

**Substance Use and Mental Health Problems in Young Australians:
A Report to the Alcohol Education & Rehabilitation Foundation
Ltd**

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Overview

The AER Foundation kindly provided funding in 2005 for the study “Substance use and mental health problem in young Australians”. The study aimed to study a large cohort of Australian youth over two time points one year apart, documenting their substance use and how it related to their mental health, attitudes to substance use, and the peer and family influences they experienced about substance use. This document provides a comprehensive report on the project. The authors gratefully acknowledge the support given by the AER Foundation.

- 1) Evaluation of the project results against the project objectives. The present research was funded to:
- Identify or ‘map’ the developmental pathways associated with co-occurring mental health and substance use problems in young people;
 - Examine the patterns of onset, offset, and change in substance use, in populations with distinct mental health vulnerabilities;
 - Examine the motives young people develop for substance use, and how these motives relate to mental health problems (e.g., that substances might aid coping with particular mental health problems they experience). Our preliminary research indicates that motives vary consistent with the mental health profile the individual demonstrates, thus holding implications for the development of effective preventive interventions;
 - Identify emotional and social skill characteristics that are common to, and thus help explain the co-occurrence of, mental health and substance use/abuse behaviours;
 - Identify the role parent, familial, and peer environmental characteristics play in the development and maintenance of substance use/abuse behaviours, the motives for their use, and their co-occurrence with mental health problems;
 - Thus, contribute to the development of early intervention strategies that are informed by research evidence as the most cost effective means of reducing the harmful effects of substance use in Australia.

Outcomes: All of the above goals were achieved. The project successfully recruited and retained a large sample of Australian youth and took measures of substance use, mental health status, motives for using substances, emotion regulation and social skills, and peer and family influences over a one-year period. The results show increase use of substances with age over the year period associated with externalising problems (i.e., aggression, antisocial behaviour, impulsivity) but not with anxiety and depression once their association with externalising problems was controlled. This is the first study to simultaneously assess externalising and internalising problems and substance use in young Australians and show that the relations between anxiety/depression and substance use are in part associated with increased behaviour problems found in adolescents with emotional problems.

Further, the association between externalising problems and substance use held for males and females and was largely mediated by the influences of peers and family. That is, the extent to which mental health problems led to substance use was related to the extent to which the individual had family and friends that used and had positive attitudes to substance use. These results were particularly strong for alcohol and cigarette use; marijuana use was more stable over the 12 month period of the study such that externalising problems and parent and peer attitudes were associated with time 1 use, however, once this pattern of use had been established, stability became the rule whereby patterns of use showed increased stability with little change occurring due to environmental factors.

The results show that adolescence is a key time for the development of substance use problems. As predicted, increased SU was associated with 'outward acting' behaviour problems but once these effects were noted, there was little relationship of SU to anxiety and depression in the sample. The relationship between mental health and SU was largely mediated by the influence of family and friends for both genders and this occurred mainly in early adolescence. These results show that early adolescence is a key window of opportunity for targeting substance use prevention and early intervention programmes to youth, and that these programmes should emphasise the relationships of substance use to impulsive, antisocial behaviour, and peer and family influences.

The following performance indicators were nominated:

- Development of measurement tools (Achieved);
 - Parent and Peer Attitudes Toward Substance Use (PAPA-TSU): The PAPA-TSU (McAloon & Dadds, unpublished)
 - The Emotion Regulation Questionnaire (ERQ) (McAloon & Dadds, unpublished) is a 26 item self report measure designed to assess participant ability to regulate emotion in socially and situationally appropriate terms.
- Establishing partnerships with NSW school systems (Achieved);
 - Ethics approval and individual school testing completed.
- Development of full research protocol and ethics approvals (Achieved);
- Recruitment of target sample size (Achieved);
- Present state-of-the-art drug education information to schools in return for participation (Achieved) – each participant school received an individually tailored report setting out confidential information on substance use rates across age and gender in their school;
- Feedback data to key agencies that will contribute to curricular developments on alcohol and drug education within schools (Achieved and ongoing);
- Disseminate present research to the development of evidence-based and assessable preventive intervention programmes (Ongoing).

Other reporting information

- Overview of the evaluation methodology implemented to assess the outcomes and processes of the project: The project was based on measuring adolescent SU and mental health, and a range of possible mediating variables at two time points one year apart. This was achieved with good sample sizes, retention rates, and all measures successfully utilized.
- Enduring benefits of the project addressing key questions around the development of alcohol problems, prevention strategies and policy in relation to youth: Dissemination of the project findings is underway through scientific papers and presentations to local and international research, policy and practitioner forums.
- A copy of any project material produced such as articles in peer reviewed journals and educational materials for schools: Attached.
- The research paper entitled "Substance use and mental health problem in young Australians" follows.

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5.0 REFERENCES

Alcohol, tobacco and marijuana are the three substances most often used by adolescents (Young, Corley, Stallings, Rhee, Crowley and Hewitt, 2002; Sutherland and Shepherd, 2001; Gledhill-Hoyt, Lee, Strote and Wechsler, 2000; Johnston, O'Malley & Backman, 2000). Evidence from the United States, Britain and Australia consistently indicated an increase in the use of each substance as adolescents increased in age (Young et al, 2002; Guo, Hill, Hawkins, Catalano and Abbott, 2002; Gledhill-Hoyt et al, 2000; Hawkins, Kosterman, Maguin, Catalano, and Arthur, 1997). Several large longitudinal studies assessing substance use in normative samples have been undertaken in the United States (Grant, 1996; Johnston et al, 2000), Great Britain (Meltzer, Gatward, Goodman and Ford, 2000), and Australia (Australian Institute of Health and Welfare 2005), and earlier evidence from the US pointed to an increase in adolescent use of both alcohol and marijuana in the ten years prior to data collection, and a decrease in the use of tobacco over the same period (Young et al, 2002; Hawkins et al, 1997).

One large study undertaken in the United States, The Monitoring the Future Study (MTF), was funded by the National Institute of Health and has collected normative adolescent substance use data since 1975. The MTF study (Johnson et al, 2000) indicated that between 70% and 80% of 10th and 12th graders and 52% of 8th graders had any experience of alcohol use. Participant report indicated that 25% of 8th graders, 49% of 10th graders, and 62% of 12th graders had been had been intoxicated as a result of alcohol use, a rate that demonstrated stability within age cohort over the previous decade (Johnson et al, 2000). However, more recent indications from the MTF study (Johnston, O'Malley, Bachman, & Schulenberg, 2006), suggested a continuing decline in 30-day prevalence of alcohol and cigarette use across 8th, 10th and 12th grade students, and a decline in 12 month prevalence of marijuana use in the same sample over the last decade.

One English study drawing on a normative sample of 9742 adolescent school pupils reported that 5.1% of their sample of 11 year olds, and 36% of their sample of 16 year olds were drinking on a weekly basis (Sutherland and Shepherd, 2001). A second study from the UK and Wales, reported that 30.3% of males and 26.4% of females aged 13 reported past weekly use of alcohol, a figure that rose to 75.3% and 72.0% respectively by age 18 (Parker and Egginton, 2002). Of note, changes in patterns of use of these three substances are not characterised by displacement effects. For instance, an increase in the use of Marijuana has not generally been shown to signal a decrease in the use of alcohol (Johnson et al, 2000).

First results from the Australian Institute of Health and Welfare 2004 National Drug Strategy Household Survey (Australian Institute of Health and Welfare 2005) indicated that 3.3% of males and 3.2% of females aged between 12 and 15 years reported weekly alcohol use. The same study reported that 21.9% of males and 21.3% of females aged between 16 and 17 years, and 51.5% of males and 39.1% of females aged between 18 and 19 years reported weekly use of alcohol. Somewhat surprisingly, in a comparison of levels of use in the US and Australia, Maxwell (2001) presented evidence suggesting that while 70.3% and 70.7% of Australian males and females aged 14-19 years respectively reported past year use of alcohol, only 51.6% and 50.3% of males and females in the same age group from the US reported past year use of alcohol. This anomaly must, in part, be due to different legal drinking ages between the two countries.

Evidence from the Monitoring the Future (MTF) studies (Johnson et al, 2000) suggested that adolescent tobacco use was at its highest in the US in 1997 with 65% of 12th graders, 60% of 10th graders, and 47% of 8th graders reporting lifetime use of cigarettes. Sutherland and Shepherd (2001) reported nicotine was the second largest substance used by adolescents, and was significantly more prevalent in females than males (13.7% and 9.5% respectively). 4.8% of 11 year olds and 24.1% of 16 year olds in Sutherland and Shepherd's sample reported regular use of tobacco. First results from the Australian Institute of Health and Welfare 2004 National Drug Strategy Household Survey (Australian Institute of Health and Welfare 2005)

indicated that 2% of males and 2.6% of females aged between 12 and 15 years reported daily tobacco use. The same study reported that 2.1% of males and 1.3% of females aged between 16 and 17 years, and 2.6% of males and 2.3% of females aged between 18 and 19 years reported weekly use of alcohol. Overall, fewer than one in twelve people aged 12 – 19 years that participated in this study reported daily tobacco use, and 16 – 17 year old females were almost twice as likely as same age males to use tobacco on a daily basis (Australian Institute of Health and Welfare, 2005)

Marijuana remains the most widely used illicit substance in the US, Britain and Australia (Young et al, 2002; Miller & Draper, 2001; Degenhardt, Hall and Lynskey, 2001; Maxwell, 2001, Sutherland and Shepherd, 2001). One study drawing on a normative sample of 15 043 high school students in the US reported that the 30-day prevalence rate for marijuana rose from 13% to 16% between 1993 and 1997 (Gledhill-Hoyt et al, 2000). The MFT study (Johnston et al, 2006) offered support for these findings suggesting that marijuana was most easily assessable to 8th, 10th and 12th grade students between 1996 and 1998, but that use was at its height for 8th grade students in 1996, and for 10th and 12th grade students in 1997. Results from the British Crime Survey from the UK and Wales suggested that cannabis use at age 12-13 stood at 14.6%, and by the age of 18 rose to 48.0%. In a similar study also from the UK, cannabis use at age 12-13 stood at 14.6%, and by the age of 18 rose to 48.0% (Parker and Egginton, 2002). First results from the Australian Institute of Health and Welfare 2004 National Drug Strategy Household Survey (Australian Institute of Health and Welfare 2005) indicated that 24.9% of males and 26.2% of females aged between 14 and 19 years had ever used cannabis, and that 18.4% of males and 17.4% of females aged between 14 and 19 years reported use of cannabis in the last year. Overall, over one quarter (25.5%) of Australian adolescents aged between 14 and 19 years (Australian Institute of Health and Welfare 2005) and 39.1% of Australians aged 14 years and over (Miller and Draper, 2001) reported having used cannabis in their lifetime.

Comparisons of lifetime and past year use between 14–19 year old adolescents from Australia and the US suggest that 44.6% and 44.8% of Australian males and females respectively report lifetime use of marijuana compared with 31.7% and 28.4% of males and females in the US (Australian Institute of Health and Welfare 2005). Past year rates of use varied to a similar extent with 35% and 34.2% of Australian males and females respectively reporting past month use of marijuana. 25.4% and 21.9% of male and female participants in the US reported past month use of marijuana (Maxwell, 2001). It is noteworthy that while 48% of Australians who had ever smoked marijuana by 1998 continued to do so in 1998, only 26% of participants in the US who had ever smoked marijuana by 1998 continued to do so in 1998 (Maxwell, 2001)

Given the high levels of lifetime, past year, and past month use for each of these substances, some authors have suggested that some level of experimental use may be viewed within a developmental context (Young et al, 2002). However, Substance Use Disorders (SUDs) remain prevalent, and are necessarily distinguishable from experimental or developmentally appropriate use. In addition, gender patterns of prevalence suggest that males are more likely (Maxwell, 2001; Sutherland and Shepherd, 2001) or no less likely (Young et al, 2002) to use alcohol or marijuana than females. One noteworthy exception to this finding was for female Australian adolescents aged 14 – 19 who reported more lifetime use of marijuana than males of the same age (Australian Institute of Health and Welfare 2005). Generally, results by gender also suggest that females are more likely to use nicotine than males (Young et al, 2002, Gledhill-Hoyt et al, 2000; Sutherland and Shepherd, 2001).

Importantly, the use of substances has been demonstrated to differ across ethnic and racial groups. Generally, White adolescents or adolescents of European decent appear to consume more alcohol than either Black (Guo et al, 2002), Hispanic (Chen, Bauman, Rissel, Tang, Forreo and Flaherty, 2000; Warner, Canino and Colon, 2001), Asian (Guo et al, 2002)

or South African coloured (Flisher Parry, Evans, Muller and Lombard, 2003) adolescents, both in terms of 30-day prevalence and in terms of binge drinking. White adolescents in the US were also significantly more likely than Black and Hispanic adolescent students to report frequent cigarette use (Chen et al, 2000). In addition, they reported later onset of use, and a decline in rates of use since the 1970s (Chen et al, 2000). Both Australian Aboriginal and New Zealand Maori have been shown to smoke at markedly higher rates than European Australians and European New Zealanders respectively (McGee, Williams and Stanton, 1995; Forero, Bauman and Chen, 1998)

The increase in prevalence of use of marijuana between 1993 and 1997 held for all in a large US sample except Hispanic students for whom it decreased (Gledhill-Hoyt et al, 2000). However contrary findings have been reported (Valois, McKeown and Garrison, 1995; Brindis, Wolfe and McCarter, 1995). Again, White adolescents or adolescents of European decent appear to consume more illicit substances than either Black (Chen et al, 2000; Geldhill-Hoyt et al, 2000, Guo et al, 2002), Hispanic (Chen et al, 2000; Warner et al, 2001), Asian (Guo et al, 2002) or coloured (Flisher et al, 2003) adolescents. Of note, adolescents of Asian descent are commonly reported as having the lowest rates of substance use (Graham, Johnson and Hanson, 1990; Guo et al, 2002, Chen et al, 2000). This finding is extended by evidence from New South Wales that the prevalence of both licit and illicit substance use was significantly lower in adolescents from homes that spoke a language other than English, as opposed to those from homes from which the language spoken was English. The only exception to this rule was for solvent sniffing (Chen et al, 2000).

1.1 Age of Initiation Into Substance Use

The age at which people begin use of different substances has the potential to inform both the trajectory of substance use (Joun, Ensminger and Sydnor, 2002; Angold, Costello & Erkanli, 1999) as well as its outcome (Kosterman, Hawkins, Guo, Catalano & Abbott, 2000) and associated pathology (Kessler, 2004; Angold et al, 1999). However, despite this, accurate age of initiation into substance use data drawn from normative or population samples is relatively rare. Age of initiation into Alcohol Use has been shown to be significantly related to a range of differential outcomes including elevated rates of Alcohol Use Disorders (AUDs) (McGue, Iacono, Legrand, Malone & Elkins, 2001; Grant & Dawson, 1997) number of drinks typically consumed (York, Welte, Hirsch, Hoffman & Barnes, 2004), peak blood alcohol level attained during drinking episode (York et al, 2004), alcohol related co-morbid pathology (York et al, 2004; Wienberg, 2001; McGue et al, 2001), and indices of dis-inhibitory behaviour (McGue et al, 2001; Kessler, 2004).

Similarly, age of initiation into use of substances other than alcohol has been shown to be related to differential outcomes in terms of SUDs (Sung, Erkanli, Angold & Costello, 2004; Wienberg, 2001), poly-drug use (Ellickson, Tucker, Klein & Saner, 2004), school problems (Ellickson et al, 2004; Hawkins, Catalano & Miller, 1992), low academic intentions (Ellickson et al, 2004) and CD (Sung et al, 2004). Evidence suggests that depression in boys and anxiety in girls may generally be associated with age at first use (Sung et al, 2004), however this finding has been the subject of recent debate and may not hold for the association between cannabis and affective or anxiety disorders (Degenhardt et al, 2001). Initiation of substance use other than alcohol has been shown to be predicted by peer use (Coffey, Lynsky, Wolfe & Patton, 2000; Hawkins et al, 1992), daily cigarette use (Coffey et al, 2000), frequent or high dose alcohol use and anti social behaviour (Coffey et al, 2000), parental substance abuse and social problem solving deficits (Kaplow, Curran, & Dodge, 2002).

Data from a large US normative sample suggested that the mean age of initiation into alcohol use in the US was 16.83 years, 15.73 years for males and 17.92 for females (York et al, 2003). In a second study from the US that drew on self report data gathered from public school students, participants (with a mean age of 17.7 years) were divided into early (age 10-12years) and late (age 13+) age of alcohol use onset. Early onset drinkers were significantly

more likely than later onset drinkers to drink once per week, drink six or more standard drinks in a single sitting, or to get drunk once per week. In addition, early drinkers evidenced greater tolerance to alcohol, more blackouts as a result of drinking, greater alcohol dependence, more treatment, or more drinking related problem behaviour (Gruber, DiClemente, Anderson & Lodico, 1996). The National Household Survey on Drug Abuse (Substance Abuse and Mental Health Services Administration, 2000, 2005) offered evidence that age of first use of alcohol was younger than that reported by York et al, (2003). They reported the mean age of initiation into alcohol use for their sample was 14.9 years for males and 15.3 for females, the mean age of initiation into tobacco use was 14.9 years for males and 15.6 for females, and the mean age of initiation into marijuana use, 15.9 years for males and 16.1 for females (Substance Abuse and Mental Health Services Administration, 2000). Between the years of 1993 and 2003, the total number of high school students reporting life-time use of marijuana had decreased in a linear fashion from 26.7% to 22.4%.

Recent Australian statistics (Australian Institute of Health and Welfare, 2005) suggest a marginal delay in age of initiation into alcohol, cigarette and marijuana use between 2001 and 2004. In 2001, a survey of Australians aged 14 years and over suggested that the mean age of initiation into alcohol use was 17.1 years, the mean age of initiation into tobacco use was 15.5 years, and the mean age if initiation into marijuana use was 18.5 years. Little variation in 2004 data, which included individuals aged 12 and 13 years of age, was apparent. The mean age of initiation into alcohol use was 17.2 years, the mean age of initiation into tobacco use was 15.9 years, and the mean age of initiation into marijuana use was 18.7 years.

The Australian data for age of first use of alcohol, cigarettes and marijuana are interesting in the light of similar findings from South Africa that suggest adolescents there are initiated into substance use at younger ages than their Australian peers. One study from South Africa reported that the mean age for alcohol use was 15.33 years and the mean age of initiation into tobacco use was 14.54 years (Madu & Matla, 2003). The South African study also found that the mean age of initiation into use of any illicit substance was 14.9 years. However responses to this question related to any illicit drug and not simply to the age of first use of marijuana. The results of this study were not split by ethnicity.

1.2 Co-morbidity

Within the context of psychopathology, a large body of evidence documents a shared aetiology between distinct forms of psychopathology, including substance use problems. The term co-morbidity offers an account of this co-occurrence of psychiatric disorders within the same individual (Armstrong & Costello 2002; Kessler, 1995; Angold et al, 1999; Glantz, 2002). Defining the term co-morbidity and accounting for the co-occurrence of psychiatric disorders remain among the greatest and most recently embarked upon challenges in the theory and practice of psychiatric medicine. The vast majority of research undertaken on the subject of co-morbidity did not occur until late in the 20th century and was, by-en-large, undertaken with treatment or clinical samples (Angold et al, 1999; Kessler, 1995). There is little need to underscore the necessity of undertaking treatment research in clinical samples. It is of immense importance in terms of advancing the ability of diagnosis to accurately reflect the aetiology, nature and course of pathology (Kendler, Davis & Kessler, 1997; Angold et al, 1999; Wilens, Biederman, Abrantes & Spencer, 1997) as well as advancing the efficacy of treatment as it seek to engage and ameliorate complex illness (Rivers, Greenbaum & Goldberg, 2001).

Treatment samples, however, do not accurately reflect characteristics inherent in normative or population samples. Epidemiological research may not appropriately be undertaken in treatment samples given the high association between co-morbidity and professional help seeking (Lilienfeld, 2003; Kessler, 1995). Normative samples are necessary in the interests of assessing frequency, type, type of association, and trajectory of illnesses characterised by more than one psychiatric concern (Lilienfeld, 2003; Angold et al, 1999;

Kessler, 1995). The earliest qualitatively based descriptions of co-morbid psychiatric disorders in the general population did not appear in the literature until 1987 (Angold et al, 1999) when two separate papers sought to gauge the prevalence of psychiatric disorders in normative adult (Anderson, Williams, McGee & Silva, 1987) and adolescent (Kashani, Beck, Hooper, Fallahi, Corcoran, Macallister, Rosenberg & Reid, 1987) samples. From these papers emerged an understanding that a substantial proportion of psychiatric patients were found to carry more than one diagnosis (Wolf, Schubert, Patterson, Grande, Brocco & Pendelton, 1988).

Two more recent studies, the Epidemiologic Catchment Area Study (ECA) (Robins and Price, 1991), and the National Co-morbidity Survey (NCS) (Kessler, McGonagale, Zaho, Nelson, Hughes, Eshman, Wittchen, & Kendler, 1994; Kessler et al, 1994) described the extent of co-morbidity among both clinical and normative samples and suggested that co-morbidity is more the norm rather than the exception. Over 54% of ECA respondents with a lifetime history of one DSM III disorder were found to have had a second diagnosis as well. In addition, 52% of lifetime alcohol abusers, and 75% of lifetime drug users were found to have additional DSM diagnoses (Robins et al, 1991, Kessler, 1995).

A similar pattern of results were found in the NCS, which utilised the DSM III R instead of the DSM III. 56% of NCS respondents who received a lifetime diagnosis of one DSM III R disorder were found to have had one or more other disorders. In addition, 52% of respondents with a lifetime history of an AUD were found to have had a second DSM III R diagnosis, and 59% of respondents with a illicit SUD diagnosis had also been diagnosed with some other DSM III R disorder (Kessler, 1994). When odds ratios were calculated for co-morbidity between any two disorders in both the ECA and NCS studies, almost every ratio was greater than 1. The implications, therefore, are that there is almost always a positive association between the lifetime occurrence of nearly every pair of disorders (Kessler, 1994).

Kessler & Price (1993) suggested four possible causal pathways in their attempt to account for the co-occurrence of different psychiatric disorders within any given individual. The first of Kessler and Price's pathways concern the development of a second disorder as a direct result of the onset of the first disorder. The second and third hypothesised pathways concern the development of a second disorder as an indirect consequence of an earlier disorder. In the second, the co-morbid disorder results from the indirect consequences of its predecessor. In the third, the indirect consequences that predispose the individual are specifically contextual or situational. Finally, Kessler and Price suggest that it may be possible to identify common causes for the two disorders as they occur co-morbidly. In this manner, some characteristic of the individual or their environment may be identified as causal in the development of both disorders.

Models such as Kessler and Price's are important for a number of reasons. There are obvious individual, social and economic benefits in being able to identify people at risk for the development of co-morbid psychiatric illness prior to onset of the illness. In addition, the prevention of co-morbid disorders may eliminate the exacerbation of symptoms of the initial disorder that often seem to accompany co-morbidity (Kessler & Price, 1993). However, models such as the one illustrated above remain a heuristic, a important and necessary beginning in attempting to account for mechanisms causal in the development of specific co-morbid psychiatric illness. For example, when considered specifically in relation to co-morbid psychopathology and substance abuse, the explanatory power of such models diminishes rapidly. The hypothesised pathways lack the precision necessary to give any adequate account of the process of causality or the complexity of the mechanisms that may be involved in this process.

Angold, Costello and Erkanli (1999), Weiss, Susser and Catron (1998), Kessler (1995) and Lilienfeld (2003) all offer excellent descriptions of, and contributions to, thinking on the subject of co-morbidity. One concern central to their accounts of psychiatric co-morbidity is that disorders of a psychiatric nature are not yet conceivable as discrete or distinct illnesses in

the same manner that physical illness is (Angold et al, 1999; Weiss et al, 1998). In more clearly delineating the nature of psychiatric illness within the context of co-morbidity, psychiatric research has the potential to delineate diagnostic parameters that more appropriately account for the reality of covariance within and across psychiatric illness (Kessler, 1995) rather than risking the maintenance of diagnostic systems that is characterised by overlap and therefore inaccuracy (Angold et al, 1999). Regardless, a number of important themes have already emerged with regard to the co-morbidity of psychiatric illness.

The literature remains unclear on the appropriateness of adhering to classifications within, as opposed to across, diagnostic category. There has been concern that both shared modes of assessment and/or shared diagnostic criteria may be implicated in the appearance of co-morbid illness (Kessler, 1995; Lilienfeld, 2003). In addition, classifications within a diagnostic category (for instance dysthymia and Major Depressive Disorder as mood disorders) may suggest continuity in the manifestation of an underlying or broadly based pathology that remains relatively stable (Angold et al, 1999; Lilienfeld, 2003) and, as such, have been termed homotypic (Angold et al, 1999). By contrast, classification across different diagnostic categories (for instance across mood and SUDs) may suggest differential manifestation of a common underlying or broadly based pathology (Lilienfeld, 2003; Bahr, Maughan, Marcos & Li, 1998) or may be indicative of the presence of distinct underlying concerns (Angold et al, 1999).

The issue of the temporal relation between illnesses is also of importance. Again, the notion of homotypic versus heterotypic illness is important. Appearance of homotypic illnesses across time may be indicative of underlying concerns altogether distinct from the appearance of heterotypic illness across time (Angold et al, 1999; Kessler, 1995; Lilienfeld, 2003; Bahr et al, 1998). However, further caution is warranted, for instance within the classification of heterotypic illness. An earlier illness, for instance an adolescent affective illness, may most appropriately be conceived of as a marker of risk for, but not necessarily as a factor causal in, the appearance of an adult affective illness (Kovacs, 1996). As one would expect, stronger associations within diagnostic class would be expected than those in evidence across diagnostic class (Kessler, 1995), although the degree of association within different diagnostic classes has been shown to vary depending on diagnostic class (Robins & Price, 1991; Kessler et al, 1994). Another factor central to discussions on the temporal relation between psychological disorders concerns the sequencing of illness. Disorders may demonstrate episode co-morbidity (Kessler, 1994) whereby co-occurring disorders may have a common temporal onset or may demonstrate distinct times of onset but concurrent presentation for the purposes of assessment or treatment. A third possibility exists, that discrete psychiatric illnesses may appear at entirely distinct points in across a lifetime (Kessler, 1995; Angold, 1999). Regardless, the temporal relation between illnesses offers important information with regard to their causality, relation, trajectory and treatment.

The distinction between primary and secondary disorders has also been used to account for psychiatric illness. However, as Angold et al (1999) point out, the generalisation of this terminology from medicine to psychiatry is misplaced. In medical nomenclature, a secondary physical illness is caused by a primary one, and Lilienfeld (2003) offers good account of the range of reasons such causality may occur. Angold et al's (1999) point that neither of the more commonly co-occurring psychiatric illness have been demonstrated to be causal of their pair is well taken. Despite the strong body of evidence that SUDs indicate, or are strongly indicated by, affective or anxiety disorders (Abrams, Kushner, Medina, & Voight, 2002; Allen & Frances, 1986) little evidence for this position was found in either the NCS (Robins and Price, 1991) or NCA (Kessler et al, 1994) studies. One possible account for this anomaly may be that self-medication is only effective in the short term, thereby returning a relatively small odds ratio between the anxiety/affective disorders and SUDs (Kessler, 1994; Stockwell, Smail, Hodgson, Canter, 1984).

In addition to elucidating the epidemiology of psychiatric co-morbidity, a number of questions fundamental to future research quickly emerge. For instance, in building a sufficiently detailed picture of the nature of co-morbidity, it is essential to clarify not only which but also why various symptoms that group together to form co-morbid clusters or disorders group as they do (Angold et al, 1999; Bahr, Susser & Catron; 1998). It is also essential to investigate why it is that certain disorders appear as specific symptoms in some individuals, as non-specific symptoms possibly accompanying additional disorders or symptoms in other individuals, and appear as single or unitary entities in still other individuals (Angold et al, 1999). It has been further suggested that certain non-specific genetic factors may underlie broad commonalities across disorders while environmental factors serve as determinants of particular characteristics of distinct disorders (Kendler, Heath, Martian & Eaves, 1987).

Building on the work of Ingram & Kendall (1987) Bahr and colleagues (1998) offered an attractive model for characterising common and specific features of psychopathology. They differentiate common features (which distinguish psychopathology from normality) with broadband-specific features (which distinguish Internalising Disorders from Externalising Disorders) and narrowband-specific features (which account for diagnostic classifications within the broadband groupings, for instance Major Depressive Disorder as distinct from dysthymia within the broadband of internalising disorders). A model of this nature has obvious attraction in relation to the relatively broad manifestation of psychopathology evidenced in childhood and adolescence (Lilienfeld, 2003, Bahr et al, 1998). Substantive concerns remain however, not least of all those in regard to the developmental relationship between the conceptual spheres of Internalising Disorders (IDs) and Externalising Disorders (EDs) (Lilienfeld, 2003; Frick, Lilienfeld, Ellis, Loney & Silverthorn, 1999).

1.3 The Co-occurrence of Adolescent Psychopathology and Substance Use

Epidemiological studies report high rates of co-occurrence between problems of substance use and psychopathology (Armstrong & Costello, 2002; Weinberg & Glantz, 1999; Kandel, Johnson, Bird, Canino, Goodman, Lahey, Reiger & Schwab-Stone, 1997; Kessler et al, 1994; Robins & Price, 1991). Several studies have demonstrated that alcohol, cigarette and marijuana use among adolescents is associated with increased likelihood of diagnosis of a substance use disorder and/or another psychiatric disorder even when controlling for a range of sociodemographic characteristics (Degenhardt & Hall, 2003; Rohde, Lewinsohn, Kahler, Seeley, Brown, 2001; Kandel et al, 1997). Importantly, given the age and gender differences apparent in the appearance and diagnosis of individual IDs and EDs, the rates of prevalence found in SUDs that co-occur with additional diagnoses may be artefacts of the epidemiological characteristics of one or the other, and not indicative of a co-morbid illness per se (Glantz 2002).

Individuals not reporting alcohol use in the previous 12 months were less likely to report use of a range of licit, illicit, and prescription substances whereas, of those reporting AUDs, approximately half reported regular tobacco use, approximately one third cannabis use, and 15% other drug use (Degenhardt & Hall, 2003). Studies of adolescents have reported similar findings (Glantz, 2002, Sung et al, 2004) with evidence that psychiatric morbidity co-varies with SU among adolescents across all forms of psychopathology (Boys, Farrell, Taylor, Marsden, Goodman, Brugha, Bebbington, Jenkins, Meltzer, 2003; Sung et al, 2004). The association between substance use and particular disorders has been found to vary as a function of gender (Sung et al, 2004; Kandel, et al, 1997) with adolescent males typically demonstrating more substance use problems than females but adolescent females demonstrating higher levels of concurrent, homotypic and hetrotypic continuity than males (Costello et al, 2003). These findings lend weight to the notion that multiple etiological paths are implicated in developmental trajectories toward co-occurring substance use problems and psychopathology.

Evidence further suggests that the timing of onset of psychopathology or substance use may be instrumental in the development of such problems. Distinct patterns of development are identifiable, with particular forms of psychopathology commonly implicated in the development towards substance use problems, or as the developmental result of particular substance use problems (Glantz 2002). In temporal terms, a range of child psychopathology has been seen to precede the association with early onset adolescent substance use (Glantz, 2002), however this pattern of development may, in part, be due to the possibility that levels of substance use that result in clinical concern remain higher or are harder to detect than those that would result in the clinical attention for other problems, for instance the appearance of disruptive behavioural disorders (Angold et al, 1999).

Studies have clearly demonstrated that, in terms of association, an adolescent who has used one type of substance is at increased risk of using another type of substance (Boys et al, 2003; Armstrong & Costello, 2002; Degenhardt, Hall & Lynskey, 2001a; Hanna, Yi, Dufour, & Whitmore, 2001; Coffey et al, 2000), and a solid body of evidence attests to the relation between early substance use and the development of later substance use problems (Angold et al, 1999; Gruber et al, 1996). A developing literature further suggests that adolescent use of cannabis may precipitate or exacerbate a range of substance use and mental health related problems, most notably disorders characterised by psychotic illness (Arseneault, Cannon, Witton, & Murray, 2004); Hall, Degenhardt, & Teeson, 2004; Coffey et al, 2000). However, the mechanisms that underlie such an association are not well understood. Importantly, there is no evidence to suggest that, between middle adolescence and early adulthood, depressive disorders, anxiety disorders or Conduct Disorder (CD) have any influence on substance use, once first use has occurred (Brook, Cohen, & Brook, 1998).

One of the most robust predictors of later substance use problems has been age of first use (Sung et al, 2004; Gruber et al, 1996, Grant & Dawson, 1997). The risk of adult substance use problems has been shown to be linearly related to age of first use, with problems for those whose onset of use was prior to age 13 being twice as high as for those whose onset of use was after the age of 17 (Anthony & Petronis, 1995). Irrespective of their age of first use, the time delay between age of first use and development of problem use in participants identified as having substance use problems was approximately four years (Sung et al, 2004; Anthony & Petronis, 1995). A shortage of prospective studies remains thereby inhibiting the potential to draw comparisons of outcome of early versus late adolescent use, the relation between age of onset and the age of the population under study, and length of delay between first use and development of disorder (Hanna et al, 2001; Anthony & Petronis, 1995).

Importantly, mechanisms underlying the relation between age of first use and later substance use problems remain unclear. The notion that a delay in age of first use would delay the development of later substance use or psychopathology problems has been popular and has driven prevention research and policy for the past twenty years (Sung et al, 2004). However, it remains unclear whether the mechanism underlying the association between age of first use and the development of later problems is the age at which first use took place, or the period of time between age of first use and current age (Sung et al, 2004). The distinction is important given evidence that delay in first use from 10-12 years until after 12 years significantly reduces later alcohol use and dependence problems (Gruber, 1996; Anthony & Petronis, 1995).

Research has also sought to address the predictive ability of psychiatric illness and/or substance use in adolescence and associated outcomes in terms of adult substance use and psychopathology. The evidence in this regard is mixed with some research suggesting that adolescent substance has no predictive ability into adulthood (Brook et al, 1998) and other evidence pointing to the ability of psychopathology and behavioural problems in adolescence to prospectively predict level of, and change in, alcohol and marijuana use in adulthood (White, Xie, Thompson, Loeber, & Stouthamer-Loeber, 2001). In their review of normative

literature, Armstrong & Costello (2002) found no evidence of substance-specific co-morbidity, however evidence from the Dunedin longitudinal study supported previous findings of the increasingly high association between psychopathology and tobacco use such that adolescent tobacco use may lead to later pathology (McGee, Williams, Poulton, & Moffitt, 2000; Brook et al, 1998). Indeed, it has been suggested that the relationship between adolescent psychiatric illness and drug use can primarily be explained by regular smoking and to a lesser extent regular cannabis use (Boys et al, 2003). This finding is consistent with previous research indicating that the primary causal direction among adolescents is from mental illness to marijuana use whereas in adulthood it is in the opposite direction (McGee et al, 2000; Brook et al, 1998).

Treatment samples have generally been used to generate data on the subject of the diagnostic co-morbidity between substance use and the co-occurrence of psychiatric illness (Glantz, 2002; Armstrong & Costello, 2002) and a number of clear indicators have emerged from treatment populations on this co-occurrence. For instance, with regard to psychopathology, low self-esteem, depression, anti-social behaviour, rebelliousness, aggressiveness, crime, delinquency, truancy and poor school performance, CD, anxiety disorders, suicide and ADHD have all been associated with adolescent substance use in diagnostic studies (Armstrong & Costello, 2002; Angold et al, 1999). While treatment samples remain essential in informing issues related to treatment, they risk offering skewed data concerning the prevalence, co-occurrence, sequence and factors of risk of co-occurring mental illness (Glantz 2002).

While distinctions about trajectories into substance use have commonly been made on the basis of the substance in use, or the age at which use has occurred, it is appropriate, in the present context, to draw a distinction on the basis of the psychopathology that co-occurs with the substance use problem, or characteristic features of the individual in question. Adolescent psychopathology has commonly been differentiated on the basis of whether the disturbance is characterised primarily by internalising features (including depression, anxiety, withdrawal, and eating disorders) or externalising features (including aggression, oppositional disorders, delinquency, and school problems) (Leadbeater, Kuperminc, Blatt, Hertzog, 1999; Achenbach, 1991). A solid literature attests to the validity, and the theoretical and functional utility of drawing distinctions between internalising and externalising features (De Groot, Koot, Verhulst, 1994; Hartman, Hox, Auerbach, Erol, Fonseca, Mellenbergh, Novik, Oosterlaan, Roussos, Shalev, Zilber, & Sergeant, 1999; Achenbach, 1995). However, there is also good evidence of a co-occurrence between IDs and EDs in adolescents (Lilienfeld, 2003; Leadbeater et al, 1999; Angold & Costello, 1995; Nottelmann & Jensen, 1995).

