *persistent* groups reported that one or more friends had broken the law and engaged in fighting, in addition to each type of substance use.

Discussion and implications

A number of questions concerning the relationship between substance use and antisocial behaviour were explored in this section. In summary, engagement in antisocial behaviour and in differing types of substance use at the same point in time was investigated, and these two types of problem behaviours were found to frequently co-occur. In addition, groups exhibiting differing across-time patterns of antisocial behaviour also differed greatly in their propensity to use substances, with those who engaged in persistent antisocial behaviour found to have the highest levels of moderate/high use of all substances, followed by experimental adolescents, while fewer low/non antisocial adolescents were found to use substances. Early adolescent multi-substance use appeared to be a powerful risk factor for the later development of antisocial behaviour, although this pathway was found to be quite uncommon. There also appeared to be a pathway from early adolescent antisocial behaviour to later multi-substance use which appeared to be more common. Individuals who engaged in both multi-substance use and antisocial behaviour in early adolescence had a particularly strong continuity of problem behaviour into later adolescence. Finally, there were powerful connections between adolescents' engagement in antisocial behaviour and/or substance use and their close friends' propensity to engage in such behaviours.

Among the conclusions and implications that may be drawn from these findings are:

Substance use was common and increased considerably over adolescence

While not the main focus of this study, some comments are offered on the patterns of substance use revealed by this sample of young Victorians. Consistent with previous research, the current findings suggest that adolescent substance use is relatively common and increases substantially over the adolescent period. This increase is particularly apparent for alcohol and cigarettes, and to a lesser extent for marijuana. For example, by 17-18 years approximately 87 per cent of adolescents reported that they had consumed alcohol in the past month. These findings support a view that substance use, particularly of alcohol and cigarettes, is common, perhaps "normal", during adolescence in the Australian context.

However, it is clear that some adolescents engage in substance use at levels that are potentially harmful. At 17-18 years, for instance, approximately one-in-five adolescents reportedly smoked cigarettes on more than half the days of the past month, which suggested an established cigarette habit by late adolescence. Also at this age, approximately 15 per cent of adolescents reported consuming alcohol on ten or more days of the past month (which corresponds to several times a week), while 6 per cent had reportedly smoked marijuana on 5 or more days in this period (equivalent to once a week). It is important for parents, teachers and policy makers to be mindful of the levels at which young engage in substance use and to be aware that high levels of substance use are associated with negative consequences in aspects such as physical and mental health, education, relationships with peers and family as well as with police.

Substance use and antisocial behaviour frequently co-occurred

The results indicated that across adolescence, there were strong concurrent relationships between antisocial behaviour and substance use. At each time point, highly antisocial adolescents compared to low/non antisocial adolescents reported greater use of all types of substances. In addition, over all time points and for all substances, more highly antisocial adolescents reported engaging in moderate/high levels of substance use than did low/non antisocial adolescents. However, the association was not absolute, as there were a number of adolescents who while engaging in antisocial behaviour did not use substances. For example, at 17-18 years, around 10 per cent of highly antisocial adolescents had not recently consumed alcohol, around 30 per cent had not smoked cigarettes, 50 per cent had not used marijuana and 80 per cent had not used other illicit drugs.

These findings are valuable given that few studies have investigated contemporaneous connections between antisocial behaviour and substance use in the Australian context. These findings are consistent with a view that antisocial behaviour and substance

Table 17		
Overlap between the risk factors for persistent adolescent antisocial behaviour from 13 to 18 years and multi-substance use in mid adolescence		
Precursors	Antisocial behaviour ^a	Substance use ^b
Temperament/personality		
■ Task persistence	✓	✓
■ Negative reactivity	✓	✗
■ Activity	✓	✓
■ Approach/withdrawal	✗	✓
Behaviour problems		
■ Aggression	✓	✓
■ Hyperactivity	✓	✓
■ Anxiety	✓	✗
■ Depression	✓	✓
Social competence		
■ Assertiveness	✓	✓
■ Cooperation	✓	✗
■ Empathy	✓	✗
■ Responsibility	✓	✗
■ Self-control	✓	✓
Other personal attributes		
■ Civic mindedness/engagement	✓	✗
■ Emotional control	✓	✓
■ Sensation-seeking	✓	✓
School adjustment		
■ School readiness at 5 - 6 years	✗	✗
■ School difficulties in adolescence	✓	✓
Parenting Practices		
■ Supervision / Monitoring	✓	✗
■ Harsh discipline	✓	✓
■ Warmth of relationship	✓	✗
■ Attachment to parents	✓	✓
Parental Substance Use		
■ Father's substance use	✓	✓
■ Mother's Substance use	✓	✓
Peer Relationships		
■ Antisocial peer affiliations	✓	✓
■ Participation in organised peer activities	✓	✓
■ Attachment to peers	✓	✓
■ Friendship quality	✗	✓
■ Peer involvement	✗	✓