In normative, as opposed to treatment samples, relatively little incidence of diagnosable pathology may be expected. However, internalising and externalising profiles may be accounted for on the basis of scores generated on these two dimensions. A number of recent studies drawing on normative samples have contributed to a greater understanding of the co-occurrence of substance use and mental health problems as they occur at a population level (Armstrong & Costello, 2002, Boys et al, 2003; Kashani et al, 1987). ECA data (Robins and Price, 1991) suggest the majority of psychopathology, when measured at a population level, has an age of onset prior to age twenty. The age of onset of co-morbid psychopathology is less clear (Christie, Burke, Regier, Rae, Boyd, & Locke, 1988). A recent meta-analysis undertaken on community studies of adolescence and substance use suggested that some 60% of adolescents with a substance use, abuse or dependence problem met criteria for a second psychiatric diagnosis (Armstrong & Costello, 2002; Glantz 2002). Generally, dual diagnosis is associated with increased severity and persistence of substance use and mental health problems, with stronger associations being demonstrated between externalising problems and substance use problems than between internalising problems and substance use (Kessler, 2004)

1.4 Externalising Disorders

The relationship between EDs and substance use is well illustrated in the literature. The present discussion however, is limited to two of the most commonly identified externalising disorders, CD and ADHD. CD is characterised by behaviour which disregards the rights of others and violates age and societal appropriate norms (APA, 1994). ADHD has been differentiated into three subtypes, determined by the particular cluster of presenting symptoms. The combined type is characterised by symptoms of inattention and hyperactivity/impulsivity, the inattentive type is characterised by inattentive symptoms alone, while the hyperactive/impulsive type is characterised by symptoms of hyperactivity alone (APA, 1994). While the following discussion is by no means exhaustive, it offers an account of the complexity of the relation between co-morbid EDs and SUDs, the serves to illustrate the role that future research will play in developing a better understanding of this relation.

1.5 Conduct Disorder

Prevalence of CD in the general population has been estimated at between 2% and 6% (Kazdin, 1993; Zoccolilo, 1993). Of note, research has indicated that of children who had been diagnosed with any psychiatric disorder, 70% also met the criteria for a diagnosis of CD (Rutter, Tizard, Yule, Graham and Whitmore, 1976). CD is more often diagnosed in boys than in girls (Kashani, et al, 1987) however estimates of the ratio vary. Kazdin (1997) suggests that boys are 3-4 times more likely than girls to display CD, however Forehand and Long (1988, cited in Dadds, 1996) suggest that of those referred for conduct problems, about two thirds were boys. Age of onset varies across development with more adolescents meeting criteria than children, and a greater proportion of girls meeting criteria for diagnosis in adolescence than in childhood (Kazdin, 1997). Median age of onset in boys has been reported prior to ten, whereas median age of onset for girls is reported at between 14 and 16 (Kazdin, 1997, Kashani et al, 1987). Earlier diagnosis of CD is associated with poorer prognosis (Dadds, 1996).

The evidence for a biological predisposition to CD is conflicting (for instance Dadds, 1996; Dodge, 2000). Some evidence for differences in psychological and neurological organisation of conduct disordered people has been gathered (Craig and Pepler, 1997) however there seems little which can be described as causal in the absence of interaction with environmental factors (see Dodge, 2000 for a review). It has been noted that being born male may be described as a risk factor for CD (Dadds, 1997), and twin studies demonstrate concordance rates of 87% in monozygotic twins and 72% in dizygotic twins (Polmin, 1991).

Temperamental difficulties have been implicated in CD. For instance, maternal ratings of infant temperament were shown to predict (al-be-they modestly) child externalising behaviour problems as rated by teachers (Bates, Pettit, Dodge and Ridge, 1997 cited in Dodge, 2000). In addition, ratings of Behavioural Inhibition and Behavioural Activation have been found to predict nervousness in response to punishment and happiness in response to reward (Carver and White, 1994). However, while some infants may demonstrate increased activity, problem sleeping, hyper-persistent behaviour and behavioural under-control (Dadds, 1996; Sher et al, 1991; Dodge, 2000) these temperamental difficulties are themselves related to parental adjustment and are indicative of high punitive/low nurturant discipline strategies which may characterise the early development of behaviour problems (Dadds, 1996).

Attachment relationships (characterised in the research by maternal negativity, maternal affection and warmth) have been found to influence prevalence of conduct problems although the findings are at best moderate (Dodge, 2000). However, parenting factors represent an area of greater potential in understanding risk for development of subsequent CD. Consistent with Patterson's Coercive Family Process Theory (Patterson, 1982), inconsistent and harsh discipline utilising physical punishment, and attendance to negative behaviour have clearly been defined as factors of risk for later CD (Farrington, 1993; Dodge, 2000; Dadds, 1996). Social information processing, attendance to cues, attribution of hostile intention, and lack of

behavioural interpersonal problem solving strategies have all been implicated as resulting from hostile home environments.

Environmental factors also have the potential to place children and adolescents at risk for conduct problems. Societal factors including low Socio Economic Status (SES), overcrowding at home or in schools, poorly resourced homes and schools, unemployment, ethnic heterogeneity, high residential mobility, social isolation and social disempowerment have all been implicated in the development of CD (Kazdin, 1997; Dodge, 2000; Dadds, 1996).

Parental psychopathology, criminal behaviour, poor child monitoring and substance use have also been demonstrated as factors of risk for later development of CD (Frick et al, 1999; Dadds, 1996; Kazdin, 1997, Dodge 2000). For instance, maternal depression resulted in a greater degree of child criticism than did the behaviour of non-depressed mothers (Webster-Stratton and Hammond, 1988). Parental psychopathology and substance use may result in reduced parental supervision and monitoring (Kazdin, 2000; Dadds, 1996) which in turn may promote the opportunity to identify with a deviant peer group (Dadds, 1996) and engage in problem behaviour already inadvertently reinforced by parental attention (Craig and Pepler, 1997). Children who demonstrate CD typically have a history of escalating deviant behaviour (Kazdin, 1997). Thus, CD may in part result from parental factors, the interactional style that parents adopt with their children, the degree of parental supervision, and the behavioural contingencies which parents offer as a result (Dadds, 1996).

Inter-parental conflict and change in family type have also been identified as risk factors for the development of CD (Dadds and Powell, 1991; Najman, Behrens, Anderson, Bor, O'Callaghan and Williams, 1997; Emery, 1982). In one sample of children aged between 3 and 8 years who were drawn from both clinic and non-clinic populations, parenting disagreement predicted aggression in both boys and girls. Evidence suggests that there is increased risk for the development of CD in the children of families where parental conflict is present, separation or divorce results, or the continuation of inter-parental conflict after divorce is maintained (Dadds, 1996; Emery, 1982). Further, it seems that the effect of inter-parental conflict on the development of CD is mediated, at least in part, by the severity of the conflict (Dadds, 1996).

A range of child factors, once established behaviourally, also place children at risk for the development of CD. Those who meet initial criteria for diagnosis of Oppositional Defiant Disorder (ODD) are at increased risk for development of CD. However, most children who are diagnosed with CD have a history of ODD (Kazdin, 1997). The degree of overlap between these disorders offers grounds to question their categorical independence (Dadds, 1996). In addition, children who meet criteria for CD are likely to demonstrate a history of academic difficulty, particularly with regard to reading and writing, and have poor interpersonal relationships and skills especially with adults (Kazdin, 1997; Craig and Pelter, 1997, Loeber, 1990). The development of CD, if not initiated, may be consolidated within the school context. In this manner, poor school performance and externalising behaviour may result in the development of negative attitudes toward both school and authority (Craig and Pelter, 1997).

The development of social cognition has also been demonstrated as a factor of risk for the development of CD. CD children seem to develop an inaccurate cognitive style when interpreting societal and interpersonal messages that is characterised by expectation of hostility, over-detection and elicitation of hostility in such interactions, and recourse to aggression as a problem solving strategy (Dadds, 1996; Craig and Pelter, 1997). Barrett et al (1996) demonstrated that both CD and anxious children and, importantly, their families, had a greater propensity to interpret ambiguous situations as hostile, and to respond to the perceived threat in such situations with aggressive strategies. A reciprocal relationship was demonstrated between the level of hostility inherent in parental responses and the behavioural strategies children endorsed in such situations (Barrett et al, 1996).

It is likely that negative peer experiences, identified as a risk factor for the development of CD (Dodge, 2000; Dadds, 1996; Kazdin, 1997), are also consolidated in school contexts. Peer rejection, often as a result of externalising behaviours, has been identified as a major risk factor for the development of CD (Dodge, 2000). One possible result of peer rejection is association with aggressive or behaviourally problematic contemporaries, particularly in adolescence (Dodge, 2000). As repeated engagement in aggressive or hostile situations aids the development of aggressive behaviour (Craig and Pelter, 1997), association with new peer groups already well versed in deviant behaviour can result in the escalation of CD related behaviour (Kazdin, 1997; Dadds, 1996).

1.6 Attention-Deficit Hyperactivity Disorder

Estimates of the prevalence of ADHD have been placed at between 3% and 5% (APA, 1994; Fergusson, Horwood and Lynskey, 1993). However little research has been undertaken which can differentiate between, and offer prevalence rates for, each of the three subtypes of ADHD listed in the DSM-IV (Essau, McGee and Feehan, 1997). Given that the three subtypes account for lower thresholds of symptoms, an increase in prevalence may be expected if such research were undertaken (Campbell, 2000). Evidence of rates of prevalence are effected both by the means of diagnosis (DSM-III-R, DSM-IV, ICD etc) and by the diagnosis of co-morbid disorders which usurp diagnosis of ADHD (Essau, et al, 1997). Prevalence of ADHD is greater in boys than it is in girls, however estimates vary depending on the rater. For instance teachers rated more boys under the ages of twelve as meeting criteria for the disorder than did parents (Campbell, 2000). According to the DSM-IV, gender differences in the disorder are in the order of between 4:1 and 9:1 in favour of boys.

A number of biological and genetic factors have been implicated in the occurrence of ADHD. Deficiencies in monoamines (dopamine, norepinphrine and serotonin) have been documented and a causal relationship between such deficiencies and ADHD is supported given the response to amphetamine stimulant medication (Campbell, 2000; Essau et al, 1997). The characteristic of hypervigilance commonly associated with ADHD has also been hypothesised as causal in ADHD, and implications for the role of both the reticular activating system and adrenaline formation imbalance have been suggested (Essau et al, 1997). The role of behavioural inhibition has also been implicated as causal in the development of ADHD. Barkley (1997) has proposed that as a result of impaired inhibition, a range of cognitive and behavioural deficits emerge which reflect prefrontal cortex dysfunction. Barkley posited a two factor model of ADHD, the inattentive subtype is characterised by deficits in sustained attention whereas the hyperactive/impulsive type is characterised by poorly focused attention and lack of persistence (Campbell, 2000).

Executive function was further implicated in ADHD as a result of research into working memory, self regulation and self directed behaviour (Murphy, Barkley and Bush, 2001). Executive function was found to be significantly related to ADHD in young adults. Specifically, when IQ was controlled for, differences between young adults suffering ADHD and a control group on measures of verbal working memory and attention were not significant. However, significant between group differences for inhibition, interference control, and non-verbal working memory were demonstrated (Murphy et al, 2001). Studies into familial aggregation of ADHD have demonstrated the potential for a strong genetic component in the transmission of ADHD (Iacono, Carlson, Taylor, Elkins, McGue, 1999; Essau et al, 1997). For instance Biederman, Faraone, Mick, Spencer, Wilens, Kiely, Guite, Ablon, Reed and Warburton (1995) reported that 84% of parents with ADHD had at least one child who met diagnostic criteria for the disorder, and 52% of parents had two or more children who met diagnostic criteria for the disorder. It is worth noting that considerable variability exists with regard to estimates of prevalence of ADHD in families with parents who are or have been diagnosed as suffering ADHD (Essau et al, 1997). Regardless of whether ADHD is conceptualised as a continuum of symptoms related to impulsivity, activity and attention, or as

a categorically diagnosable disorder, recent twin studies also suggest a high heritability factor (Campbell, 2000, Essau et al, 1997). Additional evidence suggests elevated levels of ADHD in parents of children who suffer from the disorder. Biederman, Faraone, Keenan, Benjamin, Kritchler, Moore, Sprich, Buckminster, Ugaglia, Jellinek, & Steingard, (1992) also found evidence demonstrating elevated rates of additional parental psychopathology including antisocial personality disorder, depression and anxiety.

A number of environmental factors have been implicated in the development of ADHD. Increased rates of family stress, adversity and break-up, parenting practice, parental monitoring and discipline, increased use of commands and directives, reduced incidence of supportive responses to child compliance and family psychopathology have all been demonstrated in children diagnosed with ADHD (Campbell, 2000; Loeber, Farrington, Stouthamer-Lober and Van Kammen, 1998; Essau et al, 1997; Hinshaw, Zupan, Simmel, Nigg and Melnick, 1997). However, it remains unclear whether these factors are causal in the development of ADHD, or develop in response to child symptoms which characterise the disorder (Essau, 1997). From a transactional standpoint it is probable that both operate simultaneously, each resulting in escalation of the other (Vasey and Dadds, 2001; Campbell, 2000). Regardless, problems apparent in the family have the potential to become more pervasive and affect peer and school functioning (Campbell, 2000). In addition, it should be noted that, with the exception of the potential for familial transmission, all of the above factors are common to a range of child and adolescent psychopathology. This suggests that there is potential for the appearance of a range of child and adolescent disorders within a context of multiple biologically and environmentally determined factors of risk (Loeber et al, 1998; Campbell, 2000).

There is an extensive literature associating the role of peer factors in both the development and maintenance of ADHD (Bagwell, Molina, Pelham and Hoza, 2001). Individual inability in attending to social cues and impulsivity in social interactions may in part account for the negative peer experiences many child and adolescent sufferers of ADHD experience (Hinshaw et al, 1997; Essau et al, 1997), and their likelihood for an earlier and greater rate of peer rejection (Campbell, 2000). A number of studies have pointed to the increased rates of peer rejection and negative peer attention, to the decreased ability to establish and maintain peer relationships, and to impairment in offering positive attention and demonstrating appropriate response to communication (see Essau, 1997; Bagwell et al, 2001 for reviews). In addition, it is noteworthy that even when they no longer meet diagnostic criteria for ADHD, adolescents diagnosed with the disorder in their childhoods continue to be more rejected than adolescents who had never been diagnosed with ADHD (Bagwell et al, 2001). Again, it is probable that the factors indicative of ADHD operate in peer contexts in a transactional manner, both eliciting and being elicited in response to negative peer interactions.

In addition to peer functioning, children and adolescents who suffer from ADHD generally demonstrate deficits in academic functioning. Reading problems, spelling difficulties and mathematical difficulties are all consistently demonstrated as present even when the effects of IQ and maternal education level are accounted for (Campbell, 2000; Essau et al, 1997). Despite a lack of empirical evidence, it is generally held that such deficits appear in response to deficits in attentional process and behavioural control (Essau et al, 1997). Continuity across age has also been demonstrated for measures of sustained attention and impulse control, suggesting that adolescents who have met diagnostic criteria for ADHD in their childhoods may not be expected to outgrow certain cognitive difficulties (Campbell, 2000).

1.7 Co-morbidity Within Externalising Disorders In Childhood And Adolescence

EDs are often characterised by substantial co-morbidity with other EDs (Ollendick, Seligman and Butcher, 1999; Craig and Pelter, 1997). For instance, evidence suggests that rates of comorbidity between CD and ADHD are between 45% and 70% (Craig and Pelter, 1997). Evidence further suggests that children who meet criteria for both CD and ADHD are likely demonstrate elevated levels of negative outcome when compared with children who meet criteria for CD alone (Craig and Pelter, 1997). CD is also characterised by an association with ODD (Kazdin, 1997; Dadds, 1996), however the relation between ODD and CD is generally accounted for in developmental terms, with the presence of ODD commonly being demonstrated to precede the appearance of CD (Kazdin, 1997).

Anderson et al (1987) found evidence to suggest that children with CD and/or ADHD who also had a co-morbid anxiety disorder were reported more aggressive by teachers and parents than children with CD or ODD alone. In addition, children and adolescents who meet criteria for CD have greater likelihood of demonstrating co-morbid anxiety or depression than do children and adolescents who do not meet diagnostic criteria for CD (Ollendick et al, 1999). One other disorder commonly found to be co-morbid with CD is Substance Use (Dadds, 1996). Illicit substance use was demonstrated to maintain a significant relationship with Disruptive Behaviour Disorders (DBDs) in female children and adolescents, while frequency of cigarette, alcohol and drug use was associated with an increased risk of the development of disruptive behavioural disorders in both male and female children and adolescents (Kendal et al, 1997).

Considerable co-morbidity has been demonstrated between ADHD and a range of other psychiatric disorders, with over half of the children and adolescents who meet criteria for ADHD also meeting diagnostic criteria for another disorder (Campbell, 2000). CD is has commonly been associated with ADHD, and estimates of co-morbidity between these two disorders has been placed at between 60% and 90% (Abikoff and Klein, 1992). Given this degree of co-morbidity, and the overlap in some symptomatology, questions have been raised about functional distinctions between the disorders (Campbell, 2000). However children diagnosed with CD are more likely to be diagnosed as ADHD than those with ADHD are CD (Dadds, 1996). Other disorders often found co-morbid with ADHD include mood disorders and anxiety disorders. Co-morbid affective and ADHD disorders have been placed at between 15% and 75% (Essau et al, 1997). It has also been noted that onset of depression is significantly earlier in those with a history of ADHD than for those without such a history (Sachs, Baldassano, Truman and Guille, 2000). Co-morbidity with anxiety disorders has been estimated at about 25% (Essau et al, 1997) with children diagnosed as suffering ADHD demonstrating a higher prevalence (about one third) of generalised anxiety disorder than other anxiety disorders, for instance social phobia (Safren, Lanka, Otto and Pollock, 2001).

1.8 Co-morbidity of Externalising Profile and Substance Use

EDs are also often characterised by substantial comorbidity with SUDs. For instance, a recent variant of adolescent substance abuse characterised by externalising pathology and behavioural dis-inhibition has recently been hypothesised (Lilienfeld, 2003; Krueger, Hicks, Patrick, Carlson, Iacono, McGue, 2002; Iacono, Carlson, Taylor, Elkins, McGue, 1999). Underlying this variant is the suggestion that a range of externalising behaviours and associated substance use indicate a homogeneous externalising spectrum (Krueger et al, 2002). Within such a model, CD, ODD, ADHD and a particular form of associated substance abuse, are represented as distinct phenotypes of an underlying spectrum in children, and behaviours characteristic of antisocial personality disorder as distinct phenotypes of the same spectrum in adults (Iacono et al, 1999; Krueger et al, 2002). Such a model builds on earlier conceptualisations of externalising pathology as indicative of a homogeneous group characterised by common genetic and environmental factors of risk (Moffitt, 1993). On balance however, current evidence suggests that externalising pathology, including substance

use behaviour, may not be well accounted for by broad classifications of homogeneity (Babor, Webb, Burleson, Kaminer, 2002; Fergusson, Lynskey, Horwood, 1996). Rather, method may be found in a myriad of symptoms that indicate distinct but correlated behavioural domains (Fergusson, 2003).

An extensive literature accounts for the association between externalising problems and the development of SUDs. CD, ODD and ADHD are most consistently found to precede, and to be predictive of, substance use, abuse or dependence (Boys et al, 2003; Brook et al, 2003; Armstrong & Costello, 2002; Glantz, 2002; Weinberg & Glantz, 1999). When assessed in early adolescence, levels of CD, ODD, ADHD, and violence have been demonstrated to prospectively predict levels of alcohol use, and levels of CD, ADHD and violence have been demonstrated to prospectively predict levels of marijuana use in late adolescence (White, Loeber, Stouthamer-Loeber & Farrington, 1999). In addition, while early adolescent CD was able to predict growth in alcohol use, measurement of CD, ADHD or ODD was able to predict growth in marijuana use in late adolescence (White et al, 1999).

Studies drawing both on treatment samples and normative samples have consistently demonstrated strong associations between conduct problems and substance use (Weinberg & Glantz, 1999; Loeber et al, 1999; Upadhyaya, Deas, Brady, & Kruesi, 2002; Rohde et al, 2001; Sung et al, 2004; Brook et al, 1998) even when accounting for additional psychopathology (Sung, et al, 2004; Rhode et al, 2001; Brook et al, 1998) and demographic variables (Lillehoj, Trudeau, Spoth, & Madon, 2005; Degenhardt & Hall, 2003; Kandel et al, 1997). However, current evidence suggests that such an association may have been underestimated in terms of its complexity and variability and, therefore, may warrant further investigation (Glantz, 2002; Weinberg & Glantz, 1999; Fergusson, 1998).

For instance, research suggesting that the development of substance use problems in the absence of CD would be rare, regardless of the age of first use (Robins & McEvoy, 1990) has received mixed support. Sung and colleagues have offered recent evidence to suggest that, even in the absence of CD (or additional psychopathology) the probability for developing a SUD was approximately 10% by age 16 in a sample of adolescents for whom first use had already occurred (Sung et al, 2004). These authors found further evidence to suggest that, in controlling for years of exposure to a substance, the risk of developing a disorder of use of that substance increased with age of onset for onsets prior to age 13, but began to fall thereafter (Sung et al, 2004). Extending earlier findings, these authors found evidence to suggest that while a history of CD lead to an approximately 20% probability of SUD at age 16, the absence of prior CD or additional psychopathology still offered approximately 10% chance of developing a SUD. Past CD had a strong additive effect on the development of a SUD at ages 13-15, but this influence of CD began to drop as normative levels of use increased as a function of age. Early results from the Dunedin longitudinal study suggested no predictive ability from CD to substance use, (Henry, Feehan, McGee, Stanton, Moffitt, & Silva, 1993) and even in the absence of CD, early use per se has not always been found to be a strong predictor of adolescent SUD (Sung et al, 2004).

In a similar fashion, the literature on the relation between ODD and SUDs remains unclear with evidence having been offered both for and against its predictive ability (Sung et al, 2004; White et al, 2001). ODD is often formulated developmentally as an antecedent to CD (Brooke, 2003; Kazdin, 1997), and has generally been found to be strongly predictive of later substance use behaviour (White, 1990; Weinberg & Glantz, 1999). ODD was found to predict future AUDs even when adolescent alcohol use and other disorders were controlled for (Rhode et al, 2001). In addition, in their review of normative samples of adolescents, Armstrong and Costello (2002) found that 60% of those meeting criteria for substance use, abuse or dependence, ODD had been one of a range of disorders present prior to the development of the substance use problems. Contrary findings suggest that ODD could not be demonstrated to be associated with increased risk or any predictive ability for the later

development of substance use problems at any age or for either gender (Sung et al, 2004; Weinberg & Glantz, 1999). One explanation for the possible lack of predictive ability of ODD suggests that while the symptoms of CD focus on particular behavioural characteristics, those of ODD are more concerned with temperamental characteristics. It may therefore be that the risk of developing a SUD, once use has begun, is determined by behaviourally rather than primarily as a result of temperamental characteristics (Sung et al, 2004).

ADHD has also been demonstrated to be associated with increased risk of substance use problems, but the nature of the association is, as yet, unclear. A five-year longitudinal study reported that the relationship of ADHD to later substance use varied as a function of type and level of externalising problems (Chilcoat & Breslau, 1999). However, contrary longitudinal evidence suggests that ADHD was not a predictor of later substance use or delinquency (Loeber, Stouthammer-Loeber, White, 1999). In the absence of co occurring CD, some evidence suggests that ADHD is no longer associated with later substance use (Glantz, 2002; Armstrong & Costello, 2002; Angold et al, 1999; Fergusson, 1998). However, it is worthy of note that a diagnosis of ADHD does not indicate membership of a homogeneous class. The variety of symptom clusters present, particularly with respect to the possibility of co-morbid ADHD and internalising problems and the possibility of co-morbid ADHD and externalising problems, may represent increased risk for the later development of substance use problems (Windle, 1993; Weinberg & Glantz, 1999).

Childhood ADHD has been associated with increased risk for alcohol use problems, as well as the use of tobacco and marijuana during adolescence (Brooke & William, 2003). In one study, ADHD participants demonstrated higher levels of drug use than sample controls (Brooke & William, 2003). In this study, the severity of the childhood inattention symptoms of the ADHD participants predicted multiple substance use outcomes to a greater extent than childhood antisocial behaviours. In addition, White et al (1999) found that level of ADHD symptoms was predictive of level of alcohol and marijuana use. The relation between ADHD and cigarette use is less than well understood, with evidence indicating those with ADHD initiate smoking earlier, and have a harder time stopping. However, comparisons of rates with normative samples are scarce and evidence limited (Upadhyaya et al, 2002). Of note, psychostimulant medication for ADHD has been shown to be unrelated to risk of drug use (Chilcoat & Breslau, 1999) however, given the inconclusiveness of the results outlined above, further study of the relationship between substance use and ADHD is warranted (Chilcoat & Breslau, 1999).

Evidence from longitudinal research suggests that while violent or aggressive behaviour does emerge in childhood, generally in a form consistent with ODD, such behaviour has been demonstrated to increase incrementally over the late childhood and early adolescent years up until its modal age of onset at 14-15 years (Loeber et al, 1999). In addition, violent or aggressive behaviour in childhood and young adolescence has consistently been shown to predict alcohol and marijuana use (White et al 2001) as has CD symptom level and early delinquent behaviour (Costello et al, 1999, White et al 2001). Even adolescents who had not experimented with drugs by the age of 14 years, but whose behaviour was characterised by antisocial features, were more likely to smoke cigarettes, and have experimented with illicit substances at age 17 than those who exhibited less antisocial behaviour at age 14 (Adalarnardottir & Rafnsson, 2002). These findings suggest that early onset adolescent antisocial behaviour may be a marker of a causal process that results in experimentation and abuse of licit and illicit substances (Adalarnardottir & Rafnsson, 2002; White et al, 2001).

Evidence has also been gathered to indicate that use of a substance in adolescence is a reliable predictor of adolescent and adult substance use problems (Rhode et al, 2001; Kandel et al, 1997) and psychopathology (Rhode et al, 2001; Coffey et al, 2000; Hawkins et al, 1992). For instance, psychoactive substance use, including alcohol use, was significantly associated with having a psychiatric disorder (Boys et al, 2003). The relationship between psychiatric

morbidity and substance use has been primarily explained by regular use of cigarettes, and to a lesser extent by regular (30-day prevalence) use of marijuana (Boys et al, 2003, Degenhardt, Hall, Lynskey, 2001a, 2001b). Use of one substance carried with it a greater risk of use of additional substances (Boys et al, 2003; Degenhardt & Hall, 2003), and use of a substance in adolescence has also been shown to significantly predict problems of use or abuse of that substance or associated substances at a later point (Boys et al, 2003; Degenhardt & Hall, 2003; Rhode et al, 2001; Kandel et al, 1997).

It has been demonstrated that adolescence levels of CD symptomatology can prospectively predict linear growth in adolescent alcohol use, however prospective prediction of growth in marijuana use has not yet been demonstrated (White et al, 2001). Uptake has, however, been predicted by antisocial behaviour in the middle school period. In a sample of Australian youth, the mid to late teens represented an important determinant of progression into late adolescent use with 13% of male and 9% of female mid school students progressing to daily use in late school (Coffey et al, 2000). Two studies indicate that peer cannabis use (Coffey et al, 2000), and family, peer and community levels of drug use (Hawkins et al, 1992) are important determinants, if not predictive of, later cannabis initiation and use (Coffey et al, 2000). Significant cross sectional associations have also been found between cannabis use and psychopathology at ages 15, 18 and 21 (McGee et al, 2000). However this study offered evidence that the association between cannabis use and mental health may not be as broad as previously assumed, and may be determined to a significant extent by the age at which use occurs (McGee et al, 2000). In young adolescence the direction of the association appears to be from substance to mental health, while the reverse appears to be the case in older adolescence (McGee et al, 2000). Late school transition to heavy cannabis use occurred in approximately 12% of students, was more likely in males with ability to source the substance and whose peers used the substance, and was more likely in females who demonstrate severe behavioural problems (Coffey et al, 2000). It is note worthy that Coffey and colleagues (2000) provided one of the first studies that examined the influence of the level of cannabis use within the context of the school and its impact on the development of use.

While cigarette smoking has been demonstrated to be an important predictor of both initiation into, and persistence of, cannabis use (Coffee et al, 2000) as well as a marker for the later development of psychopathology (Upadhyaya et al, 2002), there is also evidence to suggest that tobacco use is prevalent among those with particular mental health problems such as AHDH, depression and psychotic illness (Joun, Ensminger & Sydnor, 2002; Upadhyaya et al, 2002; Coffee et al, 2000). In females, symptoms of AHDH contributed independently to later daily smoking, however this was not the case for males. CD symptoms were significant predictors of daily smoking for both males and females. Boy's activity level and parental smoking significantly predicted adolescent smoking however shy girls were significantly less likely to smoke (Galera, Fombonne, Chastang, & Bouvard, 2005).

A developing literature suggests that smoking may act as a causal agent in the development of certain forms of psychopathology. McGee et al (2000) and Brook et al, (1998) underscore this association by arguing that the causal direction may in fact be from tobacco use to certain forms of psychopathology. White et al (2001) could not determine from their data whether psychopathology developed as a function of substance use or substance use enhanced existing pathology (for instance the relation between ODD and CD). While associations between alcohol and cigarette use and psychopathology are relatively clear, the causal direction, mechanisms and genetics underlying the association remain less so (McGee et al, 2000).

1.9 Internalising Disorders

The relationship between IDs and substance use is less well understood than that demonstrated between EDs and substance use. As with the discussion presented above on EDs, the present discussion on IDs is limited to two of the most commonly identified IDs in

adolescence, depression and anxiety disorders. It is recognised that such a limitation negates the ability to offer a comprehensive review of IDs in adolescence. It is further recognised that limiting the review in this manner risks not accounting for the substantial within category variability of both depressive and anxiety disorders. Such a review will however, offer some account of research into factors of risk that operate from a developmental psychological perspective, and will seek to describe the current status of those risk factors from this perspective.

1.10 Adolescent Depression

The search for both intrinsic and contextual risk factors that result in increased risk for the development of depression in adolescence has been an area of active inquiry within developmental psychology (Zahn-Waxler et al, 2000). The literature covered in the present review focuses on the two most common child and adolescent mood disorders; major depressive disorder (MDD) and dysthymic disorder (DD). Now distinguished from adult diagnostic criteria, MDD in childhood and adolescence may be characterised by depressed affect, anhedonia or irritability (Zahn-Waxler et al, 2000). Childhood and adolescent DD represents a milder but more chronic disorder and is characterised by similar symptoms.

Prevalence studies of depression in children and adolescence report rates of between 0.4%-2.5% and 0.4%-8.3% respectively (Birmaher, Ryan, Williamson, Brent, Kaufman, Dahl, Perel and Nelson, 1996; Zahn-Waxler et al, 2000; Kashani et al, 1986). Rates of depression increase with development into adolescence, and it is noteworthy that prevalence rates for MDD in adolescence are at comparable levels to adults, between 15-20% (Zahn-Waxler, 2000), a finding that offers support for the notion that childhood depression is a reliable predictor for the development of depressive disorders in adulthood (Birmaher et al, 1996).

Generally symptoms of depression have their onset earlier in females than they do in males (ages 6-7 and 12-13 respectively). In addition, rates of depression in females are roughly twice as high as they are for males (Holsen, Kraft and Vitterso, 2000; Giaconia, Reinherz, Pakiz, Frost and Cohen, 1993), with rates of onset in females displaying a curvilinear trend when compared to the linear trend displayed in males (Holsen et al, 2000). The course of adolescent depressive disorders is approximately 6-9 months for MDD and 4 years for DD (Birmaher et al, 1996). The probability of recurrence of MDD after first episode is approximately 40% after 2 years and approximately 70% after five years, while the probability that children and adolescents who suffer from DD will develop MDD within 2-3 years is around 70% (Birmaher et al, 1996), a finding that suggests that DD may itself represent a risk factor for MDD.

A number of genetic and temperamental risk factors have been identified for the development of childhood and adolescent depression. Results from twin and adoption studies in adult populations suggest that approximately 50% of the variance of transmission of mood disorders may be accounted for by genetic factors (Zahn-Waxler, 2000; Birmaher et al, 1996). Research into genetic transmission of mood disorders has concentrated on neurological and biological processes (a discussion beyond the scope of the current review), and little research has sought to clarify the role of temperament in the intergenerational transmission of mood disorders (Zahn-Waxler, 2000). The interaction of genetic and environmental risk factors has been reported as being indicative of the development of more severe mood disorders, with the risk of developing a depressive disorder being significantly greater if both parents rather than one parent suffer from depression (Zahn-Waxler, 2000). This finding highlights the necessity to distinguish between the biological or genetic transmission of mood disorders and the parental contextual transmission of risk for depression.

The few temperamental risk factors which have been identified as potential precursors to the development of depressive disorders include personality characteristics, individual emotion regulation, and parental /infant attachment. Those studies that have investigated personality characteristics (for instance, Kendler, Neale, Kessler, Heath and Neaves, 1992)

have been limited to self-report data, and have concentrated on traits related to emotionality. Emotion regulation has been defined as “biologically based reactions that coordinate biologically and psychologically adaptive responding to stimuli” (Shaw, Keenan, Vondra, Delliquadri and Giovannelli, 1997, P1761). While biologically based reactions to external and internal stimuli have not been studied widely, child proneness to maintain negative emotionality, the relation between parenting practices and emotion regulation, interactional difficulty with parent(s), and the over-representation of boys who suffer emotion regulation problems are factors which warrant prospective study in normative samples (Shaw et al, 1997).

One aspect of temperament that has received attention is the relationship of child temperament to maternal depression. Children who display few temperamental difficulties have been shown to be more resilient to maternal depression than have children who are temperamentally more difficult. It is suggested that such children fail to develop the cycle of negative reciprocation often evident in interactions between depressed mothers and temperamentally difficult children (Bugental, Blue and Cruzcosa, 1989). Infant shyness has been linked to reduced sociability in studies of adoptive mothers and their adopted children, underscoring the importance of environmental influences on temperament (Daniels and Plomin, 1985). Attachment has been studied and high levels of insecure or disorganised attachment have been found in the children of mothers suffering bipolar depression and MDD (Downey and Coyne, 1990). It has also been suggested that parental responsiveness to infant distress is predictive of the ability of the child to self regulate emotion (Shaw et al, 1997). However, it remains unclear whether insecure or disorganised attachment is predictive of childhood or adolescent depression.

Family factors that are indicative of childhood and adolescent depression have been the subject of extensive research. For instance, children of depressed parents have consistently been found to show higher rates of both internalising and externalising symptoms, regardless of whether the data was gained from parents or their offspring (Downey and Coyne, 1990). Such children demonstrate higher psychopathology and functional impairment, higher levels of depressive symptomatology, greater deficits in social and academic functioning regardless of intellectual ability, higher negative cognitive style, and poorer physical health than control children (Downey and Coyne, 1990; Compas, Hindem and Gerhardt, 1995; Birmaher et al, 1996). In addition, maternal and paternal depression resulted in similar child and adolescent problems, however maternal depression better predicted parent-child negativity while paternal depression better predicted child outcome (Jacob and Johnson, 1997).

The family environment has further been implicated with regard to modelling reactions to stressful events and conflict, and marital distress has been demonstrated to play an important role in accounting for child adjustment (Downey and Coyne, 1990). For instance, children may model demonstrated inability to pursue problem solving strategies, ineffective ability to deal with conflict, or propensity to give up in the face of stressful events (Birmaher et al, 1996). This is particularly pertinent if the family environment is characterised by high levels of inter-parental conflict (Shaw et al, 1997; Lewinsohn, Clarke, Seeley and Rohde, 1994). If negative family interactions, and maladaptive patterns of handling situations characterised by stress or conflict predispose children to greater risk of depression, it is further plausible to suggest that the reciprocal nature of such interactions may further exacerbate risk. Children who respond negatively to negative situations contribute to an interactive cycle that serves to maintain both their parents' and their own negative affect.

Peer relationships were studied in a series of prospective studies into adolescent depression (Cole, 1990; Cole, Martin, Powers and Truglio, 1996; Cole, Martin and Powers, 1999). These studies utilised longitudinal data gathered along five dimension; competence, academic, social, attractiveness and athletic. The results of the study suggested that girl's self-schemas were influenced by interactions and feedback from their peers, that self-schema was

mediated by peer perceptions, and that negative self-schemas developed in response to such feedback and were predictive of depression. Similarly, research has recently identified negative cognitive style as a predisposing factor to depression in response to stressful events. For instance, events such as receiving negative assessment feedback, or facing rejection from peers, may be negatively interpreted and contribute to the onset or maintenance of depression (Birmaher et al, 1996). It is not yet clear whether the negative cognitive style, attributional style and negative schema which have been shown to be more prevalent in depressed individuals than in non-depressed controls (Gotlib, Lewinsohn, Seely, Rohde, and Redner, 1993), occur as a result of individual characteristics or as a result of the onset of depression.

Additional psychopathology has also been identified as a major risk factor for the development of depression in adolescence. In addition, depression itself (including current depression, history of affective disorder, suicidal ideation) places individuals at increased risk for the development of subsequent depression (Lewinsohn, Rohde and Seeley, 1994). This position suggests that, if apparent in childhood or adolescence, depression may be expected to run an episodic and recurrent course (Downey and Coyne, 1990). In addition, serious illness at an early age has been identified as a factor which may result in the subsequent development of depression (Reinherz, Stewart-Berghauer, Pakiz, Frost, Moeykens and Holmes, 1989). However, given assertions that children of depressed parents are generally in poorer physical health (Downey and Coyne, 1990; Lewinsohn, Rohde and Seeley, 1994), the relationship between physical health, depression and cognitive style warrants further investigation.

1.11 Adolescent Anxiety Disorders

Anxiety problems account for a large proportion of child and adolescent psychopathology (Vasey and Ollendick, 2000, Achenbach, 1982). However, developmental psychopathological research into factors that increase risk for the development of anxiety in childhood and adolescence is a relatively recent pursuit (Zahn-Waxler et al, 2000; Emmelkamp and Scholing, 1997) despite the fact that evidence suggests a significant proportion of adult anxiety disorders have their genesis in childhood or adolescence (Vasey and Ollendick, 2000; Vasey and Dadds, 2000). Given concerns in the literature that anxiety in children and adolescents is characterised by considerable developmental variation, and that it may more appropriately be conceived of along dimensional lines rather than from a categorical standpoint (Vasey and Ollendick, 2000; Zahn-Waxler et al, 2000), the literature covered herein discusses factors of risk for anxiety generally.

Considerable variability has been reported in the rates of prevalence for anxiety in childhood and adolescence. Rates of between 5% and 18% have been reported for any anxiety disorder in children (Costello and Angold, 1995). In general terms, girls demonstrate higher prevalence of separation anxiety disorder, panic attacks and disorder, specific phobias and post traumatic stress disorder, while girls and boys demonstrate similar rates social phobia (Vasey and Ollendick, 2000). Considerable age effects are noted in the developmental trajectory of anxiety disorders in children and throughout their adolescence (Vasey and Ollendick, 2000; Zahn-Waxler et al, 2000).

The potential for heredity to play a role in the intergenerational transmission of anxiety disorders is supported in both the family and twin literature (Emmelkamp and Scholing, 1997; Zahn-Waxler et al, 2000). Elevated rates of anxiety have been found in children with parents who suffer from anxiety, in parents of children who suffer from anxiety, and in twins who suffer from anxiety (Emmelkamp and Scholing, 1997; Vasey and Ollendick, 2000; Zahn-Waxler et al, 2000). In addition, the family and twin literature suggests that there may be both a transmission of a generalised anxiety factor as well as a disorder specific transmission (Eley, 2000; Zahn-Waxler et al, 2000; Vasey and Ollendick, 2000). However, these studies are unable to discriminate between direct genetic effects and risk factors which operate as a result of environment (Emmelkamp and Scholing, 1997) and development (Eley, 2000). Further twin

studies, and in particular adoption studies, are warranted to clarify the role of biological factors in the transmission of child and adolescent anxiety disorders (Eley, 2000).

Clarification of the roles of biology and the environment are further confounded by the roles of temperament and emotion regulation. Temperamental factors characterised by withdrawal or inhibited approach behaviour, for instance Negative Affectivity (Watson and Clarke, 1984) or Behavioural Inhibition (Reznick, Hegemen, Kaufman, Woods and Jacobs, 1992) have been implicated in increased autonomic arousal (Emmelkamp and Scholing, 1997; Zahn-Waxler et al, 2000) and in the development and maintenance of anxiety disorders (Rubin and Burgess, 2000; Zahn-Waxler et al, 2000; Vasey and Ollendick, 2000). Social anxiety in adolescent girls can be predicted from early childhood behavioural inhibition, a finding which draws attention both to the moderating effects of gender and the role of temperament in anxiety (Schwartz, Snidman and Kagan, 1996). Emotion regulation concerns continuous monitoring, evaluation and adjustment of ongoing emotional state (Thompson, 2000). Regulation of emotion is characterised both by internal or intrinsic processes and by external or extrinsic processes. It therefore draws both on biological dispositions and environmental influences or cues (a comprehensive review on the topic is provided later in this introduction). To the extent that individual learning history influences both situationally specific expectancy and subsequent regulation, and to the extent that regulation is determined by biological determinants, emotion regulation may also be conceived of as central to a developmental psychopathological account of risk for anxiety.

Numerous environmental factors have also been implicated in the development and maintenance of childhood and adolescent depression. For instance, attachment to parent(s) both promotes effective emotional management strategies (Thompson, 2000), and provides an internal working model of self in relation to others (Rubin and Burgess, 2000). Appropriate regulation strategies include those directed toward the reduction of stress, and demonstration of appropriate strategies of dealing with anger and fear (Thompson, 2000). Thus, caregiver's anxiety management strategies have the potential to model and maintain anxiety reducing or anxiety exacerbating outcomes. These may, for instance, find form in avoidant behaviour (Thompson, 2000), through hyper-vigilance in response to stressful events, or as a perceived lack of control in response to environmental factors (Vasey and Ollendick, 2000). Insecure internal working models also have the potential to contribute to anxiety disorders (Rubin and Burgess, 2000). For instance, if a child experiences an unpredictable world, or experiences an environment devoid of comfort or response, impeded approach behaviour and reduced social interaction and competence are likely consequences (Rubin and Burgess, 2000). Related evidence suggests that the subjective experience of fear in infancy is predictive of distress in anticipation of or in response to maternal separation (Thompson, Connell and Burgess, 1988).

In addition to exposure to trauma and stressful events, other environmental factors have also been found to place children and adolescents at risk for anxiety. Respondent conditioning has been implicated in the development of phobic disorders and is hypothesised to result from modelling or conveyed verbal information (Vasey and Ollendick, 2000). However, traumatic events themselves may not necessarily result in anxious or phobic responses and, conversely, anxious or phobic responses may result in the absence of traumatic events. Heightened risk will however be demonstrated where traumatic events occur in the lives of children or adolescents who either demonstrate temperamental vulnerability or who have predisposing learning history (Vasey and Ollendick, 2000). Once established, operant conditioning has the potential to maintain and exacerbate phobic and anxious features. Reactions to child or adolescent anxious or phobic behaviour have the potential to maintain that behaviour. Long-term goals of ultimately mastering anxiety provoking situations may be compromised in the interests of gaining relief from short term consequences (Vasey and Ollendick, 2000). Similarly, avoidance may be reinforced as a method for coping with anxiety provoking situations, as suggested by Dadds, Barrett, Rapee and Ryan (1996) who found evidence to

suggest that parents of anxious children fostered their children's tendency to choose avoidance strategies while problem solving.

Such avoidance strategies, once established, may have the potential to be reinforced within peer related contexts. A number of studies into peer neglect undertaken by Coie and colleagues (see Brunch, 1989 for a review) have demonstrated that children classified as shy did not approach their peers as often as non-shy children, and were more likely to be classified as neglected than they were to be classified as rejected, popular or controversial. Cognitive processes have also been implicated in shyness. Self focused attention or anticipated scrutiny from others may operate to prevent shy children from seeking dis-confirmatory information regarding their perceived separateness from their peers. Shy children have been shown to overly interpret and attend to stimuli that they perceive as threatening (Vasey and Ollendick, 2000). The role of cognitive or attentional biases remains unclear, but they may function either as a causal factor in the development of anxiety, or as a maintaining factor in children who are already disposed to or display anxious features. The result is that children who demonstrate such biases perceive the world as a markedly different place than children who do not demonstrate such biases (Vasey and Ollendick, 2000).

1.12 Co-morbidity Within Internalising Disorders In Adolescence

Children and adolescents demonstrate co-morbidity between anxiety and depression to the extent that co-morbidity is itself more prevalent than either disorder in its pure form (Zahn-Waxler et al, 2000). Research has consistently demonstrated this co-morbidity, with the co-occurrence reported in moderate to high levels (Vasey and Ollendick, 2000). A number of authors have suggested that it is possible that co-morbidity may be indicative of a common underlying dimension (Compas and Oppedisano, 2000; Zahn-Waxler et al, 2000) that may be differentiated as a result of development (Eley, 2000). Parent and teacher report data demonstrates considerable co-variation between anxious and depressed symptoms (Compas and Oppedisano, 2000) however this may represent a failure to accurately differentiate between the two on the part of raters.

A second position offers support for categorical distinctions between the two disorders, and holds that anxiety and depression are in fact distinct disorders which have the potential to share a considerable proportion of their clinical features. Evidence for this position may be found in research which demonstrates that anxiety is more likely to be found co-morbid with depression in adolescents whereas depression is less likely to be found co-morbid with anxiety in the same population (McConaughy and Achenbach, 1994). In addition, further support for this position may be drawn for the finding that depression is more likely to follow than it is to precede anxiety (Kovacs, Gatsonis, Pauluaskas and Richards, 1989).

1.13 Co-morbidity of Internalising Profile and Substance Use

IDs are also often characterised by substantial comorbidity with SUDs. However, in contrast to research findings regarding the relation between EDs and substance use problems, research offers a much less clear picture of the association between internalising problems and substance use in adolescence (Grant, Stinson, Dawson, Chou, Dufour, Compton, Pickering, & Kaplan, 2004; Dierker, Avenevoli, Stolar, & Merikangas, 2002; Grant et al, 2004; Weinberg & Glantz, 1999; Woodward & Fergusson, 2001). Consistent with EDs, a review of the literature suggests that in adolescent treatment samples, direction of progression is from internalising psychopathology to SUD. However, the normative literature offers a less clear account of the direction of, and the mechanisms inherent in, such a progression (Armstrong & Costello, 2002). Consistent with recent hypotheses conceptualising a variant of adolescent substance use characterised by externalising pathology and behavioural disinhibition (Lilienfeld, 2003; Krueger, Hicks, Patrick, Carlson, Iacono, McGue, 2002; Iacono, Carlson, Taylor, Elkins, McGue, 1999), some evidence has been offered to suggest that internalising behaviours and substance use in adolescence may be indicative of a syndrome of behaviours already in evidence in childhood (Hanna et al, 2001).

Of considerable interest is the unique contribution that various subtypes of IDs have been shown to play in adolescent acquaintance with substance use. While externalising characteristics in childhood have been demonstrated to prospectively predict substance use behaviour in adolescence (Barkin, Smith, DuRant, 2002; Coffey et al, 2000; White et al, 1999), a more varied picture has emerged with regard to internalising disorders. When symptoms of anxiety in childhood and adolescence were taken together, they were demonstrated to be unrelated to the onset of alcohol use (Kaplow et al, 2001). When differentiated on the basis of disorder, symptoms of generalized anxiety placed children and young adolescents at increased risk for initiation into alcohol use four years after initial assessment, while symptoms of separation anxiety in children and young adolescents decreased their risk of initiation into alcohol use (White et al, 2001; Kaplow, Curran, Angold, & Costello, 2001). These findings were equally strong for boys and girls, and are consistent with the suggestion that avoidant characteristics and social anxiety in childhood appear to act as a protective factor against the development of later substance use problems while negative affect is positively related to adolescent substance use (Myers, Aarons, Tomlinson & Stein, 2003; Windle, 1993). The implication is, therefore, that if the relation between IDs and substance use is to yield information regarding the presence and direction of causality, it may be necessary to dissect broad classifications of homogeneity (Babor, Webb, Burleson, Kaminer, 2002; Fergusson et al, 1996) and examine the association at the level of symptomatology (Fergusson, Goodwin & Horwood, 2003; Kaplow et al, 2001).

Depression co-morbid with substance use has been studied more than any other internalising disorder co-morbid with SU (Armstrong & Costello, 2002). In a review of community studies looking at psychiatric co-morbidity, approximately 5% of adolescents who never used substances, approximately one quarter of weekly drinkers, and approximately one quarter of last year illicit substance users showed some kind of depression (Armstrong & Costello, 2002). In the same study, approximately 20% of those in review demonstrated concurrent depression and substance use, however considerable variation was evident in these findings with estimates ranging from 11% to 32%. The prevalence of affective disorders was also higher in those meeting criteria for alcohol dependence. This population were approximately four and one half times as likely as non-drinkers to meet criteria for an affective disorder (Armstrong & Costello, 2002). Of note, drinkers who did not meet criteria for abuse had significantly lower rates of affective disorders compared with non-drinkers (Degenhardt et al, 2001a).

The relation between depression in adolescence and the later development of substance use has been the subject of a large amount of research. Generally, males but not females with a history of depression have been found to be at increased risk of developing substance use problems by age 16 (Sung et al, 2004; Armstrong and Costello, 2002). While level of depression in early adolescence has been found to predict alcohol use but not marijuana use at age 18 (White et al, 2001; Loeber et al, 1999), Brook et al (1998) found no evidence that depressive disorders or anxiety disorders in late adolescence were predictive of later substance use, a finding contrary to some previous research (Kandel et al, 1997; Kessler, 1995; Henry et al, 1993). Once an adolescent started to use substances, the later development of psychopathology was not demonstrated to increase either the level or incidence of use in young adulthood (Brook et al, 1998). Depressed adolescents had earlier onset of substance use problems than adolescents with no depression (Rao, Ryan, Dahl, Birmaher, Rao, Williamson, & Perel, 1999), and those with substance use problems had more significant psychological impairment than those without substance use problems (Rao et al, 1999).

Use of substances in adolescence has been found to predict later affective disorders by some researchers, however the nature and extent of the relationship remains unclear. Brook et al (1998) found that use of alcohol, marijuana, and tobacco in adolescence was predictive of later depressive disorders, even when controlling for the influence of prior depressive illness

(Brook et al, 1998). This research was extended by McGee et al (2000) who found evidence that tobacco use may be causal in the development of certain forms of psychopathology, and by Dierker et al (2002) who demonstrated that a common vulnerability existed between dysthymia and smoking, but not between major depression or double depression and heavy smoking. While Dierker et al's (2002) sample were adult, the generalisability of their data to an adolescent population warrants investigation to determine the etiologic relation between particular forms of substance use and symptom specific forms of affective illness. It is noteworthy that while adolescent alcohol and tobacco use were both demonstrated to have predictive value for the later development of psychopathology, adolescent cannabis use was not shown to predict later depressive or anxiety disorders (McGee et al, 2000; Fergusson, & Horwood, 1997). This finding is inconsistent with evidence offered by Brook et al (1998). McGee et al (2000) conclude that adolescent cannabis use may have a "more limited association" (McGee et al, 2000, p500) with the development of mental health problems than has previously been suggested. Further, given the conclusion that the direction of causality is from psychopathology to cannabis use in adolescence, but from cannabis use to psychopathology in early adulthood, McGee et al (2000) suggest that the association may operate as a function of age or developmentally level.

In a review of the epidemiological literature Armstrong & Costello (2002) reported that eight of the fifteen studies they reviewed offered evidence to suggest that the likelihood of anxiety disorders in adolescents with SUDs was no greater than in those without, with a median Odds Ratio of only 1.3 across the fifteen studies (Armstrong & Costello, 2002). A second study which assessed child and adolescent participants at three time points over nine years found no evidence of a significant cross sectional relation between level of use of alcohol, tobacco, or marijuana, and rates of anxiety disorder (Brook et al, 1998), a finding in contrast to that of Upadhyaya et al, (2002) who found that, in cross sectional terms, anxiety disorders were modestly associated with cigarette smoking. However, the earlier study did provide evidence that substance use at an earlier age predicted anxiety at a later age even after controlling for earlier anxiety (Brook et al, 1998). Extending the findings of Brook et al, (1998), data from the Dunedin longitudinal study demonstrated significant and linear associations between number of anxiety disorders reported in adolescence and later risk of anxiety disorder, major depression, and dependence on alcohol, nicotine and illicit substances even after demographic and family variables were controlled for (Woodward & Fergusson, 2001). Consistent with McGee et al's (2000) suggestion that the association between earlier substance use and the development of later psychopathology operating as a function of age or developmentally level, Sung et al (2004) offered evidence that anxiety increased the risk of SUD in girls at age 16, but not before that (Sung et al 2004).

The comorbidity of AUDs and psychopathology has been studied widely with adult populations. One Australian study found that, in the 12 months prior to survey, approximately twenty percent met DSM-IV criteria for an affective disorder, approximately fifteen per cent met DSM-IV criteria for an anxiety, and approximately thirty-five percent met criteria for any co-morbid DSM-IV disorder (Burns & Teeson, 2002). Those who met criteria for any co-morbid DSM-IV disorder were ten times more likely to have a substance use disorder (Burns & Teeson, 2002) however, those reporting alcohol use in the absence of disorder had lower rates of affective and anxiety problems (Degenhardt et al, 2001a). Adolescent studies have demonstrated that, regardless of gender, a significant relationship existed between earlier adolescent use of alcohol, tobacco and marijuana and depression (Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Brook et al, 1998) and that those with AUDs experienced more SUDs and depression as young adults, even when depression in adolescence was controlled for (Rhode et al, 2001). However AUDs were not found to predict onset of cigarette smoking or anxiety disorders in young adulthood (Rhodes et al, 2001) and psychiatric disorders in adolescence did not predict changes in substance use in young adulthood (Brook et al, 1998).

Evidence about the relationship between marijuana use and the development of later psychopathology is inconsistent. Research has not yet clearly demonstrated either the relation between cannabis use and later mental health problems, nor the relation between earlier mental health problems and the development of later cannabis use (McGee et al, 2000). For instance, strong predictive relationships have been reported between adolescent alcohol, tobacco and marijuana use and the later development of EDs (with the exception of ADHD), the predictive ability of tobacco use for later affective disorders, and the predictive ability of alcohol and tobacco for the development of later anxiety disorders. However, while some evidence pointed to a lack of association between adolescent marijuana use and later anxiety or depression in adolescence (Armstrong & Costello, 2002) and adults (Degenhardt et al, 2001), other evidence suggested that adolescent marijuana use significantly predicted later major depressive disorder, alcohol dependence, and substance use problems in the mid twenties (Brook et al, 2002). These findings are of particular interest in the light of findings regarding the primary direction of risk in adolescence as being from psychopathology to cannabis use (McGee et al, 2000).

A somewhat clearer picture is emerging about the relationship between tobacco use and its relation to mental health problems. Predictive relationships have been noted between persistent, heavy smoking and later depressive symptoms, however the inverse was also true (Windle and Windle, 2001). Generally, there is consensus that early onset tobacco may be taken at least as a marker for the development of later psychopathology including substance use problems later in life (Upadhyaya et al, 2002). This finding is underscored by Brook et al, (2002) who found that tobacco use in adolescence was predictive of an increased risk of alcohol dependence and SUDs at a mean age of 27 years, but was not predictive of an increased risk of new episodes of major depressive disorder. However, evidence further attesting to a disorder specific relation between substance use and psychopathology is offered by Dierker et al (2002) who reported that the pattern of association between heavy smoking and affective disorder differed according to diagnostic classification. "There was evidence of a shared aetiology between dysthymia and heavy smoking, whereas major and double depression did not demonstrate a shared vulnerability with heavy smoking" (Dierker et al, 2002, P947). Fergusson and colleagues suggested that common confounding factors were responsible for much of the association between smoking and depression. Even after controlling for demographic, temperamental, mental health and environmental factors, evidence of the potential for a causal relation between smoking and depression was reported. However, the direction of the relation remains unknown (Fergusson et al, 2003).

EDs are also often characterised by substantial comorbidity with SUDs. For instance, a recent variant of adolescent substance abuse characterised by externalising pathology and behavioural dis-inhibition has recently been hypothesised (Lilienfeld, 2003; Krueger et al, 2002; Iacono et al, 1999). Underlying this variant is the suggestion that a range of externalising behaviours and associated substance use indicate a homogeneous externalising spectrum (Krueger et al, 2002). Within such a model, CD, ODD, ADHD and a particular form of associated substance abuse, are represented as distinct phenotypes of an underlying spectrum in children, and behaviours characteristic of antisocial personality disorder as distinct phenotypes of the same spectrum in adults (Iacono et al, 1999; Krueger et al, 2002). Such a model builds on earlier conceptualisations of externalising pathology as indicative of a homogeneous group characterised by common genetic and environmental factors of risk (Moffitt, 1993). On balance however, current evidence suggests that externalising pathology, including substance use behaviour, may not be well accounted for by broad classifications of homogeneity (Babor et al, 2002; Fergusson et al, 1996). Rather, method may be found in a myriad of symptoms that indicate distinct but correlated behavioural domains (Fergusson, 2003).

1.14 Summary

A range of evidence has demonstrated that substances most commonly used by adolescents are alcohol, tobacco and marijuana (Young et al, 2002; Sutherland and Shepherd, 2001; Gledhill-Hoyt et al, 2000; Johnston et al, 2000). Evidence also suggests that use of each of these substances increases with age across the adolescent years (Young et al, 2002; Guo et al, 2002; Gledhill-Hoyt et al, 2000; Hawkins et al, 1997). Recent US data has, however, indicated a reduction in rates of use of each of these substances since the mid to late 1990's (Johnston et al, 2006). While age of initiation data has the potential to inform the trajectory, outcome, and pathology associated with substance use (Joun et al, 2002; Angold et al, 1999; Kosterman et al, 2000; Kessler, 2004) accurate age of initiation data drawn from normative or population samples is relatively rare. Until recently, the study of co-morbid psychopathology had also been rare with the majority of research undertaken on the subject occur only in the late 20th century (Angold et al, 1999; Kessler, 1995). The implications of undertaking such research cannot be underestimated, both in diagnostic and treatment terms (Kendler et al, 1997; Angold et al, 1999; Wilens et al, 1997; Rivers, Greenbaum & Goldberg, 2001).

Epidemiological studies report high rates of co-occurrence between problems of substance use and psychopathology (Armstrong & Costello, 2002; Weinberg & Glantz, 1999; Kandel et al, 1997; Kessler et al, 1994; Robins et al, 1991). The relationship between EDs and substance use is well illustrated in the literature, however the relationship between IDs and substance use is less well understood (Grant et al, 2004; Dierker et al, 2002; Weinberg & Glantz, 1999; Woodward & Fergusson, 2001). Consistent with externalising literature that suggests that a variant of adolescent substance use characterised by externalising pathology and behavioural dis-inhibition may be identified (Lilienfeld, 2003; Krueger et al, 2002; Iacono et al, 1999), some evidence has been offered to suggest that internalising behaviours and substance use in adolescence may be indicative of a syndrome of behaviours already in evidence in childhood (Hanna et al, 2001).

Adolescent psychopathology has commonly been differentiated on the basis of whether the disturbance is characterised primarily by internalising features (including depression, anxiety, withdrawal, and eating disorders) or externalising features (including aggression, oppositional disorders, delinquency, and school problems) (Leadbeater, Kuperminc, Blatt, Hertzog, 1999; Achenbach, 1991). While relatively little incidence of diagnosable pathology may be expected in normative samples, a solid literature attests to the validity, and the theoretical and functional utility of drawing distinctions between internalising and externalising features (De Groot et al, 1994; et al, 1999; Achenbach, 1995).

1.15 Substance Use As A Mediated Relation

A number of recent studies drawing on normative samples have contributed to a greater understanding of the co-occurrence of substance use and mental health problems as they occur at a population level (Armstrong & Costello, 2002, Boys et al, 2003; Kashani et al, 1987). However, the potential for the developmental relationship between mental health and substance use to be influenced in a mediational manner by additional factors has received relatively little explicit attention. A review of the literature identified a number of usual suspects (Armstrong and Costello, 2002) and in the present context, the potential for mediation was narrowed down to four potential influences. A significant body of intervention and prevention work has sought to address social skills deficits in adolescence in an attempt to avert or address adolescent trajectories into substance use (Bartholomew, Hiller, Knight, Nucatola, Simpson, 2000; Epstein, Griffin & Botvin, 2000; Wynn, Schulenberg, Maggs & Zucker, 2000; Botvin & Kantor, 2000). However, existing evidence is unclear with some research pointing to the developmental importance of social skills in averting substance use (Gaffney et al, 1998; Lewis & O'Neil, 2000), and other evidence suggesting a lack of effect

from teaching specific skills to guard against the development of substance use (Lewis & O’Neil, 2000).

Secondly, the relation between individual reasons for substance use and patterns of substance use is an area that has been widely studied (Miller & Plant, 2002; Tarter, 1988; Wills, Cleary, & Windle, 1998; Stacy, Marlatt, & Widaman, 1990; Cooper, Frone, Russell, & Mudar, 1995). Specifically, research into motives for substance use is concerned with the individual’s motivational state with regard to substance use, and its relation with use (Simons, Correia & Carey, 2000; Cox & Klinger, 1990; Cooper, 1994; Cooper et al, 1995). From this standpoint, substance use may be regarded as a range of distinct, directed and purposeful behaviours determined on the basis of motivational forces (Read, Wood, Kahler, Maddock, Palfai, Tibor, 2003; Newcomb, Chou, Bentler & Huba, 1988; Cooper, 1994).

Thirdly, efforts to understand the role of emotional processes and their relation to the development of substance use have been offered within a range of models of human behaviour (Lazarus, 1966; Conger, 1956; Buss & Plomin, 1984; Tarter, 1988). The relation between affect and substance use has also received a good deal of attention with the development of models of self control, affect and emotion regulation drawing on a range of environmental, cognitive and neurological processes (Wills, Cleary, Filer, Shinar, Mariani & Spera, 2001; Wills, Sandy, Shinar, & Yeager, 1999; Eisenberg, Fabes, & Losoya, 1997; Eisenberg, Fabes, Guthrie, Murphy, Maszk, Holmgren, & Suh, 1996; Hawkins et al, 1992; Thayer & Lane, 2000; Gross, 1998b; Ochsner, Bunge, Gross, Gabrieli, 2002) and substance related problems. Finally, parental and peer influences are commonly recognised as being central in adolescent development towards substance use (Pomery, Gibbons, Gerrard, Cleveland, Brody, Wills, 2005; Hawkins et al, 1992; Windle, 2000). Research has demonstrated that family of origin and peer characteristics have the potential to operate as factors of both risk and protection in relation to the development of substance use in adolescence (Gou, Hill, Hawkins, Catalano, & Abbott, 2002; Weinberg, Rahdert, Collier & Glantz, 1998; Malone, Iacono, & McGue, 2002; Wills, McNamara & Vaccaro, 1995; Walden, McGue, Iacono, Burt, Elkins, 2004; Kaplow, Curran, & Dodge, 2002)

Literature pertinent to the present discussion on the potential for each of these four influences to mediate the relation between mental health and trajectories of development into substance use is reviewed next.

1.16 Social Skills

A large body of research suggests that a mediational relation may exist between social ability and the development of substance use in adolescence (Gaffney, Thorpe, Young Collett, & Occhipinti, 1998; Barkin, Smith and Durant, 2002; Epstein, Griffin & Botvin, 2000). An equally large body of intervention and prevention work has been developed in an effort to address social skills deficits in adolescence in an effort to address the initiation and maintenance of substance use in adolescence (Bartholomew, Hiller, Knight, Nucatola, Simpson, 2000; Epstein et al, 2000; Wynn, Schulenberg, Maggs & Zucker, 2000; Botvin & Kantor, 2000). On the basis of existing research, it seems that an understanding of the developmental relation between social skills and substance use problems is, at best, unclear. Evidence points both to the developmental importance of social skills acquisition in protecting against the development of substance use (Gaffney et al, 1998; Lewis & O’Neil, 2000), as well as to the lack of demonstrated effect of teaching specific skills to guard against the initiation or maintenance of substance use (Lewis & O’Neil, 2000).

Social-cognitive models in particular posit that aversive outcomes such as substance use will result from underdeveloped or inadequate social acumen (Herrick & Elliot, 2001; Marlatt, Baer, Donovan & Kivlahan, 1988). Social-cognitive conceptualisations of substance use behaviour draw on cognitive and biological predisposing factors as antecedents to maladaptive social learning. According to such models, having been established on the basis of prior learning, substance use occurs in a social context as a maladaptive attempt to compensate for a

lack of appropriate or functional social behavioural repertoire (Mackay, Donovan, Marlatt, 1991). Thus, a central tenet of social cognitive models of substance use is that use will occur in the absence of appropriate social coping skills (Herrick & Elliot, 2001; Marlatt et al, 1988), and is itself indicative of an existing behavioural repertoire (Mckay et al, 1991) that is both habitual and over learned (Marlatt, 1979).

Distinctions between the acquisition of social skills and social performance utilising those skills have been drawn (Spence, 2003; Gresham, 1997). The distinction is drawn on the basis of possession versus delivery of the skill in question, and has obvious importance for the conceptualisation and treatment of social behavioural deficits. Interpersonal problem solving deficits have been found to be implicated in inappropriate or problematic social interactions (Spence, 2003). Inappropriate social response will result from inability to identify the demands of a situation, inability to generate a range of response options, or inability to undertake and evaluate the possible consequences of a proposed response (Spence, 2003). Interpersonal problems consistent with social cognitive conceptualisations of substance use behaviour may be either acquisitional or performance based, and may be addressed either by instilling the requisite social skills, or by enhancing them by means of cognitive restructuring, contingency management, impulse control, or rehearsal in situ (Miller & Brown, 1997; Spence, 2003).

Several experimental studies also point to the relation between social behaviour and substance use. Adolescence is important both for facilitation of social behaviour, and for learning appropriate ways to alleviate aversive social and interpersonal stimulus (Spear, 2000). The relation between adolescence and alcohol use may therefore be important to the acquisition of substance related social behaviour (Spear, 2000; Varlinskaya & Spear, 2002). The animal literature has demonstrated that ethanol can significantly increase social facilitation, investigation and play-fighting in adolescent rats in familiar environments (Varlinskaya & Spear, 2002). In addition, ethanol has been shown to result in a reduction of social inhibition in unfamiliar situations in both adolescent and adult rats (File & Hyde, 1978; Varlinskaya & Spear, 2002), with the higher doses required in adult animals (Varlinskaya & Spear, 2002) indicative of the robustness of social repertoire.

Human literature also offers evidence of a relation between social behaviour and substance use. For instance, a solid literature has been developed on the subject of using substances both in the interests of engaging others socially, as well as in an effort to cope with or alleviate aversive life events or situations (Windle & Windle, 1996; Cooper, 1994; Cooper et al, 1995). Social and coping motives have been shown to predict level of alcohol use in adolescents, and have also been studied in relation to tobacco and marijuana use (Comeau, Stewart & Loba, 2001; Simons, Correia, Carey & Borsari, 1998; Cooper, 1994; Cooper et al, 1995). Invariance of coping motives for alcohol use has been demonstrated across gender, race and age, although conflicting evidence has been offered for gender, (Wills, Sandy, Yaeger, Cleary & Shinar, 2001; Bradizza, Reifman & Barnes, 1999) and age (Bradeizza et al, 1999) effects.

The realm of social behaviour has further been linked to level of adolescent substance use through studies of self-appraisal of social problem ability (Godshall & Elliott, 1997; Herrick & Elliot, 2001). Of particular interest are findings that adolescents and young adults who self report a tendency to actively avoid dealing with daily problems also have a tendency for increased alcohol use. This finding was true for a sample of substance abusing adolescents whose alcohol use behaviour was studied two weeks prospectively (Godshall & Elliott, 1997), for a sample of adults in an inpatient treatment programme (Herrick & Elliot, 2001) and for alcohol-abusing children of problem drinkers when compared with adolescents whose parents did not abuse alcohol (Slavkin, Heimberg, Winning & McCaffrey, 2002). Similarly, adolescents who abuse substances may come from families that lack skills in family problem solving and coping with every day problems (Hops et al, 1990). These findings suggest, amongst other things, that the relationship between personal alcohol use and self-appraised

problem solving ability may be mediated by parental relationship to substance use (Slavkin et al. 2002).

Family of origin variables have consistently been shown to predict substance use in offspring, as they have to predict social, interpersonal, and social problem solving ability. For instance, close and supportive intra-familial relationships have been associated with lower substance use (Averna & Hesselbrock, 2001), as has close-affectionate attachment between parent and child (Brook, Brook, Gordon & Whiteman, 1990). Conversely, adolescents who come from family environments with a family history of alcohol use problems have been demonstrated to have lower levels of attachment to parents and to experience elevated levels of stress in response to social interpersonal factors (Johnson & Pandina, 2000). There is some evidence that such an effect may differ across gender, with evidence that stressful life events and low family support have been demonstrated as significant prospective predictors of problem behaviour in female adolescents but not male adolescents. (Windle, 1992; Dijkstra, Sweeney & Gebhardt, 2001). Averna and Hesselbrock (2002) offer evidence to suggest that levels of perceived social support are implicated in choice of substance used. Generally, participants in this research, who were children of people with and without alcohol use problems, perceived greater social support from without the family than from within it. This finding was more pronounced for females than males, for older adolescents than younger adolescents, and for heavy alcohol users. Of particular note, this study reported that adolescents who used tobacco and marijuana at heavy levels generally reported lower perceived social support than adolescents who reported use at lower levels.

Gender of parent may also be important in elucidating the relationship between social acumen and substance use in adolescence. In particular, the parenting style of the parent who is the same sex as the respondent has been shown to predict self-regulation, which has been implicated both in the development of social behaviour and substance related problems (Rydell, Berlin & Bohlin, 2003; Wills et al, 2001; Tarter, 1988). Respondents, who had same sex parents who were described as permissive, were more likely to demonstrate poor self-regulatory process regardless of gender (Patock-Peckham, Cheong, Balhorn, Nagoshi, 2001). The same study also offered evidence to the effect that the presence of an authoritative mother predicted higher levels of self-regulation in women, and concluded that parenting skills suffered in families where alcohol use problems existed (Patock-Peckham et al, 2001; Duncan, Duncan, Biglan & Ary, 1998). This conclusion is supported by evidence indicating differential parental interactions in families with parents with alcohol use problems compared with those without alcohol use problems. Specifically fathers with alcohol use problems demonstrated lower affect, engagement and levels of interaction with their children, while mothers with alcohol use problems showed poorer and less verbal interaction with their children (Miles, Silberg, Pickens, & Eaves, 2005; Leonard, Eiden, Wong, Zucker, Puttler, Fitzgerald, Hussong, Chassin, Mudar; 2000).

However the developmental literature has indicated that peer relationships may be more influential for adolescents than family or parental relationships (Brown, 1990). This may be particularly so with regard both to social norms and the extent to which adolescents perceive their friends or peers are able to offer them social support (Averna & Hesselbrock, 2001; Wood, Nagoshi & Dennis, 1992). In addition, adolescents have been found not only to perceive greater social support from their friends than from their parents, but to demonstrate more complex representations of the support they gain from friends than that they gain from their parents (Averna & Hesselbrock, 2001). Thus, the role of peers in the development and maintenance of substance use may be greater than the influence parents can exert on it. Peer relationships have the potential both to protect against, and provide risk for, the initiation and development into substance use and its associated problems (Averna & Hesselbrock, 2001). Given that age in adolescence is differentially related to motivation for and level of substance use (Windle & Windle, 1996; Cooper, 1994; Cooper et al, 1995), the interaction between the

source of greatest perceived social support, motivation for use, and level of use, may act as determinants of the onset and maintenance of substance use in adolescence.

Efforts to steer adolescents away from initiation into, or maintenance of, use of substances, have drawn on the importance of peer influences. Typically, the so called resistance training approaches have involved teaching participants to recognise situations high in risk for substance use, teaching them strategies to avoid or deal with such situations, and teaching them skills to accurately assess advertising and other prevalence of use information. Building on early approaches of Psychological Inoculation (Evens, 1976) that stressed the importance of graded exposure in effectively challenging increasingly more forceful influences to initiate or continue substance use, and Normative Education (Hansen, & O'Malley, 1996; Fishbein, 1977) which sought to correct erroneous assumptions regarding the prevalence of substance use, Resistance Training was developed on the basis that adolescents begin to use substances because they don't possess sufficient confidence, skills or insight to counter the influences of those already given to doing so (Botvin, 2000).

The manner in which social ability was related to the development of substance use was studied by Griffin, Epstein, Botvin, and Spoth (2002). These authors presented evidence to suggest that the development of social skills was directly implicated in levels of substance use in adolescence. Specifically, adolescents who demonstrated greater social confidence, increased assertiveness, and good communication skills, reported less consumption of alcohol and tobacco. Additional research has suggested that involvement with alcohol is explainable in terms of social skills, either independently of, or in combination with, expectations about alcohol use (Gaffney et al, 1998). Barkin et al, (2002) hypothesised that 12-13 year olds engagement in substance one year prospectively would operate as a function of their so called "self efficacy to say no" (Barkin et al, 2002, P489) to anyone who offered them substances. 51% of variance associated with current use was accounted for by ability to say no to use, positive drug attitudes, peer positive drug attitudes, male gender and CD characteristics. Prospectively, approximately 74% of the variance associated with use one year hence was accounted for by current use, positive drug attitudes, ability to say no to use, and CD characteristics (Barkin et al, 2002). Additional research by Botvin (2000) supported these findings suggesting the most promising prevention approaches target individuals during the beginning of adolescence and teach social skills in the form of drug resistance skills, and Bartholomew et al (2000) who demonstrated that training in communication and relationship skills for adult men increased knowledge and social conformity, and reduced attitudes consistent with rigid socialisation and gender role conflict.

Long term evaluations of resistance training programmes have identified two major categories of substance use prevention programmes: Interactive and Non-interactive (Tobler & Stratton, 1997; Botvin & Kantor, 2000), and provide only limited support for the efficacy of such programmes immediately after programme delivery (Ennett, Rosenbaum, Flewelling, Bieler, Ringwalt, & Bailey, 1994; Clayton, Cattarello, & Johnstone, 1996), and little support for long-term effect (Ennett et al, 1994; Clayton et al, 1996; Tobler & Stratton, 1997). Most commonly, evaluation studies find interactive programmes demonstrate superior gains when compared with dissemination programmes (Tobler & Stratton, 1997), but report mixed evidence of programme efficacy on a range of outcome measures including resistance skills, (Barkin et al, 2002; Wynn, Schulenberg, Maggs & Zucker, 2000; Clayton et al, 1996; Epstein et al, 2000; Ennett et al, 1994; Hansen and Graham, 1991) self esteem (Ennett et al, 1994) decision making skills (Barkin et al, 2002; Epstein et al, 2000) attitudes (Clayton et al, 1996), social skills (Ennett et al, 1994; Clayton et al, 1996), norm setting (Wynn et al, 2000, Hansen & Graham, 1991) and related knowledge (Clayton et al, 1996). Of note, Wynn et al (2000) concluded that norm setting, and not refusal skills per se, mediated programme effectiveness. A number of authors have alluded to the value of adding follow-up booster sessions to underscore post intervention gains later (Botvin, 2000; Bell, Ellickson & Harrison, 1993), but

evidence on the addition of booster sessions is limited (Tobler & Stratton, 1997; Clayton et al, 1996), especially when programme effects post intervention were limited (Ennett et al, 1994).