Notes: Antisocial behaviour = persistent antisocial behaviour between the ages of 13 and 18 years.
Substance use = multi-substance use at 15-16 years of age

use form part of a cluster of co-occurring adolescent problems (see Fagan, Weis, and Cheng 1990; Jessor and Jessor 1977; Loeber et al. 1998).

This study cannot fully determine whether this co-occurrence arose because of common risk factors shared by the two types of problem behaviour, or whether there are causal relationships between the problem behaviours. However, we were able to compare the findings of our previous investigation of the precursors of antisocial behaviour (see Vassallo et al. 2002) with the findings of a study that used ATP data to examine precursors of multi-substance use in mid adolescence (see Williams, Sanson, Toumbourou and Smart 2000). In each investigation, problem groups were compared to non-problem groups to identify risk factors for the particular type of problem behaviour. The results emerging from these analyses are summarised in Table 17, and reveal a high degree of overlap in the risk factors for each type of problem behaviour across a number of domains.

Overall, more risk factors were found for antisocial behaviour than multi-substance use, particularly in the domain of social competence, where there were more widespread differences between *persistently antisocial* adolescents and *low/non antisocial* adolescents than there were between *substance using* and *non-substance using* adolescents. In addition, some specific associations were also evident. Most notably, a more sociable or gregarious temperament style distinguished *multi-substance users* from non-users, while *persistently antisocial* adolescents were distinguished by being temperamentally more reactive and volatile than *low/non antisocial* adolescents. Thus, to a large extent, there appeared to be many risk factors common to both antisocial behaviour and multi-substance use, but some specific risk factors were also apparent.

The strong association found between antisocial behaviour and substance use in this current study highlights the fact that antisocial adolescents tend to experience a range of difficulties. This reinforces the view that antisocial individuals may require assistance in a number of areas of their lives. These findings carry important implications for intervention and prevention strategies. The high level of co-occurrence between antisocial behaviour and substance use demonstrated here and in other studies (for example, Loeber et al. 1998) suggest that broad based intervention programs are needed which can target and ameliorate a range of adolescent problem outcomes including antisocial behaviour and substance use. The use of such broad based strategies may have associated benefits, including the efficient and effective use of resources for intervention.

Differing across-time patterns of antisocial behaviour were strongly related to substance use

Rates of moderate/high substance use were significantly higher among both the *persistent* and *experimental* groups than the *low/non antisocial* group. Particularly apparent was the strong association between *persistent* antisocial behaviour and moderate/high substance use across adolescence. Thus, consistent high levels of substance use may be associated with the maintenance of antisocial behaviour across adolescence, which supports previous research indicating that problematic levels of substance use are associated with more enduring antisocial behaviours (Moffitt and Harrington 1996).

It was also found that more experimental than low/non adolescents engaged in moderate/high levels of substance use. Interestingly, however, moderate/high substance use among experimental adolescents appeared to stabilise at 17-18 years, which coincided with their desistance from antisocial behaviour. It is notable, however, that despite the stabilisation that appeared to be occurring, the extent of moderate/high use among experimental individuals remained considerably higher than low/non antisocial individuals.

These findings show that the experimental group displayed higher levels of substance use at the end of adolescence than the low/non adolescent antisocial group. However, as reported earlier in Section 2, the experimental group appeared to be progressing well in early adulthood and closely resembled the low/non adolescent antisocial group on the whole. As noted earlier on page 26, with regards to substance use, only higher levels of cigarette use significantly differentiated the experimental from the low/non antisocial group at 19-20 years. Thus, for the experimental group, it appeared that desistance from antisocial behaviour was also associated with desistance from substance use in the longer term. It will be important to continue following the progress of the experimental group to determine whether these positive developmental pathways are maintained.

Overall, the across-time similarities in levels of antisocial behaviour and substance use found among the persistent group in particular, point to the powerful connections between these two types of problem behaviours.