The evidence on the efficacy of the so-called “say no” programmes in reducing substance use among adolescents is also mixed. While some research points to successful results from intervention (Botvin and Kantor, 2000; Botvin, 2000; Bell et al, 1993), a range of literature attests to the inconclusive, if not conflicting results of teaching resistance skills. This is true for alcohol with some research reporting a reduction in alcohol use until the end of high school as a result of offering normative information, resistance skills and social skills (Botvin, 2000). However other research reported either a lack or loss of follow-up intervention effects (Bell et al, 1993; Ennett et al, 1994; Clayton et al, 1996; Hansen & Graham, 1991) on level of alcohol use. In addition, one study reported increases in level of alcohol use for rural students post intervention (Ennett et al, 1994). Similar evidence has been presented on tobacco with some evaluations reporting effects post intervention or at follow up (Ennett et al, 1994; Botvin, 2000; Botvin & Kantor, 2000; Hurd, Johnson, Pechacek, Bast, Jacobs, and Luepker, 1980), and some research reported no post or follow-up intervention effects (Clayton et al, 1996; Hansen & Graham, 1991). Results of interventions into the use of marijuana suggest that some programmes result in reductions in use post intervention or at follow up (Botvin, 2000 Clayton et al, 1996; Hansen & Graham, 1991) and others report no post or follow-up intervention effects (Ennett et al, 1994; Bell et al, 2002).

1.17 Motivation for Use Among Adolescents

The reasons that people engage in substance use, as well as the relation between their reasons for use and their patterns of use, are areas of inquiry that have been actively pursued within the substance use literature (Miller & Plant, 2002; Tarter, 1988; Wills et al, 1998; Oei & Baldwin, 1993; Stacy, Marlatt, & Widaman, 1990; Cooper et al, 1995). The majority of research and theoretical interest in the relation between cognition and substance use has focused on one of two areas, the area of Expectancies, and the area of Motives. Despite theoretical and conceptual distinctions between these two distinct areas of inquiry, considerable conceptual overlap continues to exist between them (Simons et al, 2000; Leigh, 1989). In general terms, expectancy research is concerned with identifying reinforcing outcomes that are developed on the basis of prior learning, and that act to determine the effects people expect to result from the use of any given substance (Jones, Corbin and Fromme, 2001; Oei & Baldwin, 1993; Stacy et al, 1990). Research and theory into the motives for substance use is more concerned with the individual’s motivational state and the manner in which this state influences use (Simons et al, 2000; Cox & Klinger, 1990; Cooper, 1994; Cooper et al, 1995). Evidence does, however, suggest that expectancies precede motivation in substance use behaviour (Cooper et al, 1995). A full account of the relation between expectancy theory and motives for use is beyond the scope of the present discussion, and the interested reader is referred to reviews of expectancy theory that contain discussion on the overlap with and implications for theory and research into motives for use (Jones et al, 2001; Galen, Henderson & Coovert, 2001).

Models of motivation for substance use maintain that substance use does not simply arise as a result of the quantity or frequency of use (Read et al, 2003; Cooper, 1994; Cox & Klinger, 1988). Within a motivational model, substance use may be regarded as a range of qualitatively distinct, directed and purposeful behaviours determined on the basis of the motivational forces that give rise to the use of the substance in question. This notion (Read et al, 2003; Newcomb, Chou, Bentler & Huba, 1988; Cooper, 1994) is based on two major theoretical assumptions: that people engage in substance use to attain certain valued outcomes (Cox & Klinger, 1988) and that people assume (implicitly or explicitly) that unique factors (patterns of antecedents and/or consequences) characterise the motivation toward use (Cutter & O’Farrell, 1984). Effective assessment of the motives that people endorse in their use of substances may therefore offer insight into the functional nature of the behaviour, the quantity and frequency

of use, and appropriate cognitive and behavioural strategies for intervention in the event that substance use problems result.

Early efforts to account for the manner in which individual's motives for substance use impacted on the behaviour were directed largely at alcohol use and were characterised by a lack of consistency with regard to operationalisation and measurement. The number and breadth of motives used to account for the functional dimensions of the behaviour differed markedly. Newcomb et al (1988) suggested that four factors, Enhance Positive Affect and Creativity, Reduce Negative Affect, Social Cohesion and Addiction accounted for fifteen reasons that adolescents would use substances. However, these authors proposed a single second order latent factor, Alcohol Motivation, to account for alcohol use (Newcomb et al, 1988). In contrast, other researchers found evidence to support numerous and distinct motives to account for substance use behaviour among both adolescents and adults (Mann, Chassin & Sher, 1987; Cutter & O'Farrell, 1984; Johnston and O'Malley, 1986). Early research was also characterised by a lack of consistency with regard to the measures employed to account for motivation toward substance use, with regard to the classification of motives, and with regard to the conceptual basis upon which the motivation for substance use was determined (Mann, Chassin & Sher, 1987; Cooper, 1994; Comeau et al, 2001).

There is substantial evidence to suggest that an important motivator of substance use behaviour may be regulation of affect (Leigh, 1989; Wills & Shiffman, 1985; Cooper, 1995). In general terms, substance use behaviour undertaken on the basis of affective motives will be directed to achieving enhancement of positive affective states and/or reduction of negative affective states (Leigh, 1989; Wills & Shiffman, 1985). The strong positive association between negative affect and elevated use of substances is well established (Wills et al, 1999). Clinically, it has been found that adolescents who use illicit substances have elevated rates of major depression and anxiety disorders (Clark, Pollock, Bromberger, Bukstein, Mzzich & Donovan, 1997; Kandel, Johnson, Bird, Canin, Goodman, Lahey, Reiger, & Schwab-Stone, 1997).

However, similar numbers develop negative affect disorders prior to the onset of their SUD's as do those who develop negative affect disorders after the onset of SUD's (Clark et al, 1997). The potential for alcohol to act to reduce both physiological and psychological aspects of anxiety has been demonstrated experimentally (eg: Sher & Walitzer, 1986) and sensitivity to anxiety has been proposed as a factor of risk for alcohol use, with women highly sensitive to anxiety engaging in alcohol use as a coping strategy and men highly sensitive to anxiety engaging in alcohol use in an effort to conform to the behaviour of others (Stewart, Zvolensky & Eifert, 2001). The implication from such evidence is that it may be reasonable to suggest that one factor implicit in substance use behaviour may be the reduction of negative affect commonly associated with internalising psychopathology (King et al, 2004; Stewart et al, 2001). This has, for example, been demonstrated in the use of cannabis by people suffering psychosis, who reported modification of negative affect as a primary motive for use (Green, Kavangah & Young, 2004)

The association between desire to induce, increase, or maintain positive affect and the use of substances is less well established (Wills et al, 1999; Cooper 1994; Stewart et al, 1996). From a theoretical standpoint, a lack of agreement still characterises conceptualisation of positive and negative affective state as lying on the same continua or as lying along orthogonal dimensions (Watson & Tellegen, 1985). In contrast to negative affect, positive affect has been shown to be inversely related to alteration in the level of use of alcohol, tobacco and marijuana (Wills et al, 1999, Cooper, 1994; Newcomb et al, 1988). Wills and Shiffman (1985) argued that desire for enhancement of positive emotion would result in (enhancement motive) drinking behaviour. However, positive emotions are not generally associated with behavioural responding (Cooper, et al, 1995), and if alcohol use is, in the strictest sense, an appetitive, it should be characterised by a desire to effect change in the current affective state. In one study,

Colder and Connor (2002) suggested that strong appetitive response sets and expectation of reward decrease the potential for inhibition of behaviour. Thus, both frequent alcohol use and enhancement of affect were strongly related to reward cues and disinhibited behaviour (Colder and Connor, 2002).

Based on the conceptual work of Cox & Klinger (1988), Cooper (1993, 1994) developed model of motivation for substance use in adolescence. Cox & Klinger's (1988) model was based on the assumption that individuals will drink when the positive affective consequences they expect to result from drinking are greater than those they expect will result from not drinking (Cox & Klinger, 1988). Within their model, the potential influences on affect were both direct (physiological) and indirect (instrumental) and were conceptualised within a 2 x 2 (enhancement – reduction x positive – negative) framework. Cooper's model, which generalised well across adults and adolescents, was also conceptualised as a 2x2 (source x valence) model and was initially applied to alcohol use (Comeau et al, 2001). The source (internal – external) of the reinforcement that may result from consumption, in combination with the valence (+ve reinforcement - -ve reinforcement) of reinforcement, offered four specific drinking motives.

Each of Cooper's motives is associated with a unique pattern antecedents, drinking behaviour, and consequences (Comeau et al, 2001; Cooper, 1994). Social motives (external reward, +ve reinforcement) determine that drinking will occur in the company of others, are normative (Cooper et al, 1995), and will be undertaken in the interests of obtaining positive (social) reinforcement. Enhancement motives (internal reward, +ve reinforcement) are undertaken in the interests of increasing positive affect (Cooper et al, 1995), in situations where heavy drinking is the norm (Cooper 1994), and as an appetitive process rather than on the basis of avoidance (Cooper et al, 1995). Neither social motives nor enhancement motives are strongly predictive of alcohol use problems (Cooper, 1994; Cooper et al, 1995). In contrast, both coping motives (internal reward, -ve reinforcement) and conformity motives (external reward, -ve reinforcement) are more strongly related to (high – low) quantity and (high – low) frequency of alcohol use and are therefore predictive of alcohol use problems (Cooper, 1994). Coping motives are characterised by a desire to escape, regulate, or avoid negative affect and drinking behaviour is reactive thereby serving an aversive motivational role (Cooper et al, 1995). Despite its negative relation to quantity and frequency of use, conformity motives are strongly predictive of alcohol use problems (Comeau et al, 2001; Cooper, 1994).

Simons et al (2000) added a fifth motive to Cooper's (1994) four, and sought to test the motives for alcohol use across alcohol and marijuana. The additional motive, expanded experiential awareness (expansion) was added to account for the potential for substance use in the interest of gaining cognitive or perceptual enhancement (Simons et al, 2000). Results suggested that participants endorsed marijuana expansion motives significantly more than expansion motives for alcohol, and alcohol social motives were more strongly endorsed than marijuana social motives. Simons et al suggest these results may reflect drug specific expectations that were not reflected in coping and conformity motives, which were endorsed equally across the two substances (Simons et al, 2000).

Simons et al (2000) finding that motives for substance use vary across gender groups is consistent with evidence from most research on the subject, although the results demonstrate some variability across studies. Cooper (1993) reported "drinking motives were related in a largely invariant manner to patterns of alcohol use and abuse across gender, race and age subgroups" (Cooper, 1993, P126), a position supported by Bradizza et al (1999) who found few gender differences between alcohol motives and predictive ability for alcohol problems. While coping motives have been found to be better predictors of alcohol use in women (Newcomb et al, 1988), they have been found to be both significantly more strongly related to alcohol problems in women than men (Simons et al, 1998), and more strongly related to

alcohol problems in men than women (Cooper et al, 1995). Generally, social motives are not strongly related to alcohol use problems (Simons et al, 2000; Cooper et al, 1995), conformity motives have been found to be better predictors of alcohol use in men (Cooper, 1994), and positive emotions significantly negatively related to enhancement drinking in men but not women (Cooper, 1994, Cooper et al, 1995).

With regard to invariance across race, Coping motives have been found to strongly predict drug use and alcohol problems among Blacks (Bradizza et al, 1999; Cooper et al, 1992; Cooper et al, 1995). Whites endorsed social, coping and enhancement motives for drinking significantly more than Blacks (Cooper, 1994) and enhancement motives strongly predicted alcohol use in Whites (Cooper et al, 1995) and drug use and alcohol problems in Whites (Cooper et al, 1992). Social motives were found to be better predictors of alcohol misuse among Whites than among Blacks (Bradizza et al, 1999)

Comeau et al (2001) drew on Cooper's (1994) four categories of substance use motivations in their study of adolescent motivation to use alcohol, tobacco, and marijuana. Coping, conformity, enhancement and social motives for substance use were studied in relation to measures of trait anxiety, anxiety sensitivity, and sensation seeking behaviours. The authors found that substance use motives were more successful in predicting the three risky categories of motive (coping, conformity and enhancement) than were demographic data. Low anxiety sensitivity and high intensity seeking were found to predict enhancement motives for alcohol use, high anxiety sensitivity alone predicted conformity motives for alcohol and marijuana use, and high trait anxiety predicted coping motives for alcohol and cigarette use (Comeau et al, 2001).

1.18 Emotion and its Regulation

The ability to exhibit control over emotional expression is central to adaptive human behaviour (Levesque, Fanny, Joanne, Paquette, Mensour, Beaudoin, Leroux, Bourgoin, Beauregard, 2003; Oshner & Gross, 2005; Thompson, 1994). The complexity that is inherent both in emotional processes and in their study is underscored by the lack of a succinct and functional definition of the term (Quirk, 2001). Groundbreaking efforts to understand the role of emotional processes involved in the development of substance use problems were offered within stress and coping models (Lazarus, 1966), from the reinforcing properties of substances within behavioural – learning paradigms (Conger, 1956) and within temperamental vulnerability models (Buss & Plomin, 1984; Tarter, 1988). More recently, important theoretical and experimental links have been made between emotion and its role in relation to positive and negative affect (Wills et al, 2001; Wills et al, 1999; Eisenberg et al, 1997; Eisenberg et al, 1996; Wills et al, 1999), the development of self-control of affect (Wills et al, 2001; Hawkins et al, 1992), emotion regulation and dysregulation (Thayer & Lane, 2000; Gross, 1998b; Cooper et al, 1995), limbic, prefrontal and frontal cortical structures (Oshner et al, 2002; Davidson, Jackson, Kalin, 2000) and substance related problems. Currently, theories central to our understanding of emotion are defined in terms of process, and describe a coordinated series of functions that involve environmental, limbic, frontal cortical, behavioural, and experiential activity (Quirk, 2001; Gross, 1998b).

The study of temperament continues to be important in understanding the role of emotion in substance use (Wills et al, 2001). Temperamental disposition has been hypothesised to contribute to vulnerability to both behavioural and substance use problems (Blackson, 1994; Windle, 2000; Tarter & Mezziah, 1992; Buss & Plomin, 1984) and research has demonstrated that certain temperamental traits, when measured in childhood, have high association with behavioural problems later in childhood (Buss & Plomin, 1984) and with substance use in adolescence (Lerner & Vicaey, 1984; Tarter & Mezziah, 1992). In addition, when compared with other factors commonly highly correlated with behavioural and substance use problems, temperamental characteristics were also demonstrated to be highly predictive of these problems (Tarter, 1988). Importantly, temperamental dimensions demonstrated to protect

against the development of substance use include positive emotionality, whereas those that place individuals at risk for the development of substance use include negative affect (Wills et al, 2001). Affective state has been identified as an important determinant of social behaviour (Rydell et al, 2003; Quirk, 2001) and evidence further suggests that individual ability to regulate affect may play a central role in the development, maintenance, and potential for relapse into use (Wills et al, 1999; Quirk, 2001; Wills, Shiffman, 1985). High indices of emotionality in combination with poor ability to regulate behaviour are indicative of poor adaptive behaviour (Eisenberg et al, 2000; Rydell et al, 2003).

Elevated levels of fear commonly indicate increased propensity for internalising problems (Rydell et al, 2003), and high levels of negative affect have generally been reported as being predictive of substance use in adolescent (Wills et al, 1999), particularly when accompanied by low ability to constrain response (Krueger, 1999). Conversely, one study found evidence to suggest that high negative emotionality was a stronger predictor of externalising problems than was ability to regulate (Nelson, Martin, Hodge, Havill, & Kamphaus, 1999). While low levels of negative emotionality and high levels of positive emotionality have been associated with social competence and peer popularity (Eisenberg et al, 1997; Rydell et al, 2003), both anger and fear have also been associated with pro-social behaviour (Rydell et al, 2003). These findings are of interest in light of the research undertaken by Blackson (1994) that concluded that difficult temperament may be associated with both internalising and externalising problems.

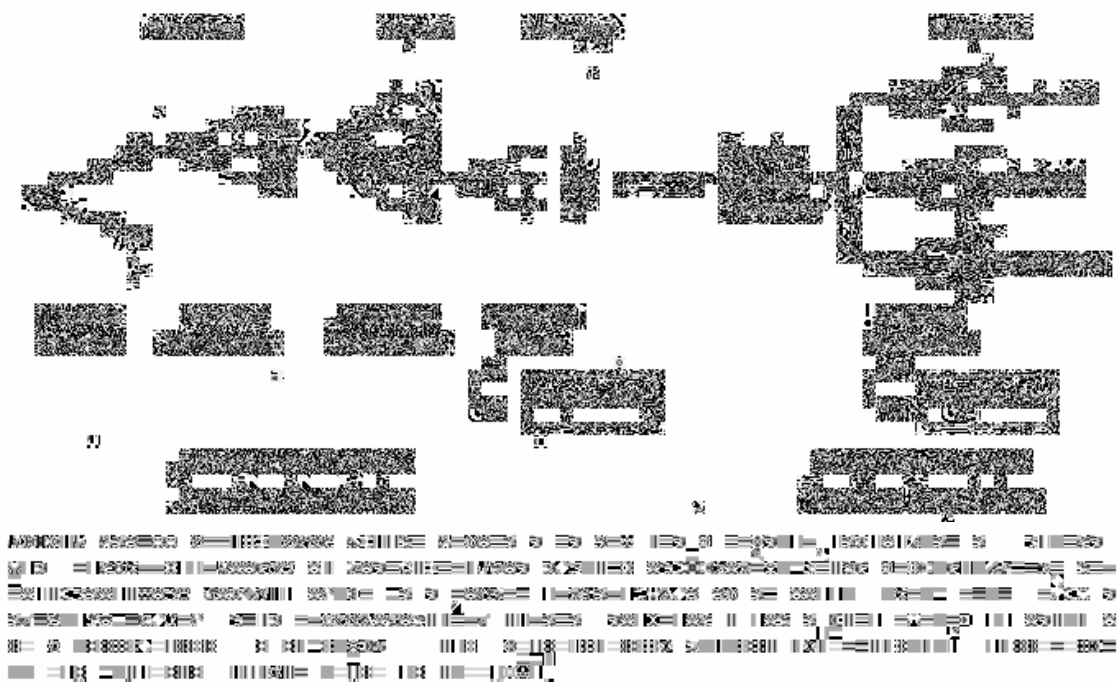
Less research has been undertaken on the relation between positive affect and its potential for reducing vulnerability, either to behavioural problems or to substance use (Wills et al, 1999). Some research has suggested that high positive emotion, particularly when accompanied by high anger or fear regulation, and low anger reactivity, can predict high levels of pro-social behaviour (Rydell et al, 2003, Southam-Gerow & Kendall, 2002). Positive affect has been found to be inversely related to change in indices of use of alcohol, tobacco and marijuana in adolescents (Wills et al, 1999) offering support for the finding that negative affect and positive affect offer independent contributions to the use of substances (Rydell et al, 2003; Wills et al, 1999). However, high levels of positive affect, together with an inability to regulate that affect, have also been linked to low behavioural inhibition in children (Fox, Henderson, Rubin, Calkins & Schmidt, 2001; Southam-Gerow & Kendall, 2002).

Taken together, the results of these studies offer support for the notion that ability to regulate, rather than the presence of negative or positive affect per se, may determine the extent to which a child's behaviour is seen as adaptive (Rydell et al, 2003). An implicit assumption, however, is that it is possible for individuals, at least when adult, to alter or maintain both positive and negative affective states (Gross, 1998b). Disorders of affect arise when an individual is unable to select an appropriate response, or inhibit an inappropriate response, given the prevailing set of environmental demands (Thayer & Lane, 2000). The implication is that both negative and positive regulatory systems are probable, if orthogonal, determinants of emotional behaviour. Neither can, therefore, be underestimated (Thayer & Lane, 2000). In studies that have drawn on adolescent samples, effect sizes suggest that affective influences are of somewhere between proximal and distal importance in the development of substance use (Wills et al, 1999). This conclusion suggests that affective factors may themselves not predict substance use. However inconsistent findings have been reported in this regard (Wills et al, 2001), and it may be that individual affective characteristics predispose individuals to more proximal factors indicative of use (Wills et al, 1999).

Of current theoretical and experimental interest are questions about the manner in which people intervene in the emotional responses they do have, the process involved in this intervention, where in terms of process and physiology it occurs, and how it alters the cognitive and behavioural expression of emotion (Oshsner & Gross, 2005; Phillips, Drevets,

Rauch & Lane, 2003; Levesque et al, 2003; Ochsner et al, 2002; Beauregard, Levesque, Bourgouin, 2001; Jackson, Malmstadt, Larson & Davidson, 2000). Current conceptualisations of emotion regulation draw on attention, cognition, learning, neurophysiology and motivation (Ochsner & Gross, 2005; Quirk, 2001; Gross, 1998a, 1998b), and assume that discrete elements or subsystems (Phillips et al, 2003; Thayer & Lane, 2000; Gross, 1998b) operate to regulate affective response both in temporal and functional terms (Phillips et al, 2003; Ochsner & Gross, 2005; Gross & John, 2003, Thayer & Lane, 2000; Thompson, 1994). Emotion regulation is, therefore, a goal directed and dynamic behaviour (Phillips et al, 2003; Thayer & Lane, 2000; Thompson, 1994).

Current models conceptualise emotion regulation as a process. One model, posited by Gross and colleagues (Gross 1998b, Gross, 2002) holds that in seeking to achieve its goals, the emotion regulation system utilises behavioural, experiential and physiological processes across two broad dimensions, as antecedent focused emotion regulation responses, or as response focused emotion regulation responses (Gross, 1998a, 2002; Thayer & Lane, 2000;). The antecedent form of emotional expression is characterised by its occurrence prior to response. Antecedent responses to stimuli occur by virtue of an interactive relationship between the predominantly limbic centres that have the capability to generate emotional responses and frontal cortical centres that serve to attend to, reappraise, and regulate them (Nauta, 1971; Thayer & Lane, 2000; Gross, 1998b, 2002). The second form of emotional regulation is characterised by its occurrence in terms of response tendencies that have the potential to be realised in experiential, behavioural or physiological terms. Importantly however, their expression in these terms may also be suppressed. As such, these are response focused emotion regulation processes (Gross, 1998b).



From: Gross: Review of General Psychology, Volume 2(3), September 1998, 271–299

Gross (2002, 1998b) further elaborated on the antecedent/response distinction by postulating that five sets of emotion regulatory processes are involved prior to and after the generation of an emotional response. The expression of emotion as an antecedent to response is characterised in temporal terms by four distinct phases: (1) the selection of situations, (2) the modification of those situations, (3) the deployment of attentional resources to aspects of those situations, and (4) the cognitive reappraisal of detrimental, aversive, or negative meaning of aspects of those situations. The fifth and final of Gross' processes, response

focused emotion regulation, is characterised by the degree to which the individual may influence the physiological, experiential or behavioural manifestation of response tendencies once they have been deployed. As such, regulative processes engaged once response tendencies have been deployed are characterised by strategies of suppression (Gross, 2002, 1998b).

In some contrast to the model proposed by Gross, Phillips and colleagues (2003) offered a process model of emotion perception developed on the basis of review of animal, human lesion and fMRI study literature (Phillips et al, 2003). In contrast to the five stage process model offered by Gross, Phillips et al (2003) posit three stages of emotion perception: 1) identification of the emotional significance of a stimulus 2) production of an affective state in response to identification, and 3) regulation of the affective state. Consistent with the notion of process, Phillips and colleagues acknowledge the functional difficulty of isolating the neural correlates of each of these three stages, and instead offer evidence to suggest both that neural subsystems may serve each of these processes, as well as each process having common subsystems at their disposal (Phillips et al, 2003).

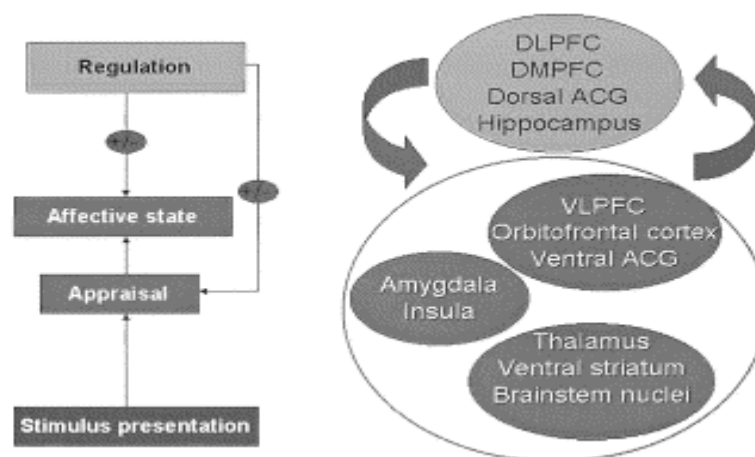


Figure 2. Schematic diagram depicting neural structures important for the three processes underlying emotion perception. A predominantly ventral system is important for the identification of the emotional significance of a stimulus, the production of an affective state, which may be associated with autonomic response regulation (depicted in pale gray), whereas a predominantly dorsal system (depicted in dark gray) is important for the effortful regulation of the resulting affective states. A reciprocal functional relationship may exist between these two neural systems (depicted by the curved arrows). DLPFC, dorsolateral prefrontal cortex; DMPFC, dorsomedial prefrontal cortex; ACG, anterior cingulate gyrus; VLPFC, ventrolateral prefrontal cortex. From Phillips, M.L., Drevets, W.C., Rauch, S.L., & Lane, Richard. (2003) Neurobiology of emotion perception I: The neural basis of normal emotion perception. *Biological Psychiatry*. Vol 54(5) 504-514. P516

The process of identifying the emotional significance of a stimulus, the production of an affective state in response, and the automatic regulation of emotional responses, falls within the ventral system (most importantly the amygdala, insula, and ventral regions of the anterior cingulate gyrus and prefrontal cortex) (Phillips et al, 2003). Importantly, these regions are also involved in autonomic arousal and regulation, in emotional response to stimuli with high emotional valence, and in the production of affective states (Phillips et al, 2003). The amygdala, in particular, has been implicated in modulating vigilance and attention to emotional information of high valence (Davis & Whalen, 2001). The process of regulation of affective state falls primarily under the control of a dorsal system (comprised of the hippocampus and dorsal regions of the anterior cingulate gyrus and prefrontal cortex) (Phillips et al, 2003). The ventral system compliments and extends the dorsal system by offering

executive control over stimuli of high emotional valence, and by allowing the allocation of attentional resources, planning, and effortful response as opposed to automatic control over affective state. The model also assumes a reciprocal functional relationship between the dorsal and ventral systems (Phillips et al, 2003).

For process models of emotion regulation, emotional expression that is characterised by reappraisal is generated primarily by limbic activity, is assessed with attentional resources, and, where necessary, is altered by means of cognitive intervention driven by frontal cortical centres that have the ability to intervene in the expression of limbic driven response (Phillips et al, 2003; Levesque et al, 2003; Beauregard et al, 2001; Jackson et al, 2000). Recent research has suggested that reappraisal is a more effective and less costly form of regulation than suppression (Gross, 2002). Characteristically, cognitive regulation (reappraisal) of emotion decreases the experience of that emotion, and alters response tendencies without impairing memory (Ochsner & Gross, 2005; Gross, 2002). However, the implications of this strategy for physiological arousal are less clear (Gross, 2002; Jackson et al, 2000). Gross and John (2003) found that reappraisers versus non-reappraisers experienced and expressed more positive emotion, less negative emotion, shared more emotional content with peers and rated higher on a range of wellbeing measures.

A number of recent studies have demonstrated the role of reappraisal in structural terms. Ochsner and colleagues used fMRI to examine neural structures used in the process of cognitive reappraisal of aversive photographic scenes in unemotional terms (Ochsner et al, 2002). Results of this study indicated that reappraisal had the potential to modulate emotion generative activity in the amygdala and the medial prefrontal cortex. In addition, the authors reported an inverse relation between activity in the ventral lateral prefrontal cortex and activity in the amygdala and the medial orbital frontal cortex (Ochsner et al, 2002) indicating that the former region may be central in the function of modulation of automatic processes (Phillips et al, 2003). Self-report in this study supported decreases in stimulus salience and relevance, with overall decreases in negative affect reported (Ochsner et al, 2002).

A second study by Schaefer, Jackson, Davidson, Aguirre, Kimberg, & Thompson-Schill (2002) investigated activity in the amygdala as a function of modulation of negative emotion. While the authors found evidence to support previous findings that activity in the amygdala operated as a function of valence, they also found that amygdala activity operated as a function of modulation, such that instruction to maintain negative emotional response increased fMRI detected activity in this structure (Schaefer et al, 2002). However, this study offered evidence that a large degree of individual variability existed in voluntary modulation of the amygdala. In addition, while important, the results are unable to isolate which of the numerous areas of the amygdala were active either on presentation or reappraisal of the stimulus.

One of the most important and comprehensive studies in the area was undertaken by Levesque and colleagues (Levesque et al, 2003). Through self-report, fMRI and fMRI *a posteriori* analyses, these authors sought to assess the neural substrates associated with the voluntary control of sadness. In manipulating response to sad films, the authors accounted for uninhibited reaction to a first film, as well as voluntary suppression of emotional reaction to a second. Consistent with previous work, (Damasio, Grabowski, Bechara, Damasio, Ponto, Parvizi, & Hichwa, 2000), and with both models illustrated above, (Gross, 2002, 1998b; Phillips et al, 2003) the uninhibited response condition demonstrated the close functional relation between autonomic response and the subjective manifestation of emotion through significant bilateral activation in the midbrain, particularly the left amygdala. This activity was accompanied by significant correlations between self-reported ratings of sadness and regional BOLD signal changes in the left insula and right ventrolateral prefrontal cortex (Levesque et al, 2003).

In the second condition, the voluntary suppression of emotional reaction to a second sad film, significant activation was seen in the right orbitofrontal cortex and the right dorsolateral prefrontal cortex. Consistent with both process models outlined above (Gross, 2002, 1998b; Phillips et al, 2003), the authors of the present study suggest that reappraisal of emotion stems from the dorsolateral prefrontal cortex maintaining an instruction to disengage from the stimuli. The dorsolateral prefrontal cortex then sends commands to the right orbitofrontal cortex seeking voluntary reappraisal or suppression of emotional response. Such commands are realised through additional activity, particularly in the amygdala and other midbrain structures, in cognitive, physiological and behavioural terms (Levesque et al, 2003).

In general terms, the work by Levesque and colleagues supports the process models of Gross (2002, 1998b) and Phillips (2003). However, some inconsistencies remain worthy of note. Definitional issues remain. For instance, Gross's (2002, 1998b) functional and temporal distinction between suppression and reappraisal does not hold when subjected to the meta-analysis undertaken by Levesque et al (2003). For Gross, reappraisal is characterised by executive function whereas suppression operates as a function of overt behaviour (Gross 2002, 1998b). Importantly, this distinction is not made in the Phillips et al (2003) model. This is insightful in light of the finding that instruction to maintain negative emotional response increased fMRI detected activity in the amygdala (Schaefer et al, 2002).

Evidence presented by Levesque et al (2003) suggests that there may be no need to make a functional distinction between reappraisal and suppression. Evidence presented both by Levesque et al (2003) and Phillips et al (2003) suggests that examining neural correlates of individual processes within a process model is difficult for two reasons. Firstly, significant individual difference has been noted in the activation of the neural substrates that subserve various emotional processes and, secondly, while there may also be neural systems subserving each of the individual processes, evidence suggests neural systems most likely serve across rather than solely within processes. Regardless, as Gross suggests, the models "illustrate(s) rather than exhaust(s) the possibilities" inherent in emotional regulation (Gross, 1998b P284).

The literature reviewed above serves to illustrate the complexity of the construct of emotion regulation, as well as the potential complexity in assessing individual ability to regulate emotion (Gross & John, 2003; Quirk, 2001). In seeking to account for the construct in research terms a review of the available psychometric measures was undertaken. The construct of emotion regulation was distinguished from similar and possibly overlapping constructs of emotional expressiveness (Rothbart, Ahadi, & Hershey, 1994; Denham, 1986) and Emotion knowledge (Denham, 1986; Denham & Couchoud, 1990a, 1990b), and two psychometrically validated measures were identified. These were the Emotion Regulation Questionnaire, (Gross and John, 2003) and the Emotion Regulation Checklist (Shields & Cicchetti, 1997).

Consistent with their process model of emotion regulation (Figure 2), Gross and John (2003) developed a ten item self-report measure of emotion regulation that contained two subscales, reappraisal and suppression. The authors offered psychometric validation of the measure, hypothesised that reappraisers would express and experience more positive emotion and less negative emotion than suppressors, and found evidence that improved interpersonal functioning and wellbeing result from reappraisal as opposed to suppression (Gross and John, 2003). The process model of emotion regulation (Gross, 2002, 1998b) illustrates the potential for both reappraisal and suppression regulatory strategies. However, the review of experimental literature undertaken above suggests that maintaining such a distinction may not be justified in light of the neural systems that subserve the process (Levesque et al, 2003; Phillips et al, 2003). The process model of emotion regulation (Gross, 2002, 1998b) also demonstrates the necessity to deliver emotional response in terms appropriate to the context. Gross and John (2002, 1998b) did not seek to assess the contextual appropriateness of emotionally regulated response in their measure.

Emotion Regulation Checklist (Shields & Cicchetti, 1997) is a 24 item other-report measure of children's emotion regulation. In developing the measure, the authors sought to assess the realms of affective liability, intensity of emotion, emotional valence, flexibility and situational appropriateness (Shields & Cicchetti, 1997). When subjected to factor analysis, two factors were revealed. The first, named Liability/Negativity, was indicated by items related to flexibility, equanimity and dysregulation. The second factor, named Emotion Regulation, represented items concerned with situational appropriateness, empathy, and emotional self-knowledge (Shields & Cicchetti, 1998). The two factors were significantly negatively correlated, and demonstrated high internal consistency both within and across subscales.

On the basis of the assessment of the two emotion regulation measures reported above, a decision was taken to develop a new measure to assess emotion regulation for the present study. Consistent with process models of emotion regulation (Phillips et al, 2003; Gross, 2002, 1998b), and with the review of the neurophysiological and drug and alcohol literatures undertaken above, three characteristics of the process of emotion regulation were considered worthy of inclusion in an assessment measure in the present context. The first, termed Emotion Regulation, sought to account for individual ability to reappraise or suppress emotional response. To this end, no attempt was made to distinguish between the antecedent focused and response focused process detailed in Gross' (2002, 1998b) model. Instead, evidence from Levesque et al (2003) and Phillips et al (2003) suggesting a common modulation process subserving both limbic and behavioural responses was drawn on. Secondly, the new measure sought to account for the degree to which individuals reported Appropriate Affect. Appropriate Affect may be defined as, the degree to which modulated response demonstrates convergence between context and emotional behaviour (Schaefer et al, 2002; Gross, 2002, 1998b). Appropriate Affect was alluded to by Gross (2002, 1998b), and accounted for explicitly by Shields & Cicchetti (1997) as situational appropriateness.

Finally, drawing on the Liability/Negativity construct advanced by Shields & Cicchetti, (1997), a distinction was drawn between response and reactivity (Rydell, 2003), and the notion of stimulus dependant responding advanced in process models of emotion regulation and perception (Phillips, 2003; Gross, 2002, 1998b). Thus, the present instrument sought to account for the degree of variability or emotionality that characterised individual response expression (Rydell et al, 2003 ; Eisenberg et al, 1997; Shields & Cicchetti, 1998) In the present context, consistency of response expression was termed Equanimity/ Emotionality.

1.19 Parent and Peer Context

There seems little doubt that parental, sibling, and peer influences are important in influencing the development towards substance use problems as they are in protecting against their development (Pomery et al, 2005; Hawkins et al, 1992; Brook, Brook, de la Rosa, Duque, Rodriguez, Montoya, Whiteman, 1998; Windle, 2000). An extensive literature attests to important contributions of family of origin characteristics and the subsequent development of substance use in adolescence (Li, Pentz & Chou, 2002; Gou et al, 2002; Weinberg, Rahdert, Colliver & Glantz, 1998; Malone, Iacono, & McGue, 2002; Wills, McNamara & Vaccaro, 1995; Chassin, Curran, Hussong, & Colder, 1996) as it does to the relation between sibling (Fagan & Najman, 2005; Pomery et al, 2005) and peer (Walden, McGue, Iacono, Burt, Elkins, 2004; Guo et al, 2002; Urberg, Luo, Pilgrim, Degirmencioglu, 2003; Kaplow, Curran, & Dodge, 2002) influences on the development of substance use in adolescence. Recent literature further suggests that peer deviance, parenting behaviour, parent-child problems, and early use of alcohol, tobacco and marijuana in adolescence, are more influenced by environmental factors than they are by heredity (Walden, et al, 2004; Hopfer, Stallings, Hewitt, & Crowley, 2003; Han, McGue, & Iacono, 1999; Plomin, Reiss, Hetherington, & Howe, 1994), although the magnitude of the influence of environment versus heredity varied across studies (Walden et al, 2004; Hopfer et al, 2003; Rhee, Hewitt, Young, Corley, Crowley, & Stallings, 2003).

Parental factors have been implicated in the development towards substance use by a number of authors (Li et al, 2002; Malone et al, 2002; Bray, Adams, Getz & Baer, 2001; Clark, Neighbours, Lesnick, Lynch, and Donovan, 1998; Stewart and Brown, 1993). Parental support generally has been found to be predictive of lower substance use initiation and better mental health (Bararra, Chassin & Rogosch, 1993) however differences by gender in parental influences have been reported (Windle, 1992; Guo et al, 2002). Bray et al (2001) offered evidence to suggest that parental separation and family conflict were predictive of increases in alcohol use three years hence, while family cohesion and developmentally appropriate individuation were prospectively predictive of lower levels of alcohol use over the same period of time. Of note, it has been suggested that the effects of family cohesion will decrease after the age of eighteen, while the effects of peer influence will begin to increase after age 15 (Guo et al, 2002)

Similarly, Duncan, Duncan, Biglan & Ary (1998) suggested that a portion of the variance in normative increases in substance use across the adolescent years may be attributable to parental influences. Increases in indices of family dysfunction were demonstrated in families that contained an adolescent with a clinical diagnosis of an alcohol use disorder (Duncan et al, 1998). These authors extended previous research suggesting that improvements in family functioning were related to decreases in substance use (Stewart and Brown, 1993, Li et al, 2002) by accounting for family functioning on the basis of the informant. That is, the account of family functioning would necessarily differ depending on whether a parent or an adolescent child's perspective of family functioning was sought.

A considerable lack of consensus has characterised the literature investigating parental substance use and its effects on substance use in offspring. A number of studies suggest that parental substance use fosters substance use development generally in adolescence, and cannot be mapped specifically with regard to substance (Li et al, 2002). Indeed, some literature points to a common use component across alcohol, tobacco and marijuana regardless of the influence of parent, peer and adolescent use of each of these three substances (Wills et al, 1995). Thus, family modelling of drug use generally predicted risk of alcohol and other drug use (Hawkins et al, 1997).

The implication therefore is that an underlying process characterised by the modelling of use rather than the modelling of substance may in part account for the development of use in adolescence. Such a conclusion is interesting in light of findings that level of paternal alcohol consumption is predictive of an offspring phenotype characterised by a disinhibited and externalising disposition (Malone et al, 2002; Young et al, 2002; Krueger et al, 2002).

Regardless, a predictive relation has consistently been shown between parental substance use behaviour and the development of substance use and mental health problems in adolescent children (Chassin et al 1996; Hawkins et al, 1992; Windle, 2000; Nash, McQueen & Bray, 2005). In contrast, protective effects have been demonstrated on adolescent's substance use behaviour by parents who did not use substances or whose attitudes toward substance use were characterised by expectations of low use (Li et al, 2002; Nash, McQueen & Bray, 2005). In testing the relative effects of parent and peer support on adolescent alcohol, tobacco, and marijuana use, several studies have found evidence that parental support was inversely related to factors of risk for the development of substance use while being positively related to factors that protect against the development of substance use factors (Wills et al, 2004; Hawkins, Catalano & Miller, 1992).

Generally, the picture that emerges for peer support is more complex. For instance, peer support has been demonstrated to be positively correlated with good self-control, generally a protective factor for substance use initiation and problem development, but also positively correlated with factors of risk for the development of substance use factors. It has been demonstrated that adolescents who have fathers with alcohol use problems, male offspring, and adolescent who have peers who use substances will demonstrate steeper growth in

substance use behaviour over time than adolescents whose fathers do not have alcohol use problems, female offspring, or adolescent who don't have peers who use substances (Chassin et al 1996). Further, it has been shown that Parental expectations about use moderated level of use, peer influence on use, and lower levels of later problem use (Nash, McQueen & Bray, 2005). However the mechanisms that underlie these influences have proved harder to identify. Studies have demonstrated both the appropriateness of including mediational variables in describing the relation between parental substance use behaviour and attitudes (Brook et al, 1998) and the lack of effect from incorporating mediators in models offering account of the influence of parental substance use behaviour and attitudes in the development of adolescent substance use (Chassin et al 1996).

Peer substance use has consistently been found to be one of the strongest predictors of substance use among adolescents (Hawkins et al, 1997; Barkin et al, 2002; Urberg et al, 2003). Wills et al found evidence to suggest a .61 correlation between the substance use of friends of adolescents and adolescent substance use (Wills et al, 2001), however the extent of the influence seems currently to be in doubt (Urberg et al, 2003). Distinctions have been drawn between two complimentary processes, peer selection and peer influence (Caspi, 1993, Urberg, 2003). Accordingly, adolescents have friends to whom they are similar, but not identical. Adolescents develop new friendships with people who have similar characteristics to their existing and old friends, and similar characteristics to themselves. The extent to which friends are dissimilar to other friends and to self is the extent to which influence may be exerted. Social influence is therefore dynamic and characterised by both selection and influence (Caspi, 1993, Urberg, 2003).

Parental influences on their offspring's choice of peer group have been demonstrated to have the potential to act to protect against the development of substance use in adolescence (Nash et al, 2005; Bray, Adams, Getz, & Baer, 2001). Despite peer influences on the use of substances having been demonstrated to be greater in magnitude than the influences of parents on the use of substances, a family environment characterised by parental monitoring, acceptance and the development of parent child communication was found to have the potential to negate the influence of peers on adolescents drinking behaviour (Nash et al, 2005). Family management practices, in particular poor parental monitoring, permissive or unclear expectations for behaviour, permissive attitudes toward drug use and excessively severe and inconsistent punishment have all been shown to predict greater risk of alcohol and other drug use (Nash et al, 2005; Clark, Neighbors, Lesnick, Lynch, Donovan, 1998; Hawkins et al, 1997; Duncan et al, 1998; Patterson, de Baryshe & Ramsey, 1989). Indeed, family environment in combination with parental attitude toward substance use emerge as important determinants of use (Nash et al, 2005). This finding builds on earlier work that suggested adolescent's alcohol, cigarette and marijuana use behaviour operated as a function of adolescent's desire to spend time with their parents, levels of parent-child conflict, and level of peer deviance (Urberg et al, 2003; Duncan et al, 1998).

Of note, adolescents who chose peers who drank more than they did, did not differ from other adolescents on a range of social family or individual variables. Only when they reported high peer acceptance and high friendship quality did they report their friends influenced their substance use behaviour (Urberg et al, 2003). This position is consistent with Patterson and colleagues' model of Coercive Family Process, and the manner in which child non-compliance in the home may be generalised to educational settings and result in the establishment of deviant peer relationships (Patterson, 1982) that foster, among other things, substance use problems. It is noteworthy that, despite peer deviance and parent-child relationship problems both appearing to share variance in common with early substance use, the contribution of parent child relationship problems to substance use may be explained entirely by its association with peer deviance (Walden et al, 2004). That is, adolescent peers may be more

proximal than parents in terms of their etiological relevance, at least in later adolescence (Brown, Dolcini & Leventhal, 1997; Wills & Cleary, 1996; Guo et al, 2002).

Gender specific differences have been found between peer pressure and drug use such that peer pressure was stronger among girls than boys, as it was among adolescents in families without fathers or step-fathers (Farrell & White, 1998). In addition, high family conflict, low family cohesion, and high peer antisocial activities have been shown to predict higher risk of substance use initiation across the developmental period (Guo et al, 2002). The increase in prevalence of externalising behaviours and behavioural problems in adolescence has been clearly linked to peer characteristics, and affiliations with delinquent or substance abusing peers provide one of the best predictors of adolescent EDs and substance use problems (Fergusson, 1998; Fergusson, Lynskey, Horwood, 1996). Thus, peer cannabis use and antisocial behaviour are important factors in the prospective prediction of mid and late school cannabis uptake and use, and females with behavioural problems are more likely than others to become daily users of marijuana (Coffey et al, 2000).

Level of parental education has also been found to be related to level of adolescent substance use. Lower levels of substance use cessation have been documented among individuals of lower education (Chassin, Presson, Rose, & Sherman, 1996). Parental level of education, however, seems to have the potential to be mediated by a range of factors that offer protection against, or risk for, substance use initiation and development (Wills et al, 1995). Mediation analyses have suggested that parental support, academic competence, behavioural competence, negative life events, and friends' substance use are important determinants on the relation between level of parental education and the development of substance use in adolescence (Wills et al, 1995). Further research in this area is necessary to fully understand the mechanisms responsible for this effect.

For instance, a range of mediated or moderated relations between level of education and the development of substance use may be possible. For instance, parental modelling, parental monitoring, antisocial behaviour, discipline practices, family management practices, sensation seeking, substance use, and co occurring psychopathology are all plausibly implicated in the later development of substance use (Wills et al, 1995, Hawkins, 1997; Crawford, Pentz, Chou, Li, & Dwyer, 2003; Duncan et al, 1998; Chassin et al, 1996). Indeed, a range of appropriate mediators may not yet have been offered to fully account for the development of substance use in adolescents (Malone et al, 2002; Chassin et al 1996). Of note, however, moderation analyses have suggested that adolescents from families that have had less education, while more vulnerable to factors of risk, may also derive greater benefit from protective factors if and when they are introduced into the environment (Wills et al, 1995).

Substance use by older siblings has been associated with increased levels of behavioural problems in a target adolescent in general (Windle, 2000) and substance use problems in particular (Griffin, Botvin, Scheier, & Nichols, 2002). Sibling influences on adolescent substance use have been demonstrated to be either direct (modelling, accessibility to substances) or indirect (for instance through peer selection) (Pomery et al, 2005; Brook et al, 1990). Some evidence points to the relatively stronger influence that sibling behaviour had on adolescent development when compared with either parental influence (Windle, 2000) or peer influence (Fagan & Najman, 2003) and older siblings behavioural willingness to use substances at time one has been shown to be predictive of target adolescents time two use, even when controlling for other time one variables (Pomery et al, 2005). When examined in terms of their level of deviance, degree of warmth, and level of conflict, only sibling deviance and peer deviance successfully predicted substance use over time, and when both sibling deviance and peer deviance were examined as predictors of changes in substance use over time, only sibling deviance significantly predicted change (Stromshak, 2004).

In examining the relation between sibling alcohol and tobacco use, one study noted that sibling substance use had greater influence on subsequent adolescent substance use than either

smoking or drinking by the siblings parents (Fagan and Najman, 2005). These authors presented evidence to suggest that a moderately strongly significant relationship remained even once the influence of a range of family-related influences was accounted for (Fagan and Najman, 2005). The authors of this study took this finding as evidence that the influences of the shared developmental environment are not able to fully account for the similarity that often characterises sibling substance use behaviour. A second study offered evidence to the effect that shared environmental influences specific to siblings, and not common to the family per se, are instrumental in sibling's apparently greater influence over substance use behaviour. Hopfer, Stallings, Hewitt, & Crowley (2003) found significant residual sibling correlations for marijuana use, abuse and dependence, related behaviours and, in conjunction with findings detailing the significant influences of peers in the development of marijuana use, posit shared age specific environmental influences as being central in the development of marijuana use behaviour, regardless of whether use is normative or problematic (Hopfer et al, 2003).

1.20 Summary and Hypotheses

In general terms, the literature review presented above indicated that mental health and the development of substance use in adolescence are associated. When the construct of mental health was refined, distinctions could be drawn between the association between mental health and substance use. A strong and positive association was generally noted in studies examining the relationship between individuals characterised by externalising profiles or characteristics, and the use of substances in adolescence. While a much less clear picture has been offered to account for the relation between internalising characteristics and the development of substance use in adolescence, the vast majority of existing research investigated individual disorders and did not assess internalising profile as a whole and its relation to substance use. It is anticipated that an investigation drawing on overall internalising profile will demonstrate a significant relation substance use.

The review also identified a number of variables that the literature generally suggests are significant in contributing to the development of substance use in adolescence. Again, in general terms, an individuals ability socially, their motivation to use substances, their innate and learned emotional regulatory ability, and the parental and peer context in which they develop have all been demonstrated at least to be associated with the use of substances in adolescence. In addition, they have all have been demonstrated to have the potential to mediate the development towards and subsequent use of substances. However, while numerous studies have sought to determine the influences of each of these four factors in trajectories toward the use of substances, no study was identified that looked at them in combination or in terms of their relative contributions to the development of substance use.

There is also potential for the association between substance use and mental health to be demonstrated both cross sectionally and over time. The demonstration of an association in cross sectional terms allows conclusions to be drawn about the nature of the association between mental health and substance use at a number of points in time or developmental phases across adolescence, the timing of this association, and the nature of influences that co occur with it. It also allows for comparisons to be made across a variety of substances commonly used in adolescence, and of the relative importance of factors commonly associated with developmental progressions towards use. When accounting for the association between mental health and substance use over time, it is possible to ask questions about the relative importance of mediating factors over time, as well as to gauge the potential to predict use from characteristics commonly associated with use.

On the basis of the above review, a number of hypotheses may be drawn. The hypotheses may be listed under four headings as follows:

1. Mental Health and Substance Use:

It is hypothesised that a significant and positive association will be found between externalising scores and use of each of the three substances of interest.

It is hypothesised that a significant and positive association will be found between internalising scores and use of each of the three substances of interest.

2. Mediating Factors:

It is hypothesised that Social Skills scores will mediate the relationship between mental health and substance use for each of the three substances of interest.

It is hypothesised that Motivation for Use scores will mediate the relationship between mental health and substance use for each of the three substances of interest.

It is hypothesised that Emotion Regulation scores will mediate the relationship between mental health and substance use for each of the three substances of interest.

It is hypothesised that Parent and Peer Attitudes Toward Substance Use scores will mediate the relationship between mental health and substance use for each of the three substances of interest.

3. Cross-Sectional Structural Model

It is hypothesised that a structural model can be developed to account for the mediated relationship between mental health and substance use.

It is further hypothesised that this model will demonstrate invariance across the three substances of interest.

4. Longitudinal Structural Model

It is hypothesised that a structural model can be developed to account for the mediated relationship between time one mental health and time two substance use.

It is further hypothesised that this model will demonstrate invariance across the three substances of interest.

2.0 Method

2.1 Participants

Time One Sample: The Time One sample consisted of N=1182 high school students from New South Wales, Australia. The sample was 45.6% male, and ranged in age from 11 to 20 years ($M = 14.30$, $SD = 1.59$). 0.9% (N=11) of the sample identified themselves as Aboriginal, 0.3% (N=3) as Torres Strait Islander, 74.8% (N=875) as Australian Born, 22.4% (N=262) as Overseas Born and 1.6% (N=19) reported they did not report their ethnic background. 74.4% (N=879) of the Time One sample attended school in metropolitan Sydney, and the remaining, 26.1% (N= 303) attended school in Wollongong. When split by school type, 71.2% (N=842) of the sample attended state schools and the remaining 28.8% (N=340) attended private schools. When divided on the basis of educational level, 19.5% (N=230) were in Year 7 at the time of assessment, 19.7% (N=233) in Year 8, 19.7% (N=233) in Year 9, 19.2% (N=227) in year 10 and 18.4% (N=217) in Year 11.

Assessment of current employment indicated 85% (N=1001) of the Time One sample were not currently working. 5.3% (N=62) reported working in retail, and 3.2% (N=37) reported working in hospitality. Approximately 1% of the sample reported working in each of trade, sport, baby-sitting or arts related occupations with the remainder distributed across other occupations. When asked to report on current living situation, 98.8% (N=1160) of the sample reported living in their family home with between 0.1% (N=1) and 0.4% (N=5) reporting living alone, with a partner, or in share accommodation situations. Assessment of level of parental education revealed that 66.5% (N=607) of the sample reported their father's highest level of education was at a tertiary level and 60% (554) of the sample reported their mother's highest level of education was at a tertiary level. 27.1% (N=247) reported their father's highest level of education was high school and 33.4% (N=309) reported their mother's highest level of education was high school. 6.4% (N=58) reported their father's highest level of education was at TAFE and 6.6% (N=61) reported their mother's highest level of education was at TAFE.

Time Two Sample: The Time Two sample consisted of N=561 high school students who had participated in Time One assessment one year earlier. The sample was 47.5% male, and

ranged in age from 11 to 18 years ($M = 14.00$, $SD = 1.45$). 0.2% ($N=1$) of the sample identified themselves as Aboriginal and 0.2% ($N=1$) as Torres Strait Islander. 73.6% ($N=410$) of the sample reported themselves as Australian Born, 25.1% ($N=140$) as Overseas Born, and 0.9% ($N=5$) reported they did not report their ethnic background. School attendance was reported by 83.1% ($N=466$) of the Time Two sample to be within metropolitan Sydney, and the remaining, 16.9% ($N=95$) attended school in Wollongong. When split by school type, 81.8% ($N=459$) of the sample reported attending state schools and the remaining 18.2% ($N=102$) reported attending private schools. When divided on the basis of educational level, 22.5% ($N=126$) were in Year 7 at the time of assessment, 21.4% ($N=120$) in Year 8, 20.3% ($N=114$) in Year 9, 22.3% ($N=125$) in year 10, 13.4% ($N=75$) in Year 11, and 0.2% ($N=1$) in year 12.

In terms of employment, 89.5% ($N=496$) of the Time One sample reported that they were not currently working. 4.0% ($N=22$) of the sample reported working in retail, and 2.7% ($N=15$) reported working in hospitality. Approximately 1% of the sample reported working in each of labouring and the arts. The remainder distributed across a range of other occupations. The vast majority, 99.8% ($N=557$) of the sample reported living in their family home and 0.2% ($N=1$) reporting living alone. Questions about level of parental education revealed that 71.0% ($N=309$) of the sample reported their father's highest level of education was at a tertiary level and 62.5% ($N=272$) of the sample reported their mother's highest level of education was at a tertiary level. 23.7% ($N=103$) reported their father's highest level of education was high school and 30.6% ($N=133$) reported their mother's highest level of education was high school. 5.3% ($N=23$) reported their father's highest level of education was at TAFE and 6.9% ($N=30$) reported their mother's highest level of education was at TAFE.

2.2 Measures

Participants were tested at both Time One and Time Two with a series of tests the generated a unique participant code, collected demographic information, alcohol, tobacco and marijuana use information, assessed motives for use of these three substances, collected parent and peer attitude information, information related to social skills ability, ability to regulate emotion, and information related to the behavioural and emotional functioning of adolescents. A description of the measures used in this context follows.

Unique Participant Identification Code: Participants were asked to report on details drawn from five personal characteristics in an effort to generate a participant specific letter-number string. Responses were sought on the following questions: 1. The first letter of the month you were born in, 2. The last number of the year you were born in, 3. The last letter of your surname, 4. The last letter of your first name, and 5. The last letter of your mother's name. Responses to these questions in the order they are presented in resulted in the generation of a standardised five character number-letter string that allowed identification of participants across the two data collection time-points of the study while maintaining their anonymity.

Demographic Information: Participants were asked to report their age, gender, school attendance status, current occupation, marital status, living situation, current level of education, ethnicity, father's occupation, father's highest level of education, mothers occupation, mother's highest level of education.. Participants were asked; Have you ever drunk alcohol?; Age when you first drank alcohol; Have you drunk alcohol in the last year?; Have you ever smoked cigarettes?; Age when you first smoked cigarettes; Do you currently smoke cigarettes?; Approximately how many cigarettes do you smoke each day?; Have you ever used Marijuana?; Age when you first used marijuana; and Have you used marijuana in the last year?

Level of Use of Alcohol: Participants were asked to respond to eight questions related to their use of alcohol. These were: 1. Have you ever drunk alcohol? Yes/No, 2. Age when you first drank alcohol: _____, 3. Have you drunk alcohol in the last year? Yes / No, 4. Have

you drunk alcohol in the last month? Yes / No, How many times____? 5. Have you drunk alcohol in the last fortnight? Yes / No, How many times____? 6. Have you drunk alcohol in the last week? Yes / No, How many times____? 7. How many drinks containing alcohol do you typically have when you drink? 8. On which day did you last drink alcohol? 9. How much alcohol did you drink on that day?

Level of Use of Tobacco: Participants were asked to respond to nine questions related to their use of tobacco. These were: 1. Have you ever smoked cigarettes? Yes / No, 2. Age when you first smoked cigarettes:____, 3. Do you currently smoke cigarettes? Yes / No, 4. If you currently smoke, how many cigarettes do you smoke each day? 5. On which day did you last use tobacco? 6. How many cigarettes did you have on that day? 7. On which day before that did you last use tobacco? 8. How many cigarettes did you have on that day? 9. And when was the day before that?

Level of Use of Marijuana: Participants were asked to respond to twelve questions related to their use of alcohol. These were: 1. Have you ever used marijuana? Yes / No. 2. Age when you first used marijuana:____, 3. Have you used marijuana in the last year? Yes / No, 4. Have you used marijuana in the last month? Yes / No, How many times____, 5. Have you used marijuana in the last fortnight? Yes / No, How many times____, 6. Have you used marijuana in the last week? Yes / No, How many times____, 7. How many joints/cones do you typically have when you smoke? 8. On which day did you last use marijuana? 9. How many joints, bongs etc did you have on that day? 10. On which day before that did you last use marijuana? 11. How many joints, bongs etc did you have on that day? 12. And when was the day before that?

Alcohol Motives Questionnaire (AMQ): Participant motives for using alcohol were assessed with The Motives for Alcohol Use Questionnaire (Wainwright & Dadds, unpublished), a 26-item self report measure based on Cooper's (1994) four factor model of alcohol use, itself an extension of an earlier three factor model (Cooper, Russell, Spinner, & Windle, 1992). The AMQ offers an account of the factors that motivate the participant toward the use of Alcohol, assuming he or she uses it. Consistent with the work of Simons (Simons, Correia, Carey, & Borsari, 1998; Simons, Correia, & Carey, 2000), the AMQ utilised a fifth factor termed expansion. Together, the five factors seek to account for enhancement motives (because you like the feeling), coping motives (to forget about your problems), social motives (to be sociable), conformity motives (to fit in with a group you like) and expansion motives (so I can expand my awareness). At the suggestion of the NSW Department of Education and Training, and additional item "Because you feel you need it or feel you are addicted to it" was added to the end of the measure. Overall, the AMQ is theoretically derived and has been shown to have good psychometric properties. Cooper et al. (1992) offered an account of the measures internal consistency across gender and ethnicity, and Cooper (1994) demonstrated similar invariance across age groups. The five-factor model was also shown to have good discriminant and concurrent validity, and Simons et al (1998) reported favourable internal consistency and construct validity for the expansion factor (Simons et al., 1998). Administration of the AMQ was consistent with Copper (1994) but was offered in self-report as opposed to other report form. Participants rated a five point likert type scale ranging from almost never/ never to Almost always/Always. Item scores ranging from 5-25 result from administration with a higher score indicating stronger endorsement of that item/motive.

Tobacco Motives (TMQ): Participant motives for using tobacco were assessed with The Motives for Tobacco Use Questionnaire (Wainwright & Dadds, unpublished), a 26-item self report measure based on Cooper's (1994) four factor model of alcohol use, itself an extension of an earlier three factor model (Cooper, Russell, Spinner, & Windle, 1992). The TMQ offers an account of the factors that motivate the participant toward the use of Tobacco, assuming he or she uses it. Consistent with the work of Simons (Simons, Correia, Carey, & Borsari, 1998; Simons, Correia, & Carey, 2000), the MMQ incorporates a fifth factor, termed expansion.

Together, the five factors sought to account for enhancement motives (because you like the feeling), coping motives (to forget about your problems), social motives (to be sociable), conformity motives (to fit in with a group you like) and expansion motives (so I can expand my awareness). At the suggestion of the NSW Department of Education and Training, and additional item “Because you feel you need it or feel you are addicted to it” was added to the end of the measure. All items, instructions and scoring for the TMQ were identical to those contained in the AMQ, with the exception that “drinking alcohol” was replaced with “smoking cigarettes” and “drink” replaced “smoke”. Administration of the AMQ was consistent with Copper (1994) but was offered in self-report as opposed to other report form. Participants rated a five point likert type scale ranging from almost never/ never to Almost always/Always. Item scores ranging from 5-25 result from administration with a higher score indicating stronger endorsement of that item/motive. No literature can be offered in support of this measure, however psychometric assessment undertaken in the present context suggested it performed in a manner consistent with the AMQ.

Marijuana Motives (MMQ): The Motives for Marijuana Use Questionnaire (Wainwright & Dadds, unpublished), a 26-item self report measure based on Cooper’s (1994) four factor model of alcohol use, itself an extension of an earlier three factor model (Cooper, Russell, Spinner, & Windle, 1992). The MMQ offers an account of the factors that motivate the participant toward the use of Marijuana, assuming he or she uses it. Consistent with the work of Simons (Simons, Correia, Carey, & Borsari, 1998; Simons, Correia, & Carey, 2000), the MMQ incorporates a fifth factor, termed expansion. Together, the five factors sought to account for enhancement motives (because you like the feeling), coping motives (to forget about your problems), social motives (to be sociable), conformity motives (to fit in with a group you like) and expansion motives (so I can expand my awareness). At the suggestion of the NSW Department of Education and Training, and additional item “Because you feel you need it or feel you are addicted to it” was added to the end of the measure. All items, instructions and scoring for the MMQ were identical to those contained in the AMQ, with the exception that “drinking alcohol” was replaced with “use marijuana” and “drink” replaced “smoke”. Administration of the AMQ was consistent with Copper (1994) but was offered in self-report as opposed to other report form. Participants rated a five point likert type scale ranging from almost never/ never to Almost always/Always. Item scores ranging from 5-25 result from administration with a higher score indicating stronger endorsement of that item/motive. Some evidence has been offered in support of the present version of the MMQ (Simons et al, 1998; Wainwright & Dadds, unpublished). psychometric assessment undertaken in the present context suggested it performed in a manner consistent with the AMQ.

Parent and Peer Attitudes Toward Substance Use (PAPA-TSU): The PAPA-TSU (McAloon & Dadds, unpublished) is a 30-item self-report assessment instrument that seeks information on seven separate realms of the participant’s life: their parents attitudes toward substance use (items 10, 18, 23), their parents behaviour with regard to substances (items 4, 11, 14), their peers attitudes toward substance use (items 6, 8, 16), their peers behaviour with regard to substances (items 3, 15, 21) their best friends attitudes toward substances (items 5, 17, 22), their best friends behaviour with regard to substances (items 1, 9, 13), substance use in relation to social behaviour (items 2, 12, 20) and ability to procure substances (items 8, 24, 30). The PAPA-TSU was developed on the basis that there was no existing measure capable of assessing family and peer influences on the use of substances, or a participants ability to source them. Previously authors have developed their own inventories (Keefe, 1994; Weiss & Moore, 1995) however none of these attempts has been produced as a formal measure. Thus, the current study employed the PAPA-TSU in an effort to establish its psychometric merit prior to its intended publication. When assessed as a unitary construct, the PAPA-TSU has demonstrated good psychometric properties, both previously (Wainwright & Dadds, unpublished) and in the present context (Test re-test $r = .94$, Alpha reliability coefficients α

=.94). The PAPA-TSU contains three subscales named Parent Influences, Peer Influences and Ability to Source Participants rate the degree to which each of the 30 statements applies to them on a four point likert type scale (0=strongly disagree, 1=moderately disagree, 2=moderately agree, 3= strongly agree) with higher scores indicating more permissive attitudes and behaviour of parents, more permissive attitudes and behaviour of peers, and greater ability to procure the substances in question.

Social Skills: The Social Skills Rating System (SSRS) (Gresham & Elliott, 1990) is a norm-referenced assessment instrument designed to identify social skills and problem behaviours from the perspective of the participant, parent or teacher. It assesses social competence and adaptive behaviour in children across three domains - social skills, problem behaviours, and academic competence. The SSRS Student Form, Secondary Level (Gresham & Elliot, 1990) contains 39 items. Each of the Teacher, Parent and Student forms contain no more than four of the subscales Cooperation, Assertion, Responsibility, Empathy, Self-Control and Total. In addition, the Teacher and Parent forms have the potential to generate Internalising, Externalising and Hyperactivity subscales. In the student form, each item is completed along two dimensions. The How Often dimension assesses the frequency with which the participant displays the behaviour inherent in the item, and seeks a response of 0 – Never, 1 – Sometimes, or 3 – Very Often. The How Important dimension assesses the degree of importance the behaviour inherent in the item has to the participant, and seeks a response of 0 – Not Important, 1 –Important, or 3 – Critical. SSRS norms are based on a large US sample of boys and girls aged three to eighteen years and include a range of learning disabled and behaviourally disordered children as well as other minorities. The SSRS Manual (1990) provides technical evidence for reliability and validity, internal consistency, test-retest reliability, inter-rater reliability, content validity, social validity, criterion-related validity, and construct validity.

Emotion Regulation: The Emotion Regulation Questionnaire (ERQ) (McAloon & Dadds, unpublished) is a 26 item self report measure designed to assess participant ability to regulate emotion in socially and situationally appropriate terms. The ERQ is theoretically derived from process models of emotion regulation (Phillips et al, 2003; Gross, 2002, 1998b; Levesque et al, 2003; Schaefer et al, 2002; Rydell et al, 2003 and Eisenberg et al, 1997). The ERQ consists of three subscales: the first, Emotion Regulation, seeks to account for the participant's ability to reappraise or suppress emotional response, the second, Appropriate Affect seeks to account for the degree to which the participant reports an ability to display situationally appropriate affect characterised by a convergence between context and emotional behaviour, the third, termed Equanimity/ Emotionality, seeks to account for the degree of variability or emotionality that characterised individual response expression. The current research provided the first opportunity to assess the psychometric properties of the measure. Alpha reliability coefficients (Equanimity, $\alpha = .82$; Regulation, $\alpha = .73$; Appropriateness, $\alpha = .62$; Total, $\alpha = .86$) and two week test re test correlations (Equanimity, $r = .86$; Regulation, $r = .72$; Appropriateness, $r = .80$; Total, $r = .90$) generated from a sample of over one thousand adolescents suggest the ERQ is functioning to assess adolescent emotional regulatory ability to a satisfactory extent.

Behavioural and Emotional Functioning: The Youth Self Report (YSR) (Achenbach, 1991) is a 112 item self-report measure designed for use with adolescents aged between 11 and 18 years. The YSR is derived from the Child Behaviour Checklist (CBCL) (Achenbach, 1991). Consistent with the CBCL, the YSR measure eight sub-scale symptoms: withdrawn, somatic complaints, anxiety and depression, social problems, thought problems, attention problems, aggressive behaviour, and delinquent behaviours (Achenbach, 1991). The eight subscales are reportable individually, within the context of Internalising versus Externalising dimensions, or as a total problem scale. An adolescent selects his response from 0 (not true) to 2 (very true or often true). Achenbach (1991) reported the mean 7-day test-retest reliability for

the problem behaviour scales was .65 for 11-14 year-old adolescents and .83 for 15-18 year old adolescents. Internal consistencies (Alpha) for the symptom scales ranged from .68 for social problems to .89 for externalising problems and .91 for internalising problems. Achenbach (1991) also reported a reliability alpha of .86 for YSR when the scores of the eight symptoms were used for reliability test.

2.3 Indices of Level of Substance Use

The level of use of the substances assessed in the present study were calculated in the following manner, and sought to account for both quantity and frequency of use.

Alcohol: 1) Age of First Use: reported age of first use. 2) Number of Drinking Events Last Month: Reported number of drinking events in last month plus reported number of drinking events in the last week multiplied by four, the overall total being divided by two. 3) Number of Standard Drinks Typically Consumed per Event: Reported number of drinks typically consumed. 4) Overall Alcohol Use Level: Reported number of drinking events in last month plus reported number of drinking events in the last week multiplied by four, the overall total being divided by two then multiplied by the Number of Standard Drinks Typically Consumed per Event.

Cigarettes: 1) Age of First Use: reported age of first use. 2) Number of Cigarettes Smoked per Day: reported number of cigarettes smoked per day.

Marijuana: 1) Age of First Use: reported age of first use. 2) Marijuana Events last Month: Reported number of marijuana events in last month plus reported number of marijuana events in the last week multiplied by four, the overall total being divided by two. 3) Number of Cones/ Joints Typically Consumed per Event: Reported amount of marijuana typically consumed in joint, cone units. 4) Overall Marijuana Use: Reported number of marijuana events in last month plus reported number of marijuana events in the last week multiplied by four, the overall total being divided by two then multiplied by the Number of Cones/Joints Typically Consumed per Event.

2.4 Procedure

Participants were recruited from both private and state secondary schools in Sydney and Wollongong, NSW, Australia. Initial approaches to schools were made with an invitation to participate in the present research project. Where favourable responses were received from schools members of staff were met with and a justification for the research offered. Parental letters of consent were then forwarded to the schools for dissemination and where consent was given students were invited to participate in the research. Data was collected at two time points, each one year apart. Time One data was collected from Cranbrook, International Grammar, Loreto, Woonoona, Figtree High, Sydney Girl's High, Sydney Boy's High, and Bulli High. Time Two data was collected from Cranbrook, International Grammar, Figtree High, Sydney Girl's High and Sydney Boy's High. Students were tested en masse in a school hall or similar area. Data collection took approximately forty minutes, about one school period, and no inducements or payment was offered to students for their involvement. Questionnaires were coded with the Unique Participant Identification Code to ensure anonymity. The test booklet provided to all participants included a statement of justification of the research followed by the self-report measures described above. All participants, irrespective of their substance use history, were asked to complete all measures. Upon completion of the task all participants placed their responses in a sealed envelope and were debriefed about the aims of the research.

2.5 Research Plan

The present study was undertaken in three phases.

Phase 1. The first Phase of the research involved development and validation of two new measures necessary for collecting data in the present context. Within this phase the PAPA-TSU and ERQ were developed and test data collected in an effort to establish the psychometric validity of each. The results of this phase are presented below. **Phase Two.** The

second phase of the study involved collection of data from the target population. These data allowed rates of prevalence to be established in the sample, facilitated the cross-sectional analyses to be undertaken about the interaction between individual motivation for substance use, peer and parental attitudes toward substance use, individual emotional regulation, social skill ability, and mental health problems (i.e., internalising and externalising profiles), as well as the development of Time One models. **Phase Three:** The third phase involved a second assessment of the same sample. Testing materials used at this time were identical to those used at time one. The data gathered within this phase of the research allowed an account to be offered of changes in the relationship between the variables of interest and the development of Time Two models.

3.0 RESULTS

3.1 SAMPLE CHARACTERISTICS AND PREVALENCE OF USE.

3.1.1 Psychometric Properties of the Measures

Alpha reliability coefficients for all measures are reported in Table 1. In those instances where the measure was previously published, the published reliability coefficients are presented. In the cases where measures were developed for use in the present study, reliability coefficients gained in this context are reported. All of the measures showed moderate to high internal consistency.

Table 1. Alpha reliability coefficients for subscale and total scores for the Motivation for Substance Use Measures, Parent and Peer Attitudes, the SSRS, the ERQ, and the YSR.

| Motivation for Substance Use | | | | | | |
|-------------------------------------|----------------|----------------|----------------|----------------|------------------------|----------------|
| | Tobacco | | Alcohol | | Marijuana | |
| Motive | | | | | | |
| Social | n=1110 | $\alpha = .85$ | n=1137 | $\alpha = .91$ | n=1104 | $\alpha = .87$ |
| Coping | n=1121 | $\alpha = .84$ | n=1135 | $\alpha = .88$ | n=1112 | $\alpha = .87$ |
| Enhancement | n=1107 | $\alpha = .81$ | n=1129 | $\alpha = .86$ | n=1099 | $\alpha = .88$ |
| Conformity | n=1129 | $\alpha = .92$ | n=1141 | $\alpha = .94$ | n=1108 | $\alpha = .92$ |
| Expansion | n=1122 | $\alpha = .82$ | n=1126 | $\alpha = .84$ | n=1107 | $\alpha = .87$ |
| Total | n=1051 | $\alpha = .93$ | n=1093 | $\alpha = .94$ | n=1060 | $\alpha = .94$ |
| PAPATSU | | | | | | |
| PAPATSU Total | n=1070 | $\alpha = .94$ | | | | |
| SSRS | | | | | | |
| Assertion | n=1071 | $\alpha = .69$ | | | Published alpha | $\alpha = .67$ |
| Empathy | n=1121 | $\alpha = .76$ | | | | $\alpha = .77$ |
| Total | n=967 | $\alpha = .84$ | | | | $\alpha = .83$ |
| ERQ | | | | | | |
| Equanimity | n=1135 | | | | | $\alpha = .82$ |
| Regulation | n=1116 | | | | | $\alpha = .73$ |
| Appropriateness | n=1138 | | | | | $\alpha = .62$ |
| Total | n=1077 | | | | | $\alpha = .86$ |
| Youth Self Report | | | | | | |
| Internalising | n=1052 | $\alpha = .91$ | | | Published alpha | $\alpha = .91$ |
| Externalising | n=1100 | $\alpha = .88$ | | | | $\alpha = .89$ |

Test-retest reliability (correlation coefficients) for all measures are reported in Table 2. As with alpha reliability coefficients, test re-test correlation coefficients for previously published measures are reported where available. In those instances where these were not available, or where measures had been developed specifically for the present study, test re-test reliability coefficients gained in the present context are reported.