Both violent and non-violent antisocial behaviour were related to substance use in late adolescence

The findings revealed powerful differences in the extent of moderate/high substance use between the comparison group and the three groups displaying differing patterns of violent and non-violent antisocial behaviour at 17-18 years of age. Specifically, violent-only adolescents tended to engage in higher levels of alcohol use than comparison individuals, while dual problem and non-violent only adolescents more frequently engaged in moderate/high levels of use of all substance types.

The finding of a relationship between alcohol and violence represents a well documented finding within the literature (White, Brick and Hansell 1993). However, the relationship between violence and alcohol is complex. Previous longitudinal research has found that alcohol use predicts later violence, but also shows that aggressive behaviour is predictive of later alcohol use and alcohol-related aggression (White et al. 1993). The latter finding is interesting in terms of our previous examination of the

precursors of violent behaviour (see Smart et al. 2003), which revealed that the developmental risk factors for such behaviour included aggression as well as lower social skills and poorer emotional control. It is possible that such characteristics in combination with heavy alcohol use and situational factors may facilitate or aggravate the use of violence by these individuals. Thus, crime prevention strategies aimed at improving individuals' functioning in these domains may also have benefits in reducing alcohol use and alcohol-related violence among this particular group of adolescents.

In contrast to the violent-only group, the non-violent only group engaged more frequently in moderate/high use of all types of substances. This finding is particularly noteworthy given that we previously found few differences between the violent-only and non-violent only antisocial groups (Smart et al. 2003). This current finding, in showing that non-violent only adolescents displayed more prevalent substance use than violent-only adolescents, provides an important qualification to this previous finding. It is possible that the stronger association between non-violent only antisocial behaviour and substance use may reflect other research findings that regular substance use results in an increase in property-related crime, perhaps as a means of funding substance use (see Anglin and Perrochet 1998).

The current findings also reinforce the conclusion that violent adolescents are a diverse group. For all types of substances, rates of moderate/high use were much higher among the dual problem adolescents than violent-only adolescents, confirming once again that dual problem adolescents were much more problematic than violent-only adolescents, and further highlighting the difficulties faced by the small group who engage in both non-violent and violent antisocial behaviour. Again, a targeted prevention approach for this group would appear to be required.

While early substance use was a strong risk factor for the development of antisocial behaviour, the pathway from early substance use to antisocial behaviour was uncommon

The current examination of across-time connections between substance use and antisocial behaviour revealed a complex picture. A strong reciprocal relationship between the behaviours was found, where early substance use was a powerful risk factor for the development of antisocial behaviour, and conversely early antisocial behaviour was a strong risk factor for the development of substance use. However, the substance-use only group was small in size (N=28), indicating that while there was a powerful pathway from early adolescent substance use to later antisocial behaviour (since over half later engaged in antisocial behaviour in mid and late adolescence), it was rare. The size of the antisocial-only group on the other hand was larger (N=103), suggesting that the pathway from antisocial behaviour to substance use may be more common. It should also be noted that as substance use was not measured earlier than 13-14 years of age, the possibility that substance use in late childhood may have already exerted an influence on the development of antisocial behaviour cannot be ruled out.

These findings are consistent with previous studies which have found reciprocal across-time relationships between substance use and antisocial behaviour (see Allen et al. 1994; Mason and Windle 2002; Van Kammer et al. 1998). Overall, the current findings are consistent with the view that the relationship between substance use and antisocial behaviour is complex, and that these two types of behaviours may co-occur, and/or precede each other developmentally.

Investigation of the connections between antisocial behaviour and substance use is made difficult by the differing across-time normative trends evident for each behaviour. Epidemiological studies show that the frequency of substance use rises throughout adolescence and peaks in the mid-twenties (Spooner, Hall and Lynskey 2001). In contrast, antisocial behaviour peaks in mid-adolescence and decreases in early adulthood (Baker 1998; Bond et al. 2000).

Thus, it may not be surprising that there were few individuals who used substances in early adolescence without also engaging in antisocial behaviour. Furthermore, these normative trends may influence connections between antisocial behaviour and substance use at differing ages, for example in early adolescence and early adulthood. For instance, given the normative trends, an 'antisocial behaviour only' group could be expected to be small in size in early adulthood relative to a 'multi-substance use only' group. Additionally, given its greater prevalence in late adolescence and early adulthood, there is scope for substance use, and particular types of substance use, to play a more powerful role in the continuation of antisocial behaviour beyond adolescence, or in the late onset of antisocial behaviour. Indeed, as reported earlier on page 16, the late onset group was found to engage significantly more often in all types of substance use than the low/non antisocial and experimental groups, perhaps indicating a role for substance use in the development of antisocial behaviour among this group. Further research is needed to illuminate the across-time relationships between substance use and antisocial behaviour.