Table 2. Test-retest reliability correlations for the subscale and total scores for the Motivation for Substance Use, Parent and Peer Attitudes, SSRS, REQ, and YSR measures.

| Motivation for Substance Use | Tobacco | Alcohol | Marijuana | |
|-------------------------------------|------------------------------|----------------|------------------|------|
| Social | r =.82** | r =.81** | r =.58** | n=54 |
| Coping | r =.81** | r =.63** | r =.84** | n=54 |
| Enhancement | r =.70** | r =.78** | r =.75** | n=54 |
| Conformity | r =.91** | r =.69** | r =.79** | n=54 |
| Expansion | r =.65** | r =.64** | r =.64** | n=54 |
| Total | r =.89** | r =.76** | r =.79** | n=54 |
| PAPATSU | | | | |
| PAPATSU Total | r =.94** | | | n=54 |
| Social Skills Rating System | | | | |
| | Published coefficient | | | |
| Assertion | r =.52 | | | |
| Empathy | r =.66 | | | |
| Total | r =.68 | | | |
| Emotion Regulation | | | | |
| Equanimity | r =.86** | | | n=57 |
| Regulation | r =.72** | | | n=57 |
| Appropriateness | r =.80** | | | n=57 |
| Total | r =.90** | | | n=57 |
| Youth Self Report | | | | |
| | Published coefficient | | | |
| Internalising | r =.80 | | | |
| Externalising | r =.90 | | | |

**Correlation is significant at the 0.01 level.

3.1.2 Characteristics of the Sample

The characteristics of the present sample are reported in Table 3. The sample consisted of a total of N=1180 participants (45.59% male, 54.01% female). Participants were divided by age (thirteen years and younger, fourteen to fifteen years, and sixteen years and over) and gender for the purposes of reporting their demographic characteristics.

Table 3. Age and Gender characteristics of the sample utilised in the present study.

| Age (Yrs) | Percent of sample | Gender | Percent of age group | Percent of sample |
|------------------|--------------------------|-------------------------------|-----------------------------|--------------------------|
| <13 | 34.8% | Male(n=188) Female(n=222) | 45.9% 54.1% | 15.9% 18.8% |
| 14-15 | 39% | Male (n=207) Female(n=254) | 44.9% 55.1% | 17.5% 21.5% |
| 16+ | 26.2% | Male (n=143) Female(n=254) | 46.1% 53.5% | 12.1% 14.1% |

Data were evaluated for the patterns and frequencies of missing values. Missing data were randomly distributed and of low frequency, and on this basis a decision was made to use SPSS Series Mean to replace the data missing from variables related to alcohol, cigarette and marijuana use, emotion regulation, parent and peer attitudes, social skills, and the Achenbach internalising/externalising scales.

Univariate outliers (Tabachnick and Fidell, 1996) were identified in four composite variables (Alcohol Events Last Month, Overall alcohol Use, Marijuana Events Last Month and Overall Marijuana Use) as a result of inspection of descriptive statistics. These variables were assessed for violation of multivariate assumptions leading to the containment of eleven univariate outliers included within these four variables. ALEVMOt1 case numbers 35, 281 419 & 658 were allocated values 18.00, 19.00, 20.00 and 21.00 respectively which were consistent with the upper end of the remaining distribution. ALUSet1 case numbers 281, 419 & 1047 were allocated values 107.00, 108.00 and 109.00 respectively, consistent with the upper end of the remaining distribution. MAEVMOt1 case number 386 was allocated a value of 15, consistent with the upper end of that distribution. MAUSet1 case numbers 386, 419 and 1026 were allocated values 55.00, 56.00 and 57.00 respectively, consistent with the upper end of the remaining distribution.

3.1.3 Indices of Level of Substance Use

Substance use data was collected in the present study in an effort to account for the use of alcohol, tobacco and marijuana. A number of different indices of use were gathered. Indices of overall level of use of alcohol and marijuana were also developed. The indices of use, together with an account of those that were developed to account for Overall levels of use of Alcohol and Marijuana, are described next.

3.1.4 Prevalence of Substance Use in the Present Sample

Age of First Use: Age of initiation for alcohol use is presented in graphical form in Figure 1. Approximately five percent of the sample, and slightly more females than males, reported initiation at between five and nine years of age. The proportion of the sample reporting initiation increased between age ten and age fourteen. Approximately fifteen percent of males and fifteen percent of females reported first use of alcohol at age ten. This proportion dropped to below ten percent for each gender at age eleven, then increased to approximately seventeen percent at age twelve, the modal age of onset for each gender. Age of initiation into cigarette use is presented in Figure 2. These data followed the general trend shown in the age of initiation into alcohol. Approximately five percent of the sample reported first use of cigarettes prior to age twelve. The modal age of onset cigarette use for females was at thirteen years, while the modal age of onset for boys came a year later at age fourteen. Data pertaining to the age of initiation into use of marijuana are presented in graphical form in Figure 3. Again, approximately five percent of the sample reported first use of marijuana prior to age thirteen. Use then increased with modal age of onset for both boys and girls at age fourteen.

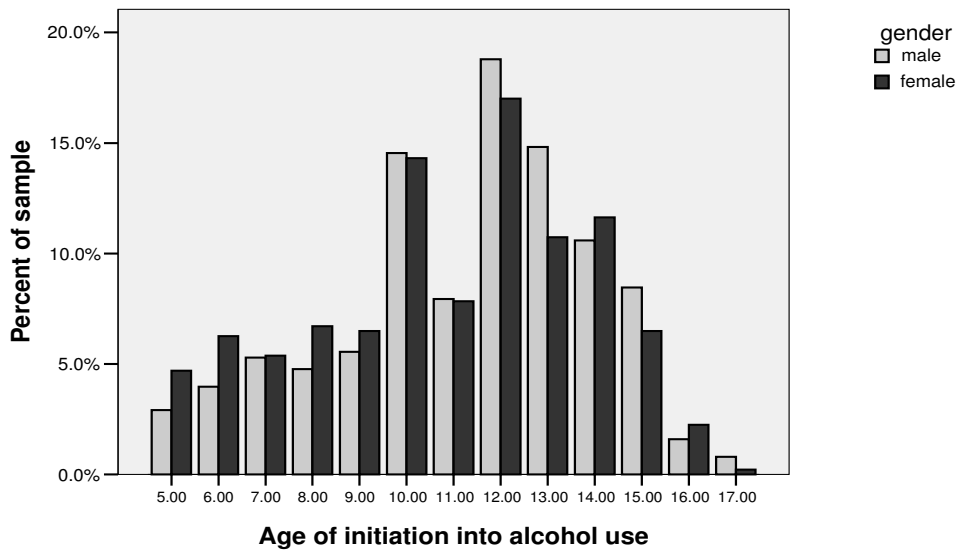


Figure 3: Male and female participant's age of initiation into Alcohol use.

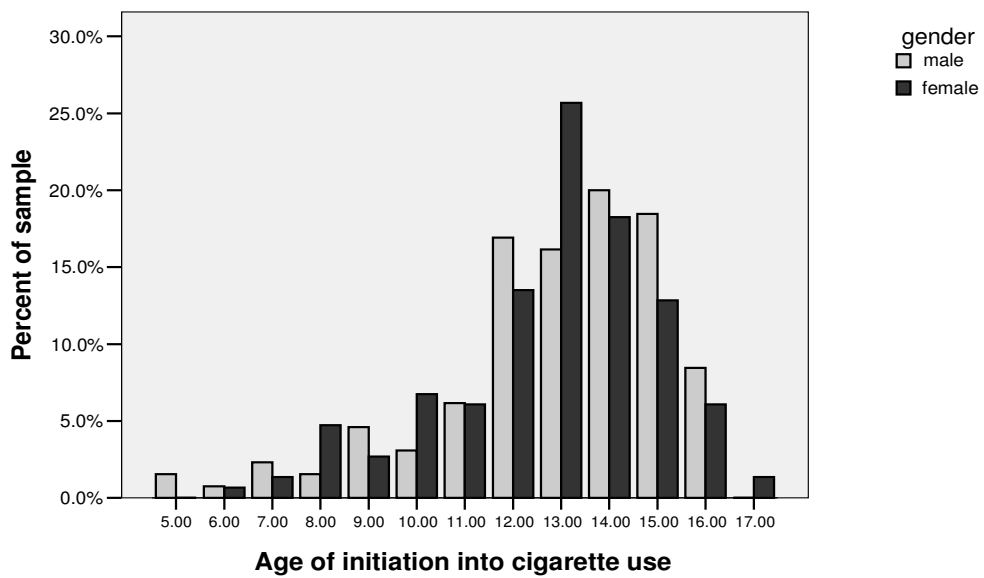


Figure 4: Male and female participant's age of initiation into cigarette use.

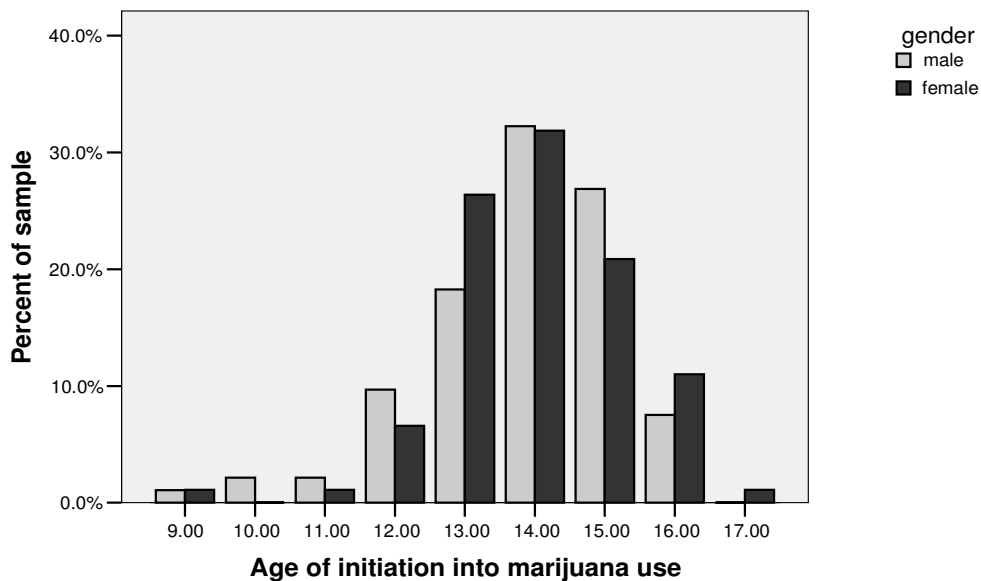


Figure 5: Male and female participant’s age of initiation into marijuana use.

Substance Use in the Last Month

The proportion of participants reporting alcohol use in the last month, current cigarette use, and marijuana use in the last month is shown in Table 4. Last month use of alcohol was determined by adding the reported number of drinking events in last month, to the reported number of drinking events in the last week multiplied by four, the total being divided by two. On this basis, approximately one quarter of the age thirteen and under sample reported use of alcohol in the month prior to being surveyed. This proportion increased to forty percent of the fourteen and fifteen year old sample, and to approximately sixty-five percent of the age sixteen and over sample. Larger proportions of females than males reported last month use of alcohol in the age thirteen and under and the age sixteen and older samples. However, males reported more last month alcohol use in the fourteen to fifteen year-old age group.

The proportion of participants reporting current use of tobacco was determined on the basis of the number of cigarettes reportedly currently smoked per day. This number increased from approximately four percent in the age thirteen and under sample, to approximately eleven percent in the fourteen and fifteen year old sample, and approximately twenty percent in the age sixteen and above group. The proportion of females in each age group who reported current use of tobacco was greater than the proportion of males in each group who reported current use of tobacco.

The proportion of the sample reporting last month marijuana use was determined on the basis of adding the number of reported marijuana events in last month, to the reported number of marijuana events in the last week multiplied by four, the overall total being divided by two. Approximately three percent of the age thirteen and younger group reported smoking marijuana in the month prior to being surveyed. This figure increased to approximately six percent of the fourteen and fifteen year old age group, and approximately eleven percent of the age sixteen and above age group. Males in all three age categories reported smoking more marijuana than females in comparable age groups.

Table 4: Number of participants reporting alcohol use in the last month, current cigarette use, and marijuana use in the last month with the sample split by age category (<13 years, 14-15 years, 16+ years) and gender.

| Age Category | N | Current Daily Use | % of Cell | % of Sample |
|----------------------|----------|--------------------------|------------------|--------------------|
| Alcohol Use | | | | |
| Male | | | | |
| <13 | 188 | 46 | 24.47 | 3.90 |
| 14-15 | 207 | 78 | 37.68 | 6.61 |
| 16+ | 143 | 96 | 67.13 | 8.14 |
| Female | | | | |
| <13 | 222 | 66 | 29.73 | 5.59 |
| 14-15 | 254 | 98 | 38.58 | 8.31 |
| 16+ | 166 | 106 | 63.95 | 8.98 |
| Total | | | | |
| <13 | 410 | 112 | 29.75 | 9.49 |
| 14-15 | 461 | 176 | 38.18 | 14.92 |
| 16+ | 309 | 202 | 65.37 | 17.12 |
| Cigarette Use | | | | |
| Male | | | | |
| <13 | 188 | 2 | 1.11 | 0.17 |
| 14-15 | 207 | 10 | 4.83 | 0.85 |
| 16+ | 143 | 12 | 8.39 | 1.02 |
| Female | | | | |
| <13 | 222 | 5 | 2.25 | 0.42 |
| 14-15 | 254 | 17 | 6.69 | 1.44 |
| 16+ | 166 | 22 | 13.25 | 1.86 |
| Total | | | | |
| <13 | 410 | 7 | 1.70 | 0.59 |
| 14-15 | 461 | 27 | 5.86 | 2.29 |
| 16+ | 309 | 34 | 11.00 | 2.89 |
| Marijuana Use | | | | |
| Male | | | | |
| <13 | 188 | 1 | 0.53 | 0.85 |
| 14-15 | 207 | 16 | 7.73 | 1.36 |
| 16+ | 143 | 19 | 13.29 | 1.61 |
| Female | | | | |
| <13 | 222 | 4 | 1.80 | 0.34 |
| 14-15 | 254 | 13 | 5.12 | 1.10 |
| 16+ | 166 | 16 | 9.64 | 1.36 |
| Total | | | | |
| <13 | 410 | 5 | 3.01 | 0.42 |
| 14-15 | 461 | 29 | 6.29 | 2.46 |
| 16+ | 309 | 35 | 11.33 | 2.97 |

Amount of Substance Consumed per Substance Use Event

The amount of each substance that was typically consumed when the substance was used was assessed. Number of alcoholic drinks consumed per alcohol use event, number of cigarettes consumed per day, and number of marijuana cones/joints typically consumed per marijuana use event are reported in Table 5.

Both males and females reported a linear increase in alcohol use across age category. For both sexes, approximately one third and one half of the age thirteen and younger and the fourteen to fifteen age groups respectively drank between one and five standard drinks per drinking event. For those in the age sixteen and greater group, approximately half of the males and sixty-three percent of the females consumed between one and five standard drinks per drinking event. Generally, males reported higher levels of consumption of between six and ten standard drinks per drinking event than females, with over twice as many males as females in the age sixteen and above age category drinking between six and ten drinks per drinking event.

The pattern of level of use of cigarettes was less clear-cut with females, but not males, showing a linear increase in level of use by age category. Male level of use increased from age thirteen and lower to its highest in the fourteen and fifteen age category, then decreased again for the age sixteen and higher category. However, males smoked more cigarettes per day than females in both the six to ten cigarettes per day and the eleven plus cigarettes per day categories.

Both males and females reported a linear increase in amount of marijuana smoked per event. However, generally, males smoked marijuana at higher levels than females in each age category. Approximately one percent of those ages thirteen and under smoked between one and five cones/joints per event, with approximately fifteen percent of boys and ten percent of girls in the fourteen and fifteen age category smoking at this level. By age sixteen and over, approximately thirty percent of males and less than twenty-five percent of females smoked between one and five cones/joints per event.

Table 5: Number of standard drinks consumed per drinking event, number of cigarettes consumed per day, and number of cones/joints consumed per marijuana smoking event with the sample split by age category (<13 years, 14-15 years, 16+ years) and gender.

| Number of drinks per drinking event (percent of cell) | | | | |
|--|-------------------|----------------|---------------|--------|
| Age category | 1-5/event (%) | 6-10/event (%) | 11+/event (%) | |
| Male | | | | |
| <13 | 60 (31.9) | 2 (1.6) | | |
| 14-15 | 99 (47.8) | 17 (8.3) | 2 | (1%) |
| 16+ | 72 (50.4) | 38 (26.6) | 2 | (1.5) |
| Female | | | | |
| <13 | 69 (31.1) | 2 (1) | | |
| 14-15 | 40 (47.3) | 7 (2.4) | 1 | (0.5) |
| 16+ | 104 (62.6) | 20 (12) | | |
| Total | | | | |
| <13 | 129 (31.5) | 4 (0.5) | | |
| 14-15 | 139 (44.5) | 24 (5.4) | 2 | (0.4) |
| 16+ | 176 (56.5) | 58 (14.3) | 3 | (1) |
| Number of cigarettes per day (percent of cell) | | | | |
| Age category | 1-5/day (%) | 6-10/day (%) | 11+/day (%) | |
| Male | | | | |
| <13 | 1 (0.25) | | | |
| 14-15 | 6 (0.57) | 3 (0.25) | 1 | (0.08) |
| 16+ | 5 (0.42) | 4 (0.34) | 3 | (0.34) |
| Female | | | | |
| <13 | 5 (0.42) | | | |

| | | | | | |
|---------------|----------|---------------|---|--------|----------|
| 14-15 | 16 | (1.36) | 1 | (0.08) | |
| 16+ | 18 | (1.53) | 3 | (0.25) | |
| Total | | | | | |
| <13 | 6 | (0.57) | | | |
| 14-15 | 22 | (1.86) | 4 | (0.34) | 1 (0.08) |
| 16+ | 23 | (1.95) | 7 | (0.59) | 3 (0.34) |

Number of cones/joints per drinking event (percent of cell)

| Age category | 1-5/event (%) | 6-10/event (%) | 11+/event (%) |
|---------------|-----------------|-----------------|---------------|
| Male | | | |
| <13 | 2 (1.06) | 1 (0.53) | |
| 14-15 | 30 (14.50) | 4 (1.93) | |
| 16+ | 41 (28.67) | 5 (3.50) | |
| Female | | | |
| <13 | 4 (1.80) | | |
| 14-15 | 27 (10.63) | 4 (1.57) | 1 (0.4) |
| 16+ | 40 (24.09) | 2 (1.20) | 1 (0.6) |
| Total | | | |
| <13 | 6 (1.43) | 1 (0.53) | |
| 14-15 | 57 (12.20) | 8 (1.75) | 1 (0.4) |
| 16+ | 81 (26.38) | 7 (2.35) | 1 (0.6) |

3.2 SCREENING ANALYSES

Differences In Use Across Age and Gender

Analysis of variance was used to determine whether significant differences existed in the level of substance use, motivation for substance use, parent and peer attitudes, social skills, emotion regulation and youth self report measures as a function of age and gender. In addition to gender, participants were divided into three age categories for the purposes of these analyses: thirteen years and younger, fourteen to fifteen years, and sixteen years and over.

Alcohol Use

Level of alcohol use was measured in four ways: Age at First Use, Number of Drinking Events in Last Month, Number of Standard Drinks Typically Consumed per Drinking Event and Overall Alcohol Use. Alcohol use was assessed in the whole (normative) sample, as well as in the portion of this sample that reported alcohol use

Whole Sample: A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on four dependent variables related to alcohol use: Age at First Use, Number of Drinking Events in Last Month, Number of Standard Drinks Typically Consumed per Drinking Event and Overall Alcohol Use. Table 6 presents means, standard deviations and ranges for responses on the four dependent variables for the whole sample utilised in the present study. Significant main effects were evident for gender, $F(4,854)=6.15$, $p<0.001$, and age, $F(8, 1708)=36.43$, $p<0.001$. The gender x age interaction was not significant. Univariate analyses revealed a significant main effect for gender on Age at First Use, $F(1, 857)=3.99$, $p<0.05$, and Number of Standard Drinks Typically Consumed per Drinking Event, $F(1, 857)=17.54$, $p<0.001$, and for age on Age at First Use, $F(2, 857)=51.15$, $p<0.001$, Number of Drinking Events in last Month, $F(2, 857)=25.98$, $p<0.001$, Number of Standard Drinks Typically Consumed per Drinking Event, $F(2, 857)=94.58$, $p<0.001$, and Overall Alcohol Use $F(2, 857)=39.78$, $p<0.001$. Post hoc (estimated marginal means) revealed that, despite their univariate significance, males and females were not significantly different on their Age at First Use of alcohol at the 95% level. Males did, however, consume significantly more alcohol than

females when assessed at the 95% level. Post hoc (Tukey's b) tests performed on age revealed that the mean scores gained by the <13 age category on each of the dependant variables were statistically significantly smaller than those gained by the 14-15 age category, which in turn were significantly smaller than those gained by the 16+ age category.

Table 6. Percent reporting lifetime use, and numbers, means, standard deviations, and ranges of responses to four level of alcohol use questions: Age at First Use, the Number of Drinking Events Reported in the Last Month, the Number of Standard Drinks Typically Consumed per Drinking Event, and an Overall Alcohol Use

| | Male | | | Female | | | |
|---|-------------|----------------|-----------|-------------|----------------|-----------|--------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) | |
| % Reporting lifetime use | | 64% | 80.2% | 93.7% | 73.4% | 79.5% | 91.6% |
| Age at first use | | | | | | | |
| N | | 116 | 153 | 126 | 141 | 187 | 140 |
| Mean | | 9.68 | 10.90 | 12.05 | 8.76 | 10.73 | 11.84 |
| S.D. | | 2.44 | 3.07 | 3.57 | 2.60 | 3.09 | 3.45 |
| Range | | 2-13 | 1-15 | 1-17 | 2-13 | 1-15 | 1-17 |
| Drinking events last month | | | | | | | |
| N | | 116 | 153 | 126 | 141 | 187 | 140 |
| Mean | | 0.56 | 1.20 | 2.63 | 0.97 | 1.63 | 2.10 |
| S.D. | | 1.11 | 2.01 | 3.83 | 1.75 | 3.11 | 2.33 |
| Range | | 0-6.5 | 0-13 | 0-13 | 0-11.5 | 0-19 | 0-12.5 |
| Number of standard drinks typically consumed per event | | | | | | | |
| N | | 116 | 153 | 126 | 141 | 187 | 140 |
| Mean | | 0.71 | 2.22 | 3.75 | 0.65 | 1.39 | 2.79 |
| S.D. | | 1.16 | 2.59 | 3.19 | 1.05 | 1.95 | 2.22 |
| Range | | 0-9 | 0-12 | 0-15 | 0-6 | 0-16 | 0-10 |
| Overall Alcohol Use | | | | | | | |
| N | | 116 | 153 | 126 | 141 | 187 | 140 |
| Mean | | 0.60 | 4.38 | 12.09 | 1.34 | 4.19 | 8.43 |
| S.D. | | 1.96 | 13.07 | 19.24 | 4.70 | 12.16 | 12.62 |
| Range | | 0-15 | 0-91 | 0-107 | 0-34.5 | 0-91 | 0-76 |

Participants Reporting Alcohol Use: A 3 (Age) x 2 (Gender) multivariate analyses of variance was performed on four dependent variables related to alcohol use for the portion of the present sample who reported current use of alcohol. The dependant variables were Age at First Use, Number of Drinking Events in Last Month, Number of Standard Drinks Typically Consumed per Drinking Event and Overall Alcohol Use. Table 7 presents numbers, means, standard deviations and ranges for responses on the four dependent variables for the subset of participants who reported alcohol use in the month prior to participating in the survey. Significant main effects were evident for gender, $F(4, 381)=2.77, p<0.05$, and age, $F(8, 764)=15.38, p<0.001$. The gender x age interaction was not significant. Univariate analyses revealed significant main effects for gender on Number of Standard Drinks Typically Consumed per Drinking Event, $F(1, 384)=7.94, p<0.05$, and for age on Age at First Use, $F(2, 384)=19.30, p<0.001$, Number of Drinking Events in Last Month, $F(2, 384)=5.71, p=0.01$, Number of Standard Drinks Typically Consumed per Drinking Event, $F(2, 384)=42.04,$

$p < 0.001$, and Overall Alcohol Use $F(2, 384) = 14.22$, $p < 0.001$. Post hoc tests (estimated marginal means) performed on gender conformed males reported consuming significantly more alcohol than females when assessed at the 95% level. Post hoc (Tukey's b) tests performed on age revealed that the mean scores gained on each of two dependant variables, Number of Standard Drinks Typically Consumed per Drinking Event, and Overall Alcohol Use, by the <13 age category were statistically significantly smaller than those gained by the 14-15 age category, which in turn were significantly smaller than those gained by the 16+ age category. The mean scores gained by the <13 age category on Age at First Use and Number of Drinking Events in Last Month were statistically significantly different from those gained by the two older age groups, however these were not significantly different from each other.

Table 7. Numbers, means, standard deviations and ranges for responses on the four dependent variables, Age at First Use, Number of Drinking Events Reported in the Last Month, Number of Standard Drinks Typically Consumed per Drinking Event, and Overall Alcohol Use for the subset of participants who reported alcohol use in the month prior to participating in the survey.

| | Male | | | Female | | | |
|-----------------------------------|-------------|----------------|-----------|-------------|----------------|-----------|----------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) | |
| Age at first use | | | | | | | |
| N | | 31 | 64 | 84 | 41 | 77 | 93 |
| Mean | | 9.48 | 10.77 | 11.60 | 8.29 | 10.86 | 11.78 |
| S.D. | | 2.51 | 2.99 | 3.36 | 3.00 | 2.82 | 3.45 |
| Range | | 3-13 | 2-15 | 1-16 | 2-13 | 2-15 | 1-16 |
| Drinking events last month | | | | | | | |
| N | | 31 | 64 | 84 | 41 | 77 | 93 |
| Mean | | 1.45 | 2.47 | 3.75 | 2.33 | 3.38 | 3.04 |
| S.D. | | 1.50 | 2.42 | 4.22 | 2.37 | 4.01 | 2.30 |
| Range | | 0.5-6.5 | 0.5-13 | 0.5-21 | 0.5-11.5 | 0.5-19 | 0.5-12.5 |
| Number of drinks per event | | | | | | | |
| N | | 31 | 64 | 84 | 41 | 77 | 93 |
| Mean | | 1.31 | 3.59 | 4.90 | 1.54 | 2.45 | 3.70 |
| S.D. | | 0.67 | 2.70 | 2.87 | 1.29 | 2.37 | 1.95 |
| Range | | 0.5-3 | 1-12 | 1-15 | 1-6 | 0.5-16 | 1-10 |
| Overall Alcohol Use | | | | | | | |
| N | | 31 | 64 | 84 | 41 | 77 | 93 |
| Mean | | 2.17 | 10.46 | 18.13 | 4.61 | 10.19 | 12.69 |
| S.D. | | 3.34 | 18.64 | 21.13 | 7.87 | 17.32 | 13.64 |
| Range | | 0.25-15 | 0.5-91 | 0.5-107 | 0.5-34.5 | 0.25-108 | 0.5-76 |

Tobacco Use

Level of Tobacco Use was measured in two ways: Participant Age at First Use, and Number of Cigarettes Currently Smoked per Day. Tobacco Use was assessed in the whole (normative) sample, as well as in the portion of this sample that reported tobacco use.

Whole Sample: A 3 (Age) x 2 (Gender) multivariate analyses of variance was performed on the two tobacco use related dependent variables: Age at First Use and Number of Cigarettes Currently Smoked per Day for the whole sample. Table 8 presents the percent reporting lifetime use, numbers, means, standard deviations and ranges for responses to the

two dependent variables Participant Age at First Use and Number of Cigarettes Currently Smoked per Day, for the whole sample. A significant main effect was evident for Age, $F(4,544)=12.93$, $p<0.001$. However the gender, and the age by gender interaction, were not significant. Univariate analyses revealed a significant main effect for Age on Age at First Use, $F(2, 273)=25.69$, $p<0.001$. Post hoc (Tukey's b) tests carried out on Age revealed that the mean scores gained by the <13 age category on the Age at First Use variable were statistically significantly smaller than those gained by the 14-15 age category, which in turn were significantly smaller than those gained by the 16+ age category

Table 8. Percent reporting lifetime use, and numbers means, standard deviations, and ranges of responses to two level of tobacco use questions: Age at first use and Number of cigarettes currently smoked per day for the subset of participants who reported tobacco use in the month prior to participating in the survey.

| | Male | | | Female | | |
|--|---------------|-------------------|--------------|---------------|-------------------|--------------|
| | Young (13) | Middle (14-15) | Old (16+) | Young (13) | Middle (14-15) | Old (16+) |
| % reporting lifetime use | 6.4% | 26.6% | 46.2% | 6.3% | 24.8% | 44% |
| Age at first use | | | | | | |
| N | 10 | 55 | 66 | 14 | 62 | 72 |
| Mean | 10.10 | 12.15 | 13.71 | 10.64 | 12.44 | 13.42 |
| S.D. | 2.56 | 2.21 | 2.42 | 1.95 | 1.62 | 2.38 |
| Range | 6-13 | 2-15 | 5-16 | 7-14 | 8-15 | 6-17 |
| Number of cigarettes smoked per day | | | | | | |
| N | 10 | 55 | 66 | 14 | 62 | 72 |
| Mean | 0.00 | 0.85 | 1.12 | 0.64 | 0.60 | 0.90 |
| S.D. | 0.00 | 2.57 | 3.18 | 1.39 | 1.37 | 2.05 |
| Range | 0-1 | 0-12 | 0-15 | 0-5 | 0-8 | 0-10 |

Participants Reporting Current Cigarette Use

A 3 (Age) x 2 (Gender) multivariate analyses of variance was performed on the two tobacco use related dependent variables: Age at First Use and Number of Cigarettes Currently Smoked per Day for the whole sample. Table 9 presents the percent reporting lifetime use, numbers, means, standard deviations and ranges for responses to the two dependent variables Participant Age at First Use and Number of Cigarettes Currently Smoked per Day, for the whole sample. A significant main effect was evident for Age, $F(4,114)=6.03$, $p<0.001$, Gender, $F(2, 57)=5.66$, $p<0.01$, and the age x gender interaction, $F(2, 57)=3.24$, $p<0.05$. Univariate analyses revealed a significant main effect for age on Age at First Use, $F(2, 58)=11.13$, $p<0.01$, a significant main effect for gender on Number of Cigarettes Currently Smoked per Day, $F(1, 58)=11.49$, $p=0.001$, and a significant gender x age interaction on Age at First Use $F(1, 58)=5.79$, $p<0.05$. Post hoc (estimated marginal means) revealed that, despite their univariate significance, males and females were not significantly different in the Number of Cigarettes Currently Smoked per Day when assessed at the 95% level. Post hoc (Tukey's b) tests carried out on Age revealed that the mean scores for the <13 age group were statistically smaller than those gained by the 16+ age group. However, those gained by the 14-15 age group were statistically significantly different from neither the <13 or 16+ age groups.

Table 9. Numbers, means, standard deviations, and ranges of responses to two level of tobacco use questions: Age at First Use and Number of Cigarettes Currently Smoked per Day for the subset of participants who reported tobacco use in the month prior to participating in the survey.

| | Male | | | Female | | |
|--|---------------|-------------------|--------------|---------------|-------------------|--------------|
| | Young (13) | Middle (14-15) | Old (16+) | Young (13) | Middle (14-15) | Old (16+) |
| Age at first use | | | | | | |
| N | 0 | 10 | 11 | 4 | 17 | 21 |
| Mean | 0.00 | 11.20 | 14.27 | 11.25 | 12.41 | 13.29 |
| S.D. | 0.00 | 1.32 | 1.27 | 2.99 | 1.66 | 1.74 |
| Range | 0 | 9-12 | 12-16 | 7-14 | 8-15 | 8-15 |
| Number of cigarettes smoked per day | | | | | | |
| N | 0 | 10 | 11 | 4 | 17 | 21 |
| Mean | 0.00 | 4.70 | 6.73 | 2.25 | 2.18 | 3.10 |
| S.D. | 0.00 | 4.42 | 4.94 | 1.89 | 1.89 | 2.79 |
| Range | 0 | 1-12 | 1-15 | 1-5 | 1-8 | 1-10 |

Marijuana Use

Level of marijuana use was measured in four ways: Age at First Use, Number of Marijuana Events in Last Month, Number of Cones/Joints Typically Consumed per Marijuana Event and Overall Marijuana Use. Marijuana use was assessed in the whole (normative) sample, as well as in the portion of this sample that reported alcohol use

Whole Sample: A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on four dependent variables related to marijuana use: Age at First Use, Number of Marijuana Events in Last Month, Number of Cones/Joints Typically Consumed per Marijuana Event and Overall Marijuana Use. Table 10 presents means, standard deviations and ranges for responses on the four dependent variables for the whole sample utilised in the present study. Significant main effects were evident for age, $F(8, 352)=3.82, p<0.001$. The gender and the gender x age interaction were not significant. Univariate analyses revealed a significant main effect for gender on Age at First Use, $F(2, 179)=13.44, p<0.001$. Post hoc (Tukey's b) tests performed for age on the dependant variable Age at First Use revealed that the mean gained by the 16+ age group was statistically significantly different from those gained by the two younger age groups, which were not significantly different from each other.

Table 10. Percent reporting lifetime use, and numbers, means, standard deviations, and ranges of responses to four level of marijuana use questions: Age at Age at First Use, Number of Marijuana Events in Last Month, Number of Cones/Joints Typically Consumed per Marijuana Event and Overall Marijuana Use for the whole sample.

| | Male | | | Female | | |
|------------------------------------|----------------|-------------------|--------------|----------------|-------------------|--------------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| % reporting lifetime use | 2.1% | 18.4% | 36.4% | 3.2% | 14.2% | 31.3% |
| Age at First Use | | | | | | |
| N | 3 | 38 | 52 | 5 | 35 | 52 |
| Mean | 12.67 | 13.21 | 14.37 | 12.80 | 13.29 | 14.33 |
| S.D. | 0.58 | 1.46 | 1.14 | 1.10 | 1.07 | 2.07 |
| Range | 12-13 | 9-15 | 1-16 | 11-14 | 9-15 | 2-17 |
| Marijuana events last month | | | | | | |
| N | 3 | 38 | 52 | 5 | 35 | 52 |

| | | | | | | |
|---|------|-------|-------|--------|-------|--------|
| Mean | 0.33 | 0.97 | 1.34 | 1.80 | 1.77 | 0.72 |
| S.D. | 0.58 | 2.48 | 2.92 | 1.82 | 3.11 | 1.52 |
| Range | 0-1 | 0-14 | 0-15 | 0-4 | 0-11 | 0-6 |
| Number of Cones/ Joints typically consumed per event | | | | | | |
| N | 3 | 38 | 52 | 5 | 35 | 52 |
| Mean | 1.00 | 2.69 | 1.93 | 1.40 | 2.43 | 2.15 |
| S.D. | 1.00 | 2.53 | 1.61 | 1.14 | 2.79 | 1.96 |
| Range | 0-9 | 0-10 | 0-8 | 0-3 | 0-14 | 0-20 |
| Overall Marijuana Use | | | | | | |
| N | 3 | 38 | 52 | 5 | 35 | 52 |
| Mean | 0.33 | 3.46 | 4.37 | 3.00 | 7.03 | 1.78 |
| S.D. | 0.57 | 10.15 | 11.34 | 4.51 | 14.12 | 4.61 |
| Range | 0-1 | 0-57 | 0-55 | 0-10.5 | 0-56 | 0-27.5 |

Participants Reporting Marijuana Use: A 3 (Age) x 2 (Gender) multivariate analyses of variance was performed on four dependent variables related to alcohol use for the portion of the present sample who reported current use of alcohol. The dependant variables were Age at First Use, Number of Drinking Events in Last Month, Number of Standard Drinks Typically Consumed per Drinking Event and Overall Alcohol Use. Table 11 presents numbers, means, standard deviations and ranges for responses on the four dependent variables for the subset of participants who reported alcohol use in the month prior to participating in the survey. No significant multivariate main effects were evident for gender or age. In addition, the gender x age interaction was also non-significant.

Table 11. Numbers, means, standard deviations, and ranges of responses to four level of marijuana use questions: Age at Age at First Use, Number of Marijuana Events in Last Month, Number of Cones/Joints Typically Consumed per Marijuana Event and Overall Marijuana Use for the portion of the sample who reported marijuana use.

| | Male | | | Female | | |
|---|----------------|-------------------|--------------|----------------|-------------------|--------------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Age at first use | | | | | | |
| N | 1 | 15 | 17 | 3 | 13 | 16 |
| Mean | 13.00 | 13.00 | 14.00 | 13.33 | 13.46 | 13.25 |
| S.D. | 0 | 1.60 | 1.17 | 0.58 | 0.97 | 3.19 |
| Range | 0 | 10-15 | 12-16 | 13-14 | 12-15 | 2-16 |
| Marijuana events last month | | | | | | |
| N | 1 | 15 | 17 | 3 | 13 | 16 |
| Mean | 1.00 | 2.47 | 3.94 | 2.67 | 4.77 | 2.34 |
| S.D. | 0 | 3.52 | 4.02 | 1.89 | 3.44 | 1.95 |
| Range | 1 | 0.5-14 | 0.5-15 | 0.5-4 | 0.5-11 | 0.5-6 |
| Number of Cones/ Joints typically consumed per event | | | | | | |
| N | 1 | 15 | 17 | 3 | 13 | 16 |
| Mean | 1.00 | 3.40 | 2.82 | 1.67 | 3.77 | 2.56 |
| S.D. | 0 | 2.92 | 1.38 | 1.15 | 3.35 | 1.89 |

| | | | | | | |
|------------------------------|------|--------|--------|----------|--------|-----------|
| Range | 0 | 1-10 | 1-6 | 1-3 | 1-14 | 1-7.50 |
| Overall Marijuana Use | | | | | | |
| N | 1 | 15 | 17 | 3 | 13 | 16 |
| Mean | 1.00 | 8.77 | 13.25 | 5 | 18.92 | 5.80 |
| S.D. | 0 | 14.92 | 18.81 | 5.07 | 17.92 | 6.90 |
| Range | 0 | 0.5-57 | 0.5-55 | 0.5-10.5 | 0.5-56 | 0.5-27.50 |

3.2.1 Differences in Experimental Variables Across Age and Gender

A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on two dependent variables, Internalising and Externalising, from the Achenbach YSR. Table 12 presents the means, standard deviations and ranges for responses on the two dependent variables. Significant main effects were evident for both gender, $F(2, 1025)=20.20, p<0.001$, and age, $F(4, 2050)=3.83, p<0.001$. However the age by gender interaction was not significant. Univariate analyses revealed a significant main effect for gender on the dependant variable Internalising, $F(1, 1026)= 29.53, p<0.001$., and significant main effects for age on both dependent variables: Internalising $F(2, 1026)=6.50, p<0.01$, and Externalising $F(2, 1026)=4.64, p<0.05$.

Post hoc tests (estimated marginal means) performed on gender conformed females reported statistically significantly higher internalising scores than males when assessed at the 95% level. Post hoc (Tukey's b) tests carried out on age confirmed that the younger age group's means on both dependent variables were significantly smaller than the two older age groups, which were not significantly different from each other.

Table 12. Numbers, means, standard deviations, and ranges of responses to the two Achenbach dependent variables, Internalising and Externalising Scores.

| | Male | | | Female | | |
|----------------------|----------------|-------------------|--------------|----------------|-------------------|--------------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Internalising | | | | | | |
| N | 167 | 175 | 131 | 184 | 227 | 148 |
| Mean | 10.35 | 13.08 | 10.79 | 13.02 | 15.43 | 15.83 |
| S.D. | 7.95 | 10.43 | 9.44 | 9.97 | 10.18 | 10.19 |
| Range | 0-49 | 0-53 | 0-41 | 0-49 | 0-52 | 1-52 |
| Externalising | | | | | | |
| N | 167 | 175 | 131 | 184 | 227 | 148 |
| Mean | 10.98 | 12.87 | 13.15 | 11.77 | 13.196 | 12.79 |
| S.D. | 7.13 | 8.47 | 7.94 | 9.09 | 7.76 | 8.05 |
| Range | 0-42 | 0-44 | 1-36 | 0-55 | 0-40 | 0-47 |

Alcohol Motives

Motivation for Alcohol Use was analysed separately for the whole sample and for the portion of the sample reporting current alcohol use, that is, the portion of participants who reported use of alcohol over the month prior to responding to the survey.

Whole Sample: A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on six dependent variables related to Motives for Use of Alcohol: Social, Coping, Enhancement, Conformity, Expansion and Total Motives. Table 13 presents the numbers, means, standard deviations and ranges for responses on the six dependent variables. A significant main effect was evident for age, $F(10, 2166)=24.37, p<0.001$, gender, $F(5, 1082)=6.08, p<0.001$, and for the age x gender interaction $F(10, 2164)=1.92, p<0.05$. Univariate analyses revealed a significant main effect for age on Social, $F(2, 1086)=34.08, p<0.001$, Enhancement, $F(2, 1086)=13.79, p<0.001$, and Conformity, $F(2, 1086)=33.71, p<0.001$, and for gender on Coping, $F(1, 1086)=10.33, p<0.001$ and Conformity, $F(1, 1086)=6.76, p<0.001$. Univariate analysis of the age x gender interaction revealed a significant effect on Social Motives $F(2, 1086)=4.59, p=0.01$. Post hoc tests (estimated marginal means) performed on gender conformed females reported statistically significantly higher coping motives when assessed at the 95% level. However, despite their univariate significance, the difference between males and females when assessed at the 95% level was not statistically significantly different. Post hoc (Tukey's b) analyses carried out for age on the Social, Enhancement and Conformity Motives revealed that in all case, the mean for the <13 age group was statistically significantly smaller from that reported by each older age group, the means for which were not statistically significantly different from each other.

Table 13. Numbers, means, standard deviations and ranges of responses to the six questions related to Motives for Alcohol Use: Social, Coping, Enhancement, Conformity, Expansion and Total Motives, for the whole sample.

| | Male | | | Female | | |
|----------------------------|-------------|----------------|-----------|-------------|----------------|-----------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Social Motives | | | | | | |
| N | 154 | 195 | 134 | 203 | 245 | 161 |
| Mean | 13.30 | 17.20 | 17.545 | 14.97 | 16.54 | 17.07 |
| S.D. | 6.09 | 5.48 | 5.39 | 5.81 | 5.22 | 4.78 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Coping Motives | | | | | | |
| N | 154 | 195 | 134 | 203 | 245 | 161 |
| Mean | 11.659 | 11.42 | 10.66 | 12.73 | 12.35 | 11.82 |
| S.D. | 5.89 | 5.30 | 5.16 | 5.46 | 5.28 | 5.34 |
| Range | 5-25 | 2-25 | 5-25 | 5-25 | 2-24 | 5-25 |
| Enhancement Motives | | | | | | |
| N | 154 | 195 | 134 | 203 | 245 | 161 |
| Mean | 11.77 | 13.47 | 14.25 | 12.69 | 13.77 | 14.48 |
| S.D. | 5.65 | 5.38 | 5.69 | 5.12 | 5.03 | 4.99 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Conformity Motives | | | | | | |
| N | 154 | 195 | 134 | 203 | 245 | 161 |
| Mean | 12.03 | 11.42 | 9.16 | 13.73 | 12.58 | 9.15 |
| S.D. | 6.30 | 5.90 | 5.19 | 6.16 | 6.51 | 5.00 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-24 |
| Expansion Motives | | | | | | |
| N | 154 | 195 | 134 | 203 | 245 | 161 |
| Mean | 8.94 | 9.24 | 8.80 | 8.77 | 8.82 | 8.08 |
| S.D. | 4.43 | 3.87 | 4.67 | 4.12 | 3.52 | 3.51 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-21 |
| Total Motives | | | | | | |

| | | | | | | |
|-------|---------|--------|--------|--------|--------|--------|
| N | 154 | 195 | 134 | 203 | 245 | 161 |
| Mean | 57.64 | 62.74 | 60.32 | 62.89 | 64.15 | 60.61 |
| S.D. | 24.75 | 19.91 | 19.29 | 21.54 | 19.75 | 17.01 |
| Range | 25-1125 | 26-125 | 25-117 | 25-125 | 25-117 | 25-108 |

Participants Reporting Alcohol Use: A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on six dependent variables related to Motives for Use of Alcohol among the portion of the present sample who reported current (last month) alcohol use. The variables were Social, Coping, Enhancement, Conformity, Expansion and Total Motives. Table 14 presents the numbers, means, standard deviations and ranges for responses on the six dependent variables. A significant main effect was evident for age, $F(10, 772)=8.83, p<0.001$, and gender, $F(5, 385)=5.29, p<0.001$. The age x gender interaction was not significant. Univariate analyses revealed a significant main effect for age on Social, $F(2, 389)=6.82, p=0.001$, Coping, $F(2, 389)=6.35, p<0.01$, Conformity, $F(2, 389)=26.02, p<0.001$, and Total $F(2, 389)=5.88, p<0.01$. In addition, univariate analyses revealed a significant main effect for gender on Expansion $F(1, 389)=13.22, p<0.001$. Post hoc tests (estimated marginal means) performed on gender conformed that male expansion motives were statistically significantly higher than those reported by females when assessed at the 95% level. Post hoc (Tukey's b) analyses carried out for age on the Social and Conformity Motives revealed that the means for the <13 age group were statistically significantly different from those reported by both older age groups, which were not statistically significantly different from each other. Post hoc (Tukey's b) analysis carried out on the Coping and Total Motives revealed no significant difference between the means gained by any age group on either of these motives.

Table 14. Numbers, means, standard deviations and ranges of responses to the six questions related to Motives for Alcohol Use: Social, Coping, Enhancement, Conformity, Expansion and Total Motives for the portion of the sample reporting current (last month) alcohol use.

| | Male | | | Female | | |
|----------------------------|-------------|----------------|-----------|-------------|----------------|-----------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Social Motives | | | | | | |
| N | 29 | 66 | 84 | 41 | 80 | 95 |
| Mean | 14.83 | 18.71 | 17.37 | 14.78 | 16.63 | 16.67 |
| S.D. | 6.54 | 4.78 | 5.24 | 6.44 | 5.38 | 4.74 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Coping Motives | | | | | | |
| N | 29 | 66 | 84 | 41 | 80 | 95 |
| Mean | 12.14 | 12.94 | 10.12 | 11.88 | 12.39 | 11.19 |
| S.D. | 6.17 | 5.08 | 4.66 | 4.84 | 5.44 | 5.07 |
| Range | 5-25 | 5-25 | 5-24 | 5-22 | 2-23 | 5-24 |
| Enhancement Motives | | | | | | |
| N | 29 | 66 | 84 | 41 | 80 | 95 |
| Mean | 13.00 | 14.76 | 13.96 | 12.07 | 13.78 | 14.07 |
| S.D. | 6.93 | 5.06 | 5.31 | 4.96 | 5.01 | 5.09 |
| Range | 5-25 | 5-25 | 5-24 | 5-24 | 5-24 | 5-25 |
| Conformity Motives | | | | | | |
| N | 29 | 66 | 84 | 41 | 80 | 95 |
| Mean | 12.66 | 12.30 | 8.29 | 14.34 | 12.19 | 9.06 |
| S.D. | 6.17 | 5.70 | 4.54 | 6.09 | 6.33 | 5.09 |
| Range | 5-25 | 5-25 | 5-25 | 5-24 | 5-24 | 5-24 |

| Expansion Motives | | | | | | |
|--------------------------|--------|--------|--------|--------|--------|--------|
| N | 29 | 66 | 84 | 41 | 80 | 95 |
| Mean | 9.97 | 9.82 | 8.77 | 7.59 | 8.51 | 7.85 |
| S.D. | 5.40 | 4.10 | 4.55 | 3.24 | 3.26 | 3.00 |
| Range | 5-25 | 5-25 | 5-22 | 5-25 | 5-18 | 5-19 |
| Total Motives | | | | | | |
| N | 29 | 66 | 84 | 41 | 80 | 95 |
| Mean | 62.59 | 68.53 | 58.51 | 60.66 | 63.49 | 58.85 |
| S.D. | 26.99 | 17.85 | 17.76 | 20.61 | 20.12 | 16.59 |
| Range | 25-125 | 29-125 | 25-115 | 25-100 | 25-100 | 28-108 |

Tobacco Motives

Motivation for Tobacco Use was accounted for separately for the whole sample and for the portion of the sample that reported current daily cigarette use.

Whole Sample: A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on six dependent variables related to Motives for Use of Cigarettes: Social, Coping, Enhancement, Conformity, Expansion and Total Motives. Table 15 presents the numbers, means, standard deviations and ranges for responses on the six dependent variables. A significant main effect was evident for age, $F(10, 2082)=11.55, p<0.001$, and gender, $F(5, 1040)=2.24, p<0.05$. The age x gender interaction was non significant. Univariate analyses revealed a significant main effect for age on Coping, $F(2, 1044)=12.18, p<0.001$, Enhancement, $F(2, 1044)=6.82, p=0.001$, and Conformity, $F(2, 1044)=31.92, p<0.001$, Expansion, $F(2, 1044)=12.18, p<0.001$, and Total $F(2, 1044)=15.38, p<0.001$. No significant effects for gender on any of the dependant variables were evident at a univariate level. Post hoc (Tukey's b) analyses carried out for age on the Social Motives revealed no significant differences between means. Post hoc (Tukey's b) analyses carried out for age on Coping and Conformity Motives revealed that in each case, the <13 age category scores significantly lower than the 14-15 age category, who in turn, scored significantly lower than the 16+ age category. Post hoc (Tukey's b) analyses carried out for age on the Enhancement and Total Motives revealed that the mean for the younger age group was statistically significantly lower from that reported by each older age group, the means for which were not statistically significantly different from each other. Finally, Post hoc (Tukey's b) analyses carried out for age on Expansion suggested that the mean for the older age group was statistically significantly lower than the mean for the younger age group. However, the mean for the middle age group was statistically significantly different from neither.

Table 15. Numbers, means, standard deviations and ranges of responses to the six questions related to Motives for Tobacco Use: Social, Coping, Enhancement, Conformity, Expansion and Total Motives for the whole sample.

| | Male | | | Female | | |
|-----------------------|-------------|----------------|-----------|---------------|----------------|-----------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Social Motives | | | | | | |
| N | 156 | 183 | 127 | 200 | 235 | 149 |
| Mean | 12.73 | 13.54 | 12.57 | 12.46 | 13.05 | 12.53 |
| S.D. | 4.54 | 4.97 | 4.87 | 4.63 | 4.15 | 4.93 |
| Range | 5-23 | 5-25 | 5-24 | 5-25 | 5-24 | 5-25 |
| Coping Motives | | | | | | |
| N | 156 | 183 | 127 | 200 | 235 | 149 |
| Mean | 12.87 | 12.07 | 11.02 | 13.41 | 12.52 | 11.62 |
| S.D. | 4.90 | 4.35 | 5.18 | 4.35 | 4.33 | 4.56 |

| | | | | | | |
|----------------------------|--------|--------|--------|--------|--------|-------|
| Range | 5-24 | 5-25 | 5-24 | 5-25 | 2-23 | 5-24 |
| Enhancement Motives | | | | | | |
| N | 156 | 183 | 127 | 200 | 235 | 149 |
| Mean | 13.22 | 12.53 | 11.44 | 12.77 | 12.47 | 11.86 |
| S.D. | 4.74 | 4.71 | 4.93 | 4.38 | 4.31 | 4.29 |
| Range | 5-23 | 5-25 | 5-24 | 5-25 | 5-25 | 5-24 |
| Conformity Motives | | | | | | |
| N | 156 | 183 | 127 | 200 | 235 | 149 |
| Mean | 14.77 | 13.99 | 11.28 | 15.39 | 14.29 | 11.73 |
| S.D. | 5.32 | 5.51 | 6.03 | 5.47 | 5.99 | 5.77 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Expansion Motives | | | | | | |
| N | 156 | 183 | 127 | 200 | 235 | 149 |
| Mean | 9.16 | 8.62 | 8.06 | 8.91 | 8.71 | 8.09 |
| S.D. | 4.27 | 3.34 | 4.17 | 3.93 | 3.28 | 3.24 |
| Range | 5-24 | 5-25 | 5-21 | 5-25 | 5-21 | 5-21 |
| Total Motives | | | | | | |
| N | 156 | 183 | 127 | 200 | 235 | 149 |
| Mean | 62.74 | 60.74 | 54.37 | 62.94 | 61.04 | 55.83 |
| S.D. | 19.05 | 17.28 | 20.58 | 17.76 | 16.36 | 16.72 |
| Range | 25-107 | 25-125 | 25-100 | 25-125 | 25-112 | 25-89 |

Participants Reporting Tobacco Use: A 3 (Age) x 2 (Gender) multivariate analyses of variance was performed on six dependent variables related to Motives for Use of Tobacco among the portion of the present sample that reported current cigarette use. Table 16 presents the numbers, means, standard deviations and ranges for responses on the six dependent variables, Social, Coping, Enhancement, Conformity, Expansion and Total Motives. No significant main effects were demonstrated at a multivariate level on either the age or gender factors, or for their interaction.

Table 16. Numbers, means, standard deviations and ranges of responses to the six questions related to Motives for Tobacco Use: Social, Coping, Enhancement, Conformity, Expansion and Total Motives for the portion of the sample reporting current use of tobacco.

| | Male | | | Female | | |
|----------------------------|----------------|-------------------|--------------|----------------|-------------------|--------------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Social Motives | | | | | | |
| N | 1 | 8 | 11 | 4 | 17 | 17 |
| Mean | 14.00 | 15.00 | 12.36 | 12.75 | 13.53 | 12.65 |
| S.D. | 0 | 5.18 | 4.34 | 3.30 | 3.08 | 4.85 |
| Range | 0 | 6-22 | 7-21 | 6-16 | 9-20 | 5-23 |
| Coping Motives | | | | | | |
| N | 1 | 8 | 11 | 4 | 17 | 17 |
| Mean | 9 | 13.63 | 9.18 | 11.25 | 11.06 | 11.18 |
| S.D. | 0 | 5.15 | 3.87 | 2.87 | 3.15 | 4.22 |
| Range | 0 | 7-21 | 5-17 | 7-14 | 5-17 | 5-18 |
| Enhancement Motives | | | | | | |

| | | | | | | |
|---------------------------|-------|--------|-------|-------|-------|-------|
| N | 1 | 8 | 11 | 4 | 17 | 17 |
| Mean | 19.00 | 14.00 | 10.09 | 13.00 | 12.47 | 12.35 |
| S.D. | 0 | 6.32 | 4.64 | 3.83 | 4.08 | 4.31 |
| Range | 0 | 7-24 | 5-18 | 10-18 | 7-23 | 5-19 |
| Conformity Motives | | | | | | |
| N | 1 | 8 | 11 | 4 | 17 | 17 |
| Mean | 16.00 | 16.13 | 9.09 | 15.75 | 14.59 | 13.06 |
| S.D. | 0 | 6.06 | 4.35 | 5.68 | 6.25 | 5.98 |
| Range | 0 | 5-21 | 5-19 | 6-22 | 5-23 | 5-23 |
| Expansion Motives | | | | | | |
| N | 1 | 8 | 11 | 4 | 17 | 17 |
| Mean | 15.00 | 10.63 | 7.09 | 9.50 | 7.94 | 8.00 |
| S.D. | 0 | 4.10 | 4.21 | 5.69 | 2.63 | 3.41 |
| Range | 0 | 6-19 | 5-19 | 6-18 | 5-15 | 5-17 |
| Total Motives | | | | | | |
| N | 1 | 8 | 11 | 4 | 17 | 17 |
| Mean | 73.00 | 69.38 | 47.82 | 63.25 | 59.59 | 57.24 |
| S.D. | 0 | 17.00 | 17.34 | 19.24 | 11.54 | 17.80 |
| Range | 0 | 38-100 | 27-81 | 44-88 | 35-81 | 25-88 |

Marijuana Motives

Motivation for Marijuana Use was accounted for separately for the whole (normative) sample and for the portion of the sample reporting current cigarette use, that is, the portion of participants who reported current use of marijuana, that is, the portion of participants who reported use of alcohol over the month prior to responding to the survey.

Whole Sample: A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on six dependent variables related to Motives for Use of Marijuana: Social, Coping, Enhancement, Conformity, Expansion and Total Motives. Table 17 presents the numbers, means, standard deviations and ranges for responses on the six dependent variables for the whole sample. A significant main effect was evident for age, $F(10, 2098)=18.29, p<0.001$, and gender, $F(5, 1049)=7.42, p<0.001$. The age x gender interaction was non significant. Univariate analyses revealed a significant main effects for age on Social, $F(2, 1053)=6.28, p<0.01$, Coping, $F(2, 1053)=6.05, p<0.01$, Enhancement, $F(2, 1053)=22.65, p<0.001$, Conformity, $F(2, 1053)=30.33, p<0.001$ and Total Motives $F(2, 1053)=3.09, p<0.05$, and for gender on Coping $F(1, 1053)=8.23, p<0.01$ and Expansion $F(1, 1053)=3.97, p<0.05$. Post hoc tests (estimated marginal means) performed on gender confirmed females reported statistically significantly lower Coping motives when assessed at the 95% level. However, despite their univariate significance, Expansion Motives were not statistically significantly different when assessed at the 95% level. Post hoc (Tukey's b) analyses carried out for age on the Social and Enhancement Motives suggested that the younger age group reported means that were statistically significantly lower than either of the two older groups, whose means were not statistically significantly different from each other. Similar analyses carried out on the Coping Motive revealed that the older group mean was statistically significantly lower than the younger two groups, whose means were not statistically significantly different from each other. Post hoc (Tukey's b) analyses carried out for age on Conformity Motives revealed that the mean for the <13 age group was statistically significantly lower than that for the 14-15 age group, which was statistically significantly lower than the 16+ age category. Post hoc (Tukey's b) analyses carried out for age on the Total Motives suggested the older age group returned a mean that was statistically different from the middle age group, however neither of these were statistically significantly different from the mean for the youngest age group.

Table 17. Numbers, means, standard deviations and ranges of responses to the six questions related to Motives for Marijuana Use: Social, Coping, Enhancement, Conformity, Expansion and Total Motives for the whole sample.

| | Male | | | Female | | |
|----------------------------|----------------|-------------------|--------------|----------------|-------------------|--------------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Social Motives | | | | | | |
| N | 155 | 179 | 129 | 205 | 239 | 152 |
| Mean | 13.69 | 15.31 | 14.68 | 13.61 | 14.59 | 14.34 |
| S.D. | 5.49 | 5.00 | 5.69 | 5.18 | 4.41 | 5.14 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Coping Motives | | | | | | |
| N | 155 | 179 | 129 | 205 | 239 | 152 |
| Mean | 14.50 | 14.576 | 13.14 | 15.30 | 15.43 | 14.26 |
| S.D. | 5.28 | 5.04 | 6.05 | 5.03 | 4.47 | 5.48 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Enhancement Motives | | | | | | |
| N | 155 | 179 | 129 | 205 | 239 | 152 |
| Mean | 15.32 | 18.10 | 18.40 | 15.60 | 17.29 | 17.17 |
| S.D. | 5.66 | 4.61 | 5.94 | 5.20 | 4.78 | 5.03 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Conformity Motives | | | | | | |
| N | 155 | 179 | 129 | 205 | 239 | 152 |
| Mean | 14.78 | 13.53 | 11.52 | 15.242 | 14.44 | 11.78 |
| S.D. | 5.68 | 5.52 | 6.01 | 5.73 | 5.28 | 5.49 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Expansion Motives | | | | | | |
| N | 155 | 179 | 129 | 205 | 239 | 152 |
| Mean | 10.50 | 10.69 | 11.25 | 10.19 | 10.12 | 10.34 |
| S.D. | 5.32 | 4.51 | 5.65 | 4.77 | 4.31 | 4.39 |
| Range | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 | 5-25 |
| Total Motives | | | | | | |
| N | 155 | 179 | 129 | 205 | 239 | 152 |
| Mean | 68.79 | 72.18 | 68.98 | 70.12 | 71.88 | 67.89 |
| S.D. | 23.06 | 18.70 | 23.02 | 19.71 | 16.74 | 19.43 |
| Range | 25-125 | 25-125 | 25-113 | 25-125 | 25-125 | 25-125 |

Participants Reporting Marijuana Use: A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on six dependent variables related to Motives for Use of Marijuana: Social, Coping, Enhancement, Conformity, Expansion and Total Motives. Table 18 presents the numbers, means, standard deviations and ranges for responses on the six dependent variables for the portion of the sample reporting current (last month) marijuana use. No significant main effects were demonstrated at a multivariate level on either the age or gender factors, or for their interaction.

Table 18. Numbers, means, standard deviations and ranges of responses to the six questions related to Motives for Marijuana Use: Social, Coping, Enhancement, Conformity, Expansion and Total Motives for the portion of the sample reporting current (last month) use of marijuana.

| | Male | | | Female | | |
|-----------------------|----------------|-------------------|--------------|----------------|-------------------|--------------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Social Motives | | | | | | |
| N | 1 | 14 | 17 | 3 | 13 | 14 |
| Mean | 12.00 | 14.43 | 15.41 | 12.00 | 12.46 | 15.50 |
| S.D. | 0 | 3.30 | 5.79 | 5.57 | 4.91 | 5.23 |

| | | | | | | |
|----------------------------|-------|-------|--------|-------|-------|--------|
| Range | 0 | 8-18 | 5-25 | 6-17 | 5-22 | 7-25 |
| Coping Motives | | | | | | |
| N | 1 | 14 | 17 | 3 | 13 | 14 |
| Mean | 13.00 | 13.29 | 14.06 | 13.00 | 14.54 | 17.14 |
| S.D. | 0 | 3.47 | 6.02 | 2.65 | 4.16 | 6.13 |
| Range | 0 | 5-19 | 5-24 | 10-15 | 9-22 | 5-25 |
| Enhancement Motives | | | | | | |
| N | 1 | 14 | 17 | 3 | 13 | 14 |
| Mean | 15.00 | 17.14 | 17.88 | 14.33 | 17.00 | 18.14 |
| S.D. | 0 | 4.80 | 5.99 | 7.37 | 4.67 | 3.11 |
| Range | 0 | 10-25 | 6-25 | 6-20 | 10-25 | 11-25 |
| Conformity Motives | | | | | | |
| N | 1 | 14 | 17 | 3 | 13 | 14 |
| Mean | 18.00 | 14.29 | 12.53 | 18.33 | 11.85 | 12.29 |
| S.D. | 0 | 4.18 | 6.30 | 1.53 | 3.89 | 6.12 |
| Range | 0 | 5-17 | 5-19 | 5-18 | 5-19 | 5-25 |
| Expansion Motives | | | | | | |
| N | 1 | 14 | 17 | 3 | 13 | 14 |
| Mean | 5.00 | 11.50 | 11.47 | 9.67 | 8.62 | 10.57 |
| S.D. | 0 | 3.32 | 5.44 | 7.23 | 4.21 | 5.84 |
| Range | 0 | 5-17 | 5-19 | 5-18 | 5-19 | 5-25 |
| Total Motives | | | | | | |
| N | 1 | 14 | 17 | 3 | 13 | 14 |
| Mean | 63.00 | 70.64 | 71.35 | 67.33 | 64.46 | 73.64 |
| S.D. | 0 | 13.76 | 22.99 | 22.55 | 12.95 | 23.56 |
| Range | 0 | 41-91 | 27-113 | 44-89 | 43-84 | 39-125 |

Emotion Regulation

A 3 (Age) x 2 (gender) multivariate analyses of variance was performed on four dependent variables related to emotion regulation: Equanimity, Regulation, Appropriate Affect and Emotional Regulation Total Score. Table 19 presents the numbers, means, standard deviations and ranges for responses on the four dependent variables. Significant main effects were evident for both gender, $F(4, 1064)=17.31, p<0.001$, and age, $F(8, 2128)=3.08, p<0.01$. However the age by gender interaction was not significant. Univariate analyses revealed a significant main effect for gender on each of the dependent variables: Equanimity $F(1, 1067)=46.39, p<0.001$, Regulation $F(1, 1067)=30.89, p<0.001$, Appropriate Affect $F(1, 1067)=4.79, p<0.05$, and Emotional Regulation Total Score $F(1, 1067)=38.09, p<0.001$. Univariate analyses also revealed significant main effects for age on Equanimity $F(2, 1067)=9.24, p<0.001$, and Emotional Regulation Total Score $F(2, 1067)=5.49, p<0.001$. Post hoc tests (estimated marginal means) performed on gender confirmed males reported statistically significantly higher Equanimity, Regulation, and Total Emotion Regulation scores than woman, when assessed at the 95% level. However, despite their univariate significance, no significant difference was apparent between males and females on Appropriate Affect when assessed at the 95% level.

Post hoc (Tukey's b) tests carried out for age on the Equanimity subscale and the Emotional Regulation Total Score suggest that scores for the 13 and younger age group were statistically significantly lower than those for both the 14-15 age group and the 16+ age groups, neither of which were statistically significantly different from each other.

Table 19. Numbers, means, standard deviations, and ranges of responses to the three Emotional Regulation subscales: Equanimity, Regulation, and Appropriate Affect and the Emotional Regulation Total Score.

| | Male | | | Female | | |
|---|-------------|----------------|-----------|-------------|----------------|-----------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Equanimity | | | | | | |
| N | 169 | 189 | 136 | 191 | 235 | 153 |
| Mean | 11.18 | 10.895 | 10.52 | 10.27 | 8.77 | 7.89 |
| S.D. | 4.23 | 4.29 | 4.60 | 4.32 | 4.89 | 4.69 |
| Range | 0-22 | 0-23 | 1-23 | 0-21 | 0-24 | 0-20 |
| Regulation | | | | | | |
| N | 169 | 189 | 136 | 191 | 235 | 153 |
| Mean | 14.70 | 14.47 | 14.768 | 13.71 | 12.69 | 13.18 |
| S.D. | 3.99 | 4.04 | 3.98 | 3.99 | 3.90 | 3.79 |
| Range | 4-23 | 3-24 | 4-24 | 3-23 | 1-21 | 5-23 |
| Appropriate Affect | | | | | | |
| N | 169 | 189 | 136 | 191 | 235 | 153 |
| Mean | 14.80 | 14.78 | 15.09 | 14.95 | 14.27 | 13.84 |
| S.D. | 3.58 | 3.94 | 3.78 | 3.66 | 3.91 | 4.31 |
| Range | 1-24 | 4-24 | 6-24 | 5-23 | 4-24 | 2-24 |
| Emotional Regulation Total Score | | | | | | |
| N | 169 | 189 | 136 | 191 | 235 | 153 |
| Mean | 38.92 | 38.25 | 38.35 | 37.14 | 34.06 | 32.90 |
| S.D. | 9.28 | 9.69 | 9.51 | 9.53 | 10.54 | 10.93 |
| Range | 9-63 | 10-61 | 14-58 | 8-61 | 9-63 | 10-60 |

Social Skills

A 3 (Age) x 2 (gender) x 3 (Social Skills) multivariate analyses of variance was performed on three dependent variables, Assertion, Empathy and Total Social Skills Score. Table 20 presents the numbers means, standard deviations and ranges for responses on the three dependent variables. Multivariate tests revealed significant main effects for both gender, $F(3, 597)=55.17, p<0.001$, and age, $F(6, 1914)=6.87, p<0.001$. However the age by gender interaction was not significant. Univariate analyses revealed a significant main effect for gender on Empathy, $F(1, 959)=91.81, p<0.001$, and Total Social Skills Score, $F(1, 959)=4.88, p<0.05$. Univariate analyses also revealed an age effect on Empathy $F(2, 959)=3.09, p<0.05$. Post hoc tests (estimated marginal means) performed on gender confirmed males reported statistically significantly lower Empathy scores than females, when assessed at the 95% level. However, despite their univariate significance, males and females did not differ significantly on Total Social Skills scores when assessed at the 95% level.

In addition, Post hoc analyses (Tukey's b) performed on age revealed that the univariate difference demonstrated for Empathy was no longer statistically significant.

Table 20. Numbers, means, standard deviations, and ranges of responses to the three Social Skills dependent variables: Assertion, Empathy and Total Social Skills Score.

| | Male | | | Female | | |
|------------------|-------------|----------------|-----------|-------------|----------------|-----------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| Assertion | | | | | | |
| N | 142 | 179 | 125 | 168 | 219 | 132 |
| Mean | 11.97 | 12.262 | 12.62 | 11.90 | 11.69 | 12.29 |

| | | | | | | |
|----------------------------|--------|-------|--------|-------|-------|-------|
| S.D. | 3.26 | 3.30 | 3.08 | 3.09 | 3.27 | 3.07 |
| Range | 1-20 | 5-20 | 3-19 | 3-19 | 4-20 | 5-19 |
| Empathy | | | | | | |
| N | 142 | 179 | 125 | 168 | 219 | 132 |
| Mean | 14.221 | 14.80 | 14.928 | 16.24 | 16.58 | 16.51 |
| S.D. | 3.11 | 2.98 | 3.30 | 2.84 | 2.31 | 2.60 |
| Range | 4-20 | 3-20 | 8-20 | 8-20 | 10-20 | 8-20 |
| Total Social Skills | | | | | | |
| N | 142 | 179 | 125 | 168 | 219 | 132 |
| Mean | 50.38 | 50.37 | 50.54 | 50.42 | 50.80 | 51.77 |
| S.D. | 9.13 | 8.47 | 9.19 | 9.03 | 7.59 | 7.86 |
| Range | 21-78 | 30-78 | 30-72 | 33-74 | 26-71 | 27-69 |

Parent and Peer Attitudes Towards Substance Use.

A 3 (Age) x 2 (gender) analyses of variance was performed on the dependent variable Parent and Peer Attitudes, the parent and peer attitudes toward substance use measure. Table 21 presents the numbers means, standard deviations and ranges for responses on the Parent and Peer measure. Analysis revealed a significant main effect for age on the dependant variable $F(2, 1062)=229.72, p<0.001$. The effects for gender, and the age x gender interaction, were non-significant. Post hoc (Tukey's b) tests carried out on age confirmed that means for the <13 age group was statistically significantly lower than that of the 14-15 age group, who were statistically significantly lower than the mean for the 16+ age category.

Table 21. Numbers, means, standard deviations, and ranges of responses to the Parent and Peer attitudes Towards Substance Use measure.

| | Male | | | Female | | |
|----------------|----------------|-------------------|--------------|----------------|-------------------|--------------|
| | Young (<13) | Middle (14-15) | Old (16+) | Young (<13) | Middle (14-15) | Old (16+) |
| PAPATSU | | | | | | |
| N | 169 | 190 | 132 | 197 | 231 | 149 |
| Mean | 12.18 | 25.77 | 39.45 | 13.32 | 24.95 | 35.95 |
| S.D. | 9.84 | 16.58 | 16.67 | 12.88 | 16.20 | 15.64 |
| Range | 0-55 | 0-90 | 0-78 | 0-90 | 0-81 | 1-71 |

3.2.2 Internalising/Externalising Profile and Substance Use

The relationship between mental health and substance use can be tested in a number of ways. Firstly, correlations between the respective Youth Self Report dimensional profiles and Substance Use variables could be calculated for age and gender. The advantages of this method are that variables are treated as continuous and thus all variance is included in the analyses. The potential also exists for partial correlations to be calculated (e.g., Externalising profile controlling for Internalising variance and vice versa) so that unique relationships between Externalising, Internalising and SU can be examined. However, correlations assume that the data they sample from are normally distributed. This assumption may not be characteristic of mental health variables generated from normative samples, and would rarely be characteristic of data sampled from normative populations from which patterns of substance use are described. In those instances where the data sampled are not normally distributed, correlations are at risk of producing skewed results.

A second possibility exists, that is for such variables to be recoded into categorical variables and then subjected to analysis by means of ANOVA. ANOVA can be used to examine the relationship of the category (e.g., high, medium, low) to the dependent variable.

While recoding of a continuous variable into a categorical variable reduces the available variance, it largely overcomes the problems associated with highly skewed data. One limitation of analysis of variance however, is that it does not support the examination of unique relationships between variables that share variance. For instance, an independent categorical variable coded from Youth Self Report Internalising scores may not be incorporated within ANCOVA as a covariate on the basis that it shares variance with the dependant measure, the Youth Self Report Externalising variable (Tabachnick and Fidell, 1996; Hair, Anderson, Tatham and Black, 1995).

Both correlational and categorical ANOVA methods have advantages but potential drawbacks. Given the constraints of the present data set the solution chosen was to employ both correlational and categorical ANOVA methods and only interpret findings that held consistent across the analyses.

Correlational analyses are presented first. Bi-variate and partial correlational analyses were initially run between Internalising and Externalising scores, and each measure of drug use with the data set split by age and gender. Next, Internalising and Externalising scores were recoded into Internalising and Externalising categorical variables for each participant, each of which contained three levels: 1=low (0 -33.3%), 2=medium (33.3% - 66.6%) and 3=high (66.6% - 100%). While these demarcations differ from those utilised in the YSR (the clinical cut-off of which is the 95th percentile), they are justifiable in the present context on the basis that normative sample distributions differ markedly from those found in clinical populations, and in the interests of maintaining appropriate within cell sizes and satisfying statistical relevant assumptions (Tabachnick & Fidell, 1996).

Youth Self Report and Age of First Use

Correlational analyses of association between Youth Self Report dimensions and Age of First Use were undertaken both in bivariate and partial form. Age of participants was not used as an independent variable in this analysis because it is confounded by the dependant variable, Age of First Use. The correlations are presented in Table 22, and revealed a significant negative association between male's Externalising scores and First Use of Alcohol, and First Use of Cigarettes. A significant bivariate association was also evident between male's First Use of Cigarettes and Internalising scores. In addition, the correlations revealed significant negative bivariate associations between female Internalising scores and First Use of Cigarettes, and between female Externalising scores and First Use of Cigarettes. No partial correlations were statistically significant.

Table 22. Bivariate and partial correlations between Internalising and Externalising scores and Age of First Use split by gender.

| | | Internalising | Externalising |
|--------------------|-----------|----------------------|----------------------|
| All Males | | | |
| Alcohol | Bivariate | r= -.10 | r= -.22** |
| | Partial | r= .14 | r= -.25 |
| Marijuana | Bivariate | r= -.11 | r= -.10 |
| | Partial | r= -.09 | r= -.04 |
| Cigarettes | Bivariate | r= -.19* | r= -.25** |
| | Partial | r= -.11 | r= -.04 |
| All Females | | | |
| Alcohol | Bivariate | r= -.05 | r= -.08 |
| | Partial | r= .05 | r= -.16 |
| Marijuana | Bivariate | r= -.03 | r= -.03 |
| | Partial | r= -.05 | r= .01 |

| | | | |
|------------|-----------|-----------|-----------|
| Cigarettes | Bivariate | r= -.26** | r= -.23** |
| | Partial | r= -.22 | r= -.15 |

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.