Adolescents' own antisocial behaviour and substance use were strongly related to their friends' antisocial behaviour and substance use

The findings revealed strong connections between adolescents' own antisocial behaviour and substance use and their friends' engagement in these behaviours. At 13-14 and 15-16 years, almost all adolescents who engaged in both antisocial behaviour and substance use reported that one or more friends likewise engaged in both behaviours. Sizeable majorities of the multi-substance use only and antisocial only groups also reported that their friends engaged in both behaviours. On the other hand, at both time points the group who engaged in neither behaviour had the highest proportion of friends who also did not engage in

either behaviour. Overall, the results are consistent with the findings of previous studies that have found that there is a strong relationship between peer behaviour and adolescent antisocial behaviour and substance use. The strong links shown here carry implications for prevention strategies and reinforce the potential dangers of grouping problem adolescents together for intervention purposes (see Dishion, McCord and Poulin 1999).

Of particular interest were the differences between the *multi-substance use only* and *antisocial behaviour only* groups. More *multi-substance use only* adolescents than *antisocial only* adolescents reported that their friends engaged in substance use only, while more *antisocial only* adolescents reported that their friends engaged in antisocial behaviour only. However, most adolescents in both groups reported that their friends engaged in both behaviours. Thus for the *multi-substance use only* and *antisocial behaviour-only* groups, the type of problem behaviour in which peers were involved differentiated between these groups only to a limited extent.

The current study, along with many others, has shown that peer associations are powerful risk factors for both antisocial behaviour and substance use. In addition, the current findings demonstrate that there was value in differentiating between the types of problem behaviours in which peers engage. The findings are consistent with those of White (1990), who speculated that different group processes and characteristics might determine whether a group engages specifically in substance use or antisocial behaviour. Furthermore, there may be individual characteristics that determine an adolescent's propensity to associate with specific peer groups. As suggested by Dishion and Owen (2002), close examination of the peer group processes associated with either substance use or antisocial behaviour will be necessary to disentangle the unique and shared risk factors associated with both behaviours.

Many adolescents reported antisocial behaviour and substance use among their friends

The high levels of antisocial behaviour and substance use evident among ATP adolescents' friends were somewhat unexpected. While most persistent and experimental adolescents reported that their friends engaged in antisocial behaviour and substance use, a surprisingly high proportion of low/non antisocial adolescents also reported that their friends engaged in such behaviours. Given that our previous investigations (Vassallo et al. 2002) and the general literature (see Dishion et al. 1995; Dishion and Owen 2002) suggest that antisocial peer affiliations are a particularly strong risk factor for antisocial behaviour and other problem adolescent behaviours, these findings raise an important issue concerning the characteristics and attributes that might protect low/non antisocial adolescents from the influence of such friends.

A preliminary comparison between the low/non antisocial group and the experimental and persistent groups revealed that the latter two groups more frequently reported that all of their friends engaged in antisocial behaviour and substance use, while the low/non antisocial group more often reported that only one or some, but not all, of their friends were involved in such behaviours. Thus, it is possible that having some friends who are not involved in problem behaviours may protect individuals from participating in antisocial behaviour and/or substance use. It is likely that other factors such as relationships with parents (for example, higher parental supervision, more positive parent-child relationship) and school attachment may also reduce the influence of problematic peers. Further research may help to clarify the factors that protect adolescents from the influences of such peer friendships.

In conclusion, strong links between adolescent substance use and antisocial behaviour were revealed by this study.

There was a considerable overlap between the occurrence of antisocial behaviour and substance use at the same point in time. In addition, individuals who engaged in persistent antisocial behaviour from early to late adolescence had the highest rates of all types of substance use, followed by those who engaged in experimental antisocial behaviour, while adolescents who did not engage in antisocial behaviour had the lowest rates of substance use. Investigation of across-time pathways between substance use and antisocial behaviour revealed strong reciprocal pathways between the two types of behaviours. Peers' levels of involvement in antisocial behaviour and/or substance use were closely linked to adolescents' own engagement in such behaviours. The powerful association between antisocial behaviour and substance use found here serves as a reminder that antisocial adolescents frequently experience a wide range of difficulties, underlining the need for broad-based intervention programs that assist these young people in a number of areas of their lives.