Mental Health and Substance Use – Correlational Analyses.

The strength of association between Internalising and Externalising scores and Overall Alcohol Use was assessed with both bivariate and partial correlations. Whole sample bivariate correlations are presented in Table 23 and suggested a significant positive association between Overall Alcohol Use and both Internalising and Externalising scores. While the Externalising partial correlations remained positive and significant, the partial correlation between Overall Alcohol Use and whole sample Internalising scores became negative and non-significant. When split by gender, a similar pattern of results was evident for females. For both males and females, both bivariate and partial correlations between externalising scores and Overall Alcohol Use were significant and positive. For Internalising scores, the female bivariate was significant and positive, and the male partial was significant and negative. In very general terms, when split by age and gender, bivariate and partial correlations between Externalising scores and Overall Alcohol Use were predominantly positive and significant, while correlations between Internalising scores and Overall Alcohol Use were predominantly negative and non-significant. This pattern was most pronounced for Male Internalising and Female Externalising scores, and least pronounced for Female Internalising and Male Externalising scores.

Table 23. Bivariate and partial correlations between Internalising and Externalising scores and Overall Alcohol Use for the whole sample, the sample split by gender, and the sample split by gender and age.

| | Internalising | | Externalising | |
|---------------------|---------------|-----------|---------------|--|
| Whole Sample | Bivariate | r= .08** | r= .21** | |
| | Partial | r= -.05 | r= .19** | |
| All Males | Bivariate | r= -.03 | r= .14** | |
| | Partial | r= -.13** | r= .19** | |
| Males <13 | Bivariate | r= .09 | r= .17* | |
| | Partial | r= -.01 | r= .15 | |
| Males 14-15 | Bivariate | r= .04 | r= .19** | |
| | Partial | r= -.09 | r= .20** | |
| Males 16+ | Bivariate | r= -.10 | r= .08 | |
| | Partial | r= -.18* | r= .16 | |
| All Females | Bivariate | r= .20** | r= .27** | |
| | Partial | r= .05 | r= .19** | |
| Females <13 | Bivariate | r= .19* | r= .29** | |
| | Partial | r= -.01 | r= .23** | |
| Females 14-15 | Bivariate | r= .24** | r= .28** | |
| | Partial | r= .10 | r= .18** | |
| Females 16+ | Bivariate | r= .16 | r= .39** | |
| | Partial | r= -.04 | r= .31** | |

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.

The strength of association between Internalising and Externalising scores and Current Cigarette Use was assessed with both bivariate and partial correlations. The correlations are presented in Table 24. When collapsed over the whole sample, significant and positive bivariate and partial correlations were revealed between Current Cigarette Use and Externalising scores. While the whole sample partial correlation between Current Cigarette

Use and Internalising Scores was non-significant, the bivariate association between these two variables was positive and significant. When the data set was split by gender, both bivariate and partial correlations between Externalising Scores and Current Cigarette Use were positive and significant. However, only the bivariate correlation between Internalising Scores and Current Cigarette Use was significant and also positive. When split by age and gender, males in the 14-15 age category and males in the 16+ age category demonstrated significant positive bivariate associations between Internalising scores and Current Cigarette Use. Males in the 14-15 age category also demonstrated a significant positive partial association between Externalising scores and Current Cigarette Use. When split by age and gender, females in the <13 demonstrated significant positive bivariate association between both Internalising and Externalising scores and Current Cigarette Use. Significant positive associations were also evident between Externalising scores generated by the 14-15 female group and Current Cigarette Use, both in bivariate and partial terms.

Table 24. Bivariate and partial correlations between Internalising and Externalising scores and number of Cigarettes Currently Smoked for the whole sample, the sample split by gender, and the sample split by gender and age.

| | | Internalising | Externalising |
|---------------------|-----------|---------------|---------------|
| Whole Sample | Bivariate | r= .10** | r= .16** |
| | Partial | r= .01 | r= .57** |
| All Males | Bivariate | r= .15** | r= .18** |
| | Partial | r= .05 | r= .14** |
| Males <13 | Bivariate | r= -.07 | r= -.07 |
| | Partial | r= -.04 | r= -.03 |
| Males 14-15 | Bivariate | r= .16* | r= .25** |
| | Partial | r= .03 | r= .21** |
| Males 16+ | Bivariate | r= .19* | r= .16 |
| | Partial | r= .11 | r= .11 |
| All Females | Bivariate | r= .07 | r= .14** |
| | Partial | r= -.02 | r= .13** |
| Females <13 | Bivariate | r= .22** | r= .23** |
| | Partial | r= .09 | r= .12 |
| Females 14-15 | Bivariate | r= .03 | r= .19** |
| | Partial | r= -.11 | r= .22** |
| Females 16+ | Bivariate | r= .06 | r= .16 |
| | Partial | r= -.01 | r= .12 |

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.

The strength of association between Internalising and Externalising scores and Overall Marijuana Use was assessed with both bivariate and partial correlations. The correlations are presented in Table 25. When collapsed over the whole sample, significant and positive bivariate and partial correlations were evident between Overall Marijuana Use and Externalising scores. When collapsed over the whole sample, while the bivariate association between Internalising Scores and Overall Marijuana Use was non-significant, the partial correlation between these two variables was negative and significant. When the data set was split by gender, both the bivariate and partial correlations between Internalising scores and Overall Marijuana Use for both males and females failed to reach significance. However, both bivariate and partial correlations between Externalising scores and Overall Marijuana Use for both males and females were positive and significant. When split by age and gender, males in

the 14-15 age category demonstrated a significant positive association between Externalising scores and Overall Marijuana Use, both in bivariate and partial terms. A similar pattern of association, but of less magnitude, emerged for males in the 16+ age category. When split by age and gender, the only correlations for significance for females were in the <13 age group. Significant positive bivariate associations between Overall Marijuana Use and Internalising scores, and Overall Marijuana Use and Externalising scores were evident.

Table 25 Bivariate and partial correlations between Internalising and Externalising scores and Overall Marijuana Use for the whole sample, the sample split by gender, and the sample split by gender and age.

| | | Internalising | Externalising |
|---------------------|-----------|---------------|---------------|
| Whole Sample | Bivariate | r= .01 | r= .14** |
| | Partial | r= -.08** | r= .16** |
| All Males | Bivariate | r= .03 | r= .18** |
| | Partial | r= -.08 | r= .19** |
| Males <13 | Bivariate | r= .11 | r= .02 |
| | Partial | r= .13 | r= -.06 |
| Males 14-15 | Bivariate | r= .12 | r= .24** |
| | Partial | r= -.01 | r= .21** |
| Males 16+ | Bivariate | r= -.02 | r= .18* |
| | Partial | r= -.14 | r= .26* |
| All Females | Bivariate | r= -.01 | r= .10* |
| | Partial | r= -.08 | r= .12** |
| Females <13 | Bivariate | r= .19** | r= .19** |
| | Partial | r= .09 | r= .08 |
| Females 14-15 | Bivariate | r= -.06 | r= .10 |
| | Partial | r= -.12 | r= .13 |
| Females 16+ | Bivariate | r= .01 | r= .14 |
| | Partial | r= -.09 | r= .16 |

*Correlation is significant at the 0.05 level. **Correlation is significant at the 0.01 level.

3.2.3 Analyses of Variance of the Relation between Mental Health and Substance Use

Alcohol Use and YSR Profile: A 3x2x3 between subjects analysis of variance was performed on Overall Alcohol Use. Independent variables were Internalising category, Gender and Age respectively and results are presented in Table 26. A significant main effect was evident for Age. Post hoc (Tukey's b) tests revealed that the mean scores for the <13 age category were significantly less than those of the 14-15 age category, which were significantly less than those of the 16+ age category. A 3x2x3 between subjects analysis of variance was performed on Overall Alcohol Use. Independent variables were Externalising category, gender and age respectively. Significant main effects were evident for Age, and Externalising category. Post hoc (Tukey's b) tests revealed that the mean Overall Alcohol Use score of the <13 age category were significantly less than those of the 14-15 age category, which was, in turn, significantly less than the mean score of the 16+ age category. In addition, (Tukey's b) tests revealed that while there was no significant difference between the Overall Alcohol Use means gained by the low Externalising and medium Externalising categories, the mean scores of the high Internalising category were significantly higher than both low and medium categories.

Cigarette Use and YSR Profile: A 3x2x3 between subjects analysis of variance was performed on Current Cigarette Use. Independent variables were Internalising category, gender and age respectively and results are presented in Table 26. Significant main effects were evident for Age, and for Internalising category. The Gender x Internalising category interaction was also significant. Post hoc (Tukey's b) tests revealed that the mean Current Cigarette Use score of the <13 age category was not significantly different from that of the 14-15 age category, however both were significantly less than the mean Current Cigarette Use score of the 16+ age category. In addition, Post hoc (Tukey's b) tests revealed that the low Internalising category returned a mean that was significantly lower than that of the high Internalising category. However, the mean score of the middle Internalising category was significantly different from neither. A 3x2x3 between subjects analysis of variance was performed on Current Cigarette Use. Independent variables were Externalising category, gender and age respectively. Significant main effects were evident for Age, and for Externalising category. Neither the gender x Externalising category, gender x age, age category x Externalising category, nor the gender x age category x Externalising category interactions were significant. Post hoc (Tukey's b) tests revealed that the mean Overall Cigarette Use score of the <13 Age category was not significantly different from that of the 14-15 Age category, however both were significantly less than the mean Overall Cigarette Use score of the 16+ Age category. In addition, Post hoc (Tukey's b) tests revealed that the mean Overall Cigarette Use score gained on the low Externalising category was not significantly different from that of the medium Externalising category, however both were significantly less than the mean Overall Cigarette Use score of the high Externalising category.

Marijuana Use and YSR Profile: A 3x2x3 between subjects analysis of variance was performed on Overall Alcohol Use. Independent variables were Internalising category, gender and age respectively and results are presented in Table 26. A significant main effect was evident for Age. However, no main effect was demonstrated for Internalising category, and no significant interactions were evident. Post hoc (Tukey's b) tests revealed that the mean Overall Marijuana Use scores of the <13 age category were significantly less than those of the 16+ age category. However, those of the 14-15 age category were significantly different from neither. A 3x2x3 between subjects analysis of variance was performed on Overall Marijuana Use. Independent variables were Externalising category, gender and age respectively. Significant main effects were evident for Age, and Externalising category. Post hoc (Tukey's b) tests revealed that the mean Overall Marijuana Use scores of the <13 age category were significantly less than those of the 14-15 age category and the 16+ age category, However, the 14-15 age category and the 16+ age category were not significantly different from each other. In addition, (Tukey's b) tests revealed that while there was no significant difference between the Overall Marijuana Use means of the low Externalising category and the medium Externalising category, the mean scores of the high Externalising category were significantly higher than both the low and medium categories.

Table 26. Numbers, means, standard deviations, and ranges of responses to the Overall Alcohol Use question by low, medium and high Internalising participants split by age category and gender.

| Age Category | Male | | | Female | | |
|--|------|-------|-------|--------|-------|------|
| | <13 | 14-15 | 16+ | <13 | 14-15 | 16+ |
| Alcohol Use and Internalising Profile | | | | | | |
| YSR Low Internalising | | | | | | |
| N | 78 | 63 | 63 | 66 | 56 | 35 |
| Mean | 0.22 | 2.50 | 13.65 | 0.28 | 0.81 | 8.00 |
| S.D. | 0.64 | 5.33 | 18.67 | 1.02 | 2.25 | 8.75 |
| Range | 0-3 | 0-28 | 0-105 | 0-6 | 0-15 | 0-28 |
| YSR Medium Internalising | | | | | | |

| | | | | | | |
|-------------------------------|------|--------|-------|------|-------|-------|
| N | 57 | 57 | 35 | 63 | 78 | 51 |
| Mean | 0.43 | 3.46 | 9.48 | 0.75 | 2.48 | 5.20 |
| S.D. | 2.05 | 12.482 | 2.72 | 3.80 | 7.52 | 9.35 |
| Range | 0-15 | 0-88 | 0-107 | 0-30 | 0-48 | 0-50 |
| YSR High Internalising | | | | | | |
| N | 33 | 57 | 35 | 62 | 98 | 64 |
| Mean | 0.70 | 4.60 | 8.74 | 1.86 | 5.37 | 9.52 |
| S.D. | 2.35 | 16.03 | 13.64 | 5.82 | 15.07 | 16.02 |
| Range | 0-13 | 0-91 | 0-57 | 0-34 | 0-106 | 0-76 |

Alcohol Use and Externalising Profile

YSR Low Externalising

| | | | | | | |
|-------|-------|--------|-------|-------|--------|--------|
| N | 58 | 58 | 44 | 75 | 65 | 44 |
| Mean | 0.08 | 1.46 | 9.36 | 0.31 | 0.55 | 3.44 |
| S.D. | 0.37 | 3.22 | 18.67 | 1.04 | 1.98 | 5.56 |
| Range | 0-2.5 | 0-17.5 | 0-105 | 0-6.5 | 0-15.7 | 0-35.5 |

YSR Medium Externalising

| | | | | | | |
|-------|------|------|-------|------|------|------|
| N | 73 | 64 | 43 | 67 | 78 | 64 |
| Mean | 0.40 | 1.37 | 7.97 | 0.51 | 1.60 | 6.11 |
| S.D. | 1.60 | 4.04 | 12.67 | 2.95 | 4.86 | 8.99 |
| Range | 0-13 | 0-28 | 0-48 | 0-24 | 0-48 | 0-36 |

YSR High Externalising

| | | | | | | |
|-------|------|-------|-------|--------|-------|-------|
| N | 47 | 67 | 52 | 54 | 95 | 50 |
| Mean | 0.66 | 7.56 | 9.36 | 2.26 | 7.67 | 13.94 |
| S.D. | 2.33 | 18.84 | 21.53 | 6.63 | 19.06 | 17.47 |
| Range | 0-15 | 0-91 | 0-107 | 0-34.5 | 0-106 | 0-108 |

Cigarette Use and Internalising Profile

YSR Low Internalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 78 | 63 | 63 | 66 | 56 | 35 |
| Mean | 0.03 | 0.06 | 0.27 | 0.00 | 0.09 | 0.03 |
| S.D. | 0.16 | 0.30 | 1.59 | 0 | 0.35 | 0.17 |
| Range | 0-1 | 0-2 | 0-12 | 0 | 0-2 | 0-1 |

YSR Medium Internalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 57 | 57 | 35 | 63 | 78 | 51 |
| Mean | 0.00 | 0.23 | 0.31 | 0.02 | 0.21 | 0.71 |
| S.D. | 0 | 1.38 | 1.69 | 0.13 | 1.04 | 1.93 |
| Range | 0 | 0-10 | 0-10 | 0-1 | 0-8 | 0-9 |

YSR High Internalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 33 | 57 | 35 | 62 | 98 | 64 |
| Mean | 0.00 | 0.49 | 1.09 | 0.06 | 0.14 | 0.39 |
| S.D. | 0 | 2.18 | 2.78 | 0.31 | 0.63 | 1.43 |
| Range | 0 | 0-12 | 0-12 | 0-2 | 0-2 | 0-10 |

Cigarette Use and Externalising Profile

YSR Low Externalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 58 | 58 | 44 | 75 | 65 | 44 |
| Mean | 0.02 | 0.03 | 0.27 | 0.00 | 0.00 | 0.11 |
| S.D. | 0.13 | 0.18 | 1.81 | 0 | 0 | 0.49 |
| Range | 0-1 | 0-1 | 0-12 | 0 | 0 | 0-3 |

YSR Medium Externalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 73 | 64 | 43 | 67 | 78 | 64 |
| Mean | 0.01 | 0.03 | 0.53 | 0.02 | 0.04 | 0.41 |
| S.D. | 0.12 | 0.18 | 2.50 | 0.17 | 0.25 | 1.46 |
| Range | 0-1 | 0-1 | 0-15 | 0-1 | 0-2 | 0-10 |

YSR High Externalising

| | | | | | | |
|------|------|------|------|------|------|------|
| N | 47 | 67 | 52 | 54 | 95 | 50 |
| Mean | 0.00 | 0.64 | 0.88 | 0.06 | 0.34 | 0.60 |

| | | | | | | |
|-------|---|------|------|------|------|------|
| S.D. | 0 | 2.35 | 2.55 | 0.30 | 1.12 | 1.83 |
| Range | 0 | 0-12 | 0-12 | 0-2 | 0-8 | 0-9 |

Marijuana Use and Internalising Profile

YSR Low Internalising

| | | | | | | |
|-------|------|------|-------|------|------|------|
| N | 78 | 63 | 63 | 66 | 56 | 35 |
| Mean | 0.00 | 0.04 | 2.44 | 0.00 | 0.91 | 0.44 |
| S.D. | 0 | 0.26 | 9.11 | 0 | 4.98 | 2.06 |
| Range | 0 | 0-2 | 0-154 | 0 | 0-33 | 0-12 |

YSR Medium Internalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 57 | 57 | 35 | 63 | 78 | 51 |
| Mean | 0.00 | 0.72 | 1.26 | 0.00 | 1.18 | 0.62 |
| S.D. | 0 | 3.54 | 6.78 | 0 | 6.19 | 3.86 |
| Range | 0 | 0-24 | 0-44 | 0-0 | 0-45 | 0-27 |

YSR High Internalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 33 | 57 | 35 | 62 | 98 | 64 |
| Mean | 0.03 | 1.23 | 2.09 | 0.18 | 0.47 | 0.66 |
| S.D. | 0.17 | 7.58 | 9.45 | 1.33 | 3.01 | 2.15 |
| Range | 0-1 | 0-57 | 0-55 | 0-10 | 0-27 | 0-10 |

Marijuana Use and Externalising Profile

YSR Low Externalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 58 | 58 | 44 | 75 | 65 | 44 |
| Mean | 0.00 | 0.03 | 1.44 | 0.00 | 0.02 | 0.05 |
| S.D. | 0 | 0.21 | 8.19 | 0 | 0.12 | 0.24 |
| Range | 0 | 0-1 | 0-54 | 0 | 0-1 | 0-1 |

YSR Low Externalising

| | | | | | | |
|-------|------|------|------|------|------|------|
| N | 73 | 64 | 43 | 67 | 78 | 64 |
| Mean | 0.01 | 0.43 | 0.51 | 0.00 | 0.52 | 0.65 |
| S.D. | 0.12 | 3.02 | 2.19 | 0 | 3.82 | 3.61 |
| Range | 0-1 | 0-24 | 0-12 | 0 | 0-33 | 0-27 |

YSR Low Externalising

| | | | | | | |
|-------|------|------|-------|------|------|------|
| N | 47 | 67 | 52 | 54 | 95 | 50 |
| Mean | 0.00 | 1.50 | 3.80 | 0.20 | 2.15 | 0.99 |
| S.D. | 0 | 7.31 | 11.32 | 1.43 | 8.58 | 2.68 |
| Range | 0 | 0-57 | 0-55 | 0-10 | 0-56 | 0-12 |

3.2.4 Summary - Internalising/Externalising Profile and Substance Use

In sum, correlational analyses and ANOVA were used to assess the relation between Internalising/Externalising scores on the Youth Self Report measure and use of alcohol, marijuana, and cigarettes. The pattern of correlations performed on the whole sample suggested a statistically significant and positive association between Externalising scores and substance use. This association was evident for alcohol, cigarettes, and marijuana. It was also demonstrated regardless of whether bivariate correlations were performed between Externalising score and use of each substance, or whether partial correlations were employed and variance attributable to Internalising Score was partialled out of the correlation. Analyses of variance confirmed the significant and positive association between substance use and externalising score with main effects demonstrated for externalising score on each substance tested.

A somewhat different pattern of association was evident between Internalising score and substance use across the whole sample. Generally, while bivariate associations were evident between Internalising scores and substance use, once the variance attributable to Externalising score was removed from the equation, partial correlations between Internalising scores and substance use failed to reach significance. This pattern held for all but overall marijuana use

for which a significant but negative partial correlation was demonstrated between use and Internalising score.

When the sample was split by gender, a similar pattern of associations was evident. Both bivariate and partial correlations between Externalising scores and use of substance were positive and significant, regardless of whether they drew on male or female participants. Again, the picture for Internalising score and its association with substance use was somewhat less clear. Generally, once externalising variance was accounted for, partial correlations either failed to reach significance (female – alcohol, male – cigarettes, female – cigarettes, female - marijuana), or were significant but negative (male – alcohol, male – marijuana). No main effect was demonstrated for gender in any analysis of variance undertaken between substance use and internalising/externalising scores.

When the sample was split by age and gender, the pattern of results described above was, to a large extent, maintained. In general terms, both bivariate and partial correlations supported an association between Externalising score and use of each of the three substances. Similarly, when externalising variance was removed from significant bivariate correlations between Internalising score and substance use, the resulting partial correlations generally failed to reach significance. An age effect was also apparent. Significant associations between Externalising score and substance use were generally apparent for the 14-15 year old male participants, and for <13 and 14-15 year old female participants. This pattern was supported by a main effect for age in each analysis of variance undertaken between internalising/externalising scores and substance, regardless of the age/gender group analysed.

Thus, as expected, a significant and positive association between externalising scores and substance use was established. However, a markedly distinct pattern of association between internalising scores and substance use, characterised by a lack of robust relationship, was demonstrated.

3.3 THE ASSESSMENT OF POTENTIAL MEDIATORS

3.3.1 Mediating Influences in the Relation between Mental Health and Substance Use.

The patterns described above were characterised by statistically significant and positive associations between externalising score and substance use, but no significant pattern of association between internalising score and substance use.

The potential for mediating variables to account for the relation between mental health and substance use was assessed next. The mediation hypothesis suggests the dependant measure (DV) is not affected directly by an independent variable (IV). Rather, the effects of the IV on the DV are mediated by the function of an additional variable(s) that act as a generative influence on the DV (Baron and Kenny, 1986). As such, any relation initially demonstrated between the IV and the DV may be termed a direct effect, while the relation between the mediating variable and the IV and/or the DV, may be termed indirect effects (Sobel, 1990).

In order to demonstrate mediation, four requirements must be satisfied (Kenny, 2003; Hoyle and Kenny, 1990; Baron and Kenny, 1986). Initially, a statistically significant relation must be established between an IV and a DV. Secondly, the first of the indirect effects, a statistically significant relation between the IV and the proposed mediator, must be established. In this regression the proposed mediator is treated as a dependant variable. Thirdly, the second of the indirect effects, a statistically significant relation between the proposed mediator and the DV, must be established. In establishing this relation, the effects of the original IV must be controlled for. Fourthly, for complete mediation to hold, the IV must have zero relation to the DV when the influence of the proposed mediator is controlled for. If all four of the above steps are met, a completely mediated relationship is indicated. In the case where only the first three steps are met, a partially mediated relationship is indicated (Kenny, 2003).

These four steps were undertaken to assess the potential of four variables to mediate the relation between mental health and substance use. The four potential mediators were Motivation for Substance Use, Social Skills, Emotional Regulation, and Parent and Peer Attitudes Toward Substance Use. Regression analysis was employed in the first instance to assess the potential for these influences to act to mediate substance use. For each, the IV was regressed onto the potential mediator, then the potential mediator was regressed on to the DV. For the purposes of the present study, a statistically significant association was required between the IV and the proposed mediator, and between the DV and the proposed mediator, before we considered the possibility of a mediated relationship. As a statistically significant relation was not demonstrated between internalising scores and overall levels of substance use, internalising scores were dropped from the analysis.

In those instances where a statistically significant association was demonstrated between an IV and the proposed mediator, and between the proposed mediator and the DV, the IV, DV and those potential mediators were entered into a regression equation in blocks in order to assess the unique variance attributable to each. The first block consisted Internalising/Externalising scores. The second block included all the mediators that, in the first run of regressions, demonstrated a statistically significant relation between mental health and substance use. In each case, the dependant variable was level of use of each of the substances studied and the sample was split by gender for the purposes of these analyses. Table 27 shows beta weights and levels of statistical significance for regressions predicting Substance Use (Alcohol, Cigarette, Marijuana) from Externalising and Internalising Scores. This analysis repeats and confirms the previous section suggesting that only externalising scores were uniquely associated with substance use.

Table 27: Beta Weights for regressions predicting Substance Use (Alcohol, Cigarette, Marijuana) from Externalising and Internalising Scores with the sample split by gender.

| Internalising Scores | Overall Alcohol | Cigarettes Currently | Overall Marijuana |
|-----------------------------|---------------------|----------------------|--------------------|
| Male | $\beta = -.15^{**}$ | $\beta = .05$ | $\beta = -.09$ |
| Female | $\beta = .06$ | $\beta = -.03$ | $\beta = -.10$ |
| Externalising Scores | Overall Alcohol | Cigarettes Currently | Overall Marijuana |
| Male | $\beta = .23^{**}$ | $\beta = .17^{**}$ | $\beta = .23^{**}$ |
| Female | $\beta = .24^{**}$ | $\beta = .16^{**}$ | $\beta = .15^{**}$ |

* β significant at the 0.05 level. ** β significant at the 0.01 level.

Both the first and second indirect effects described in the mediational model above were assessed next. In the interests of parsimony, initial screening analyses were run on the whole sample. In these analyses Externalising scores were regressed on to each of the potential mediators, the five motives for use of each substance, total Social Skills score, total Emotion Regulation score, and Parent and Peer Attitudes score. Internalising scores were dropped from the analysis on the basis that they previously failed to demonstrate a significant relation with overall levels of substance use.

Table 28. Associations between externalising scores, potential mediators (Social Skills, Emotion Regulation and Parent and Peer Attitudes), and Substance Use.

| Externalising Score | First Indirect Effect | | Second Indirect Effect | |
|---------------------|-----------------------|----------|------------------------|-----------|
| | | Alcohol | Tobacco | Marijuana |
| Alcohol Motives | R=0.12** | R=0.15** | | |
| Tobacco Motives | R=0.06 | | R=0.10 | |
| Marijuana Motives | R=0.08 | | | R=0.07 |
| Social Skills | r=-.34** | r=-.03 | r=-.01 | r=-.03 |
| Emotion Regulation | r=-.35** | r=-.09** | r=-.09** | r=-.06 |
| PAPA-TSU | r=.37** | r=.42** | r=.28** | r=.21** |

*Correlation is significant at the 0.05 level. R=multiple R. r=bivariate correlation. **Correlation is significant at the 0.01 level.

The results of the initial screening analyses are presented in Table 28. Significant first and second indirect effects were demonstrated for Alcohol Motives, the Parent and Peer Attitudes, and for Emotion Regulation. For the latter, only two (alcohol and tobacco) of the second indirect effects were significant. On this basis a decision was taken to include Emotion Regulation as worthy of further analysis. Significant first and second indirect effects were not demonstrated for Cigarette or Marijuana Motives and on this basis were discarded from the analysis. Similarly, while a significant first indirect effect was demonstrated for Social Skills, the second indirect effect was not significant and Social Skills was discarded from the analysis.

3.3.2 Hierarchical Regression Analyses of the Mediating Influences in the Relation Between Mental Health and Substance Use

Hierarchical regression analyses were run in order to assess the unique contribution of the variables assessed in the initial screen as having potential to act to mediate the relation between externalising scores and substance use. Separate regressions were undertaken for each age category and gender. Externalising scores were entered as the first block in the regressions. The second block of variables consisted of Social, Coping, Enhancement, Conformity and Expansion Motives for each substance, and the total scores for the Emotion Regulation and Parent and Peer Attitudes measures.

Beta weights, R^2 , and change in R^2 for regressions predicting Alcohol, Cigarette and Marijuana Use from Externalising Scores, Alcohol Motives, Emotion Regulation, and Parent and Peer Attitudes scores for the <13 age category are presented in Table 29. For <13 year old males, block one predicted a significant portion of the variance associated with overall alcohol use, but not tobacco or marijuana use. With the addition of the second block, the proportion of explained variance increased for all three substances, however neither the additional variance explained nor the change in explained variance was significant. In the second block of variables, externalising scores remained a significant predictor of alcohol use, and equanimity appeared as a significant but negative predictor of marijuana use for this group.

Females in the <13 year old age category, block one predicted a significant portion of the variance associated with overall use of each substance, with highly significant beta weights and R^2 being returned for current cigarette use and overall marijuana use. The R^2 that resulted from the addition of the second block of variables was significant for all three substances, with a highly significant R^2 demonstrated for current cigarette use. None of the changes in R^2 associated with addition of the second block were significant. The increase in explained

variance associated with the second block for overall alcohol use was characterised by highly significant Parent and Peer Attitudes scores, Parent and Peer Attitudes also appeared as a significant predictor of overall marijuana use.

Table 29. Beta weights, R², and ΔR^2 for regressions predicting Alcohol, Cigarette and Marijuana Use from Externalising Scores (block 1) and Externalising Scores, Alcohol Motives, Emotion Regulation, and Parent and Peer Attitudes (block 2) for males and females aged 13<.

| | Alcohol Use | Cigarette Use | Marijuana Use |
|--------------------|--|-------------------------------------|--|
| Male | | | |
| Block 1: | | | |
| Externalising | $\beta = .23^{**}$ $R^2 = .05^{**}$ | $\beta = -.11$ $R^2 = .01$ | $\beta = .03$ $R^2 = .00$ |
| Block 2: | | | |
| Externalising | $\beta = .19^*$ | $\beta = -.08$ | $\beta = -.02$ |
| Motives | | | |
| Social | $\beta = -.05$ | $\beta = -.06$ | $\beta = -.10$ |
| Coping | $\beta = -.00$ | $\beta = -.28^*$ | $\beta = -.01$ |
| Enhancement | $\beta = -.14$ | $\beta = .27$ | $\beta = -.01$ |
| Conformity | $\beta = -.06$ | $\beta = .01$ | $\beta = .20$ |
| Expansion | $\beta = .09$ | $\beta = .17$ | $\beta = -.12$ |
| Emotion Regulation | $\beta = -.15$ | $\beta = .06$ | $\beta = -.25^{**}$ |
| PAPA-TSU | $\beta = .07$ | $\beta = -.00$ | $\beta = -.02$ |
| | $R^2 = .10$ $\Delta R^2 = .05$ | $R^2 = .08$ $\Delta R^2 = .07$ | $R^2 = .08$ $\Delta R^2 = .08$ |
| Female | | | |
| Block 1: | | | |
| Externalising | $\beta = .19^*$ $R^2 = .04^*$ | $\beta = .22^{**}$ $R^2 = .05^*$ | $\beta = .24^{**}$ $R^2 = .06^{**}$ |
| Block 2: | | | |
| Externalising | $\beta = .10$ | $\beta = .10$ | $\beta = .10$ |
| Motives | | | |
| Social | $\beta = -.09$ | $\beta = -.05$ | $\beta = -.11$ |
| Coping | $\beta = .07$ | $\beta = -.07$ | $\beta = -.18$ |
| Enhancement | $\beta = -.12$ | $\beta = .03$ | $\beta = .10$ |
| Conformity | $\beta = .12$ | $\beta = .04$ | $\beta = .07$ |
| Expansion | $\beta = -.11$ | $\beta = .17$ | $\beta = .21^*$ |
| Emotion Regulation | $\beta = .07$ | $\beta = -.09$ | $\beta = -.08$ |
| PAPA-TSU | $\beta = .24^*$ | $\beta = .13$ | $\beta = .21^*$ |
| | $R^2 = .12^*$ $\Delta R^2 = .08$ | $R^2 = .09$ $\Delta R^2 = .05$ | $R^2 = .13^{**}$ $\Delta R^2 = .08$ |

* β significant at the 0.05 level. ** β significant at the 0.01 level.

Beta weights, R², and change in R² for regressions predicting Alcohol, Cigarette and Marijuana Use from Externalising Scores, Alcohol Motives, Emotion Regulation, and Parent and Peer Attitudes scores for the 14-15 age category are presented in Table 30. For 14-15 year old males, block one predicted a significant portion of the variance associated with current tobacco use, but not overall alcohol or marijuana use. With the addition of the second block, the proportion of explained variance increased for all three dependent variables. Both the

explained variance associated with the second block, and the increase in explained variance as a result of the addition of the second block, were significant for each dependant variable. The increase in explained variance for each dependant variable is reflected in the highly significant beta weights associated with the Parent and Peer Attitudes for each substance. Both conformity and expansion motives were significant predictors of overall use of alcohol. No other variables entered in the second block returned significant beta weights.

For females in the 14-15 year old age category, block one predicted a significant portion of the variance associated with overall use of each substance. With the addition of the second block, the proportion of explained variance increased for all three dependent variables. Both the explained variance associated with the second block, and the increase in explained variance as a result of the addition of the second block, were significant for each dependant variable. The increase in explained variance for each dependant variable is reflected in the highly significant beta weights associated with the Parent and Peer Attitudes for each substance. In addition, the Appropriate Affect scores emerged as a significant predictor of female's current cigarette use, and equanimity emerged as a significant predictor of overall marijuana use. No other variables entered in the second block returned significant beta weights.

Table 30. Beta weights, R², and ΔR^2 for regressions predicting Alcohol, Cigarette and Marijuana Use from Externalising Scores (block 1) and Externalising Scores, Alcohol Motives, Emotion Regulation, and Parent and Peer Attitudes (block 2) for males and females aged 14-15.

| | Alcohol Use | Cigarette Use | Marijuana Use |
|--------------------|---|--|---|
| Male | | | |
| Block 1: | | | |
| Externalising | $\beta = .15$ $R^2 = .02$ | $\beta = .22^{**}$ $R^2 = .05^{**}$ | $\beta = .10$ $R^2 = .01$ |
| Block 2: | | | |
| Externalising | $\beta = .09$ | $\beta = .15$ | $\beta = -.04$ |
| Motives | | | |
| Social | $\beta = -.05$ | $\beta = .06$ | $\beta = -.05$ |
| Coping | $\beta = .02$ | $\beta = -.06$ | $\beta = -.00$ |
| Enhancement | $\beta = .09$ | $\beta = -.05$ | $\beta = .12$ |
| Conformity | $\beta = .20^*$ | $\beta = .17$ | $\beta = -.02$ |
| Expansion | $\beta = -.18$ | $\beta = -.03$ | $\beta = -.13$ |
| Emotion Regulation | $\beta = .06$ | $\beta = -.05$ | $\beta = -.15$ |
| PAPA-TSU | $\beta = .29^{**}$ $R^2 = .15^{**}$ $\Delta R^2 = .13^{**}$ | $\beta = .25^{**}$ $R^2 = .14^{**}$ $\Delta R^2 = .09^*$ | $\beta = .40^{**}$ $R^2 = .18^{**}$ $\Delta R^2 = .17^{**}$ |
| Female | | | |
| Block 1: | | | |
| Externalising | $\beta = .29^{**}$ $R^2 = .08^{**}$ | $\beta = .19^{**}$ $R^2 = .04^{**}$ | $\beta = .16^*$ $R^2 = .03^*$ |
| Block 2: | | | |
| Externalising | $\beta = .13$ | $\beta = .10$ | $\beta = .13$ |
| Motives | | | |
| Social | $\beta = .13$ | $\beta = .00$ | $\beta = -.14$ |
| Coping | $\beta = .08$ | $\beta = -.03$ | $\beta = -.01$ |
| Enhancement | $\beta = -.15$ | $\beta = -.03$ | $\beta = .13$ |
| Conformity | $\beta = -.08$ | $\beta = .01$ | $\beta = -.01$ |
| Expansion | $\beta = .09$ | $\beta = .02$ | $\beta = -.06$ |

| | | | |
|--------------------|----------------------|-------------------------|--------------------|
| Emotion Regulation | $\beta = -.01$ | $\beta = .16^*$ | $\beta = .15^*$ |
| PAPA-TSU | $\beta = .28^{**}$ | $\beta = .31^{**}$ | $\beta = .18^*$ |
| | $R^2 = .16^{**}$ | $R^2 = .13^{**}$ | $R^2 = .09^*$ |
| | $\Delta R^2 = .08^*$ | $\Delta R^2 = .09^{**}$ | $\Delta R^2 = .05$ |

* β significant at the 0.05 level. ** β significant at the 0.01 level.

Beta weights, R^2 , and change in R^2 for regressions predicting Alcohol, Cigarette and Marijuana Use from Externalising Scores, Alcohol Motives, Emotion Regulation, and Parent and Peer Attitudes scores for the 16+ age category are presented in Table 31. For 16+ year old males, block one predicted a significant portion of the variance associated with current tobacco use and current marijuana use, but not overall alcohol use. With the addition of the second block, the explained variance for all dependant variables increased with both the R^2 and the change in R^2 reaching significance for all three dependent variables. Parent and Peer Attitudes emerged as a significant predictor of overall alcohol use and overall marijuana use, but not current cigarette use. Equanimity emerged as a significant predictor of current cigarette use and overall marijuana use, but not overall alcohol use. No other variables entered in the second block returned significant beta weights.

For females in the 16+ age category, block one predicted a significant portion of the variance associated with overall use of alcohol, but not tobacco or marijuana. Once the second block was added, the proportion of explained variance increased for all three dependent variables. Both the explained variance associated with the second block, and the increase in explained variance as a result of the addition of the second block, were significant for overall alcohol use and current cigarette use. However, the increase in explained variance associated with overall marijuana use did not reach significance. Externalising scores remained a significant predictor on overall alcohol use in the second block, and scores on the Parent and Peer Attitudes emerged as a significant predictor of all three dependent variables.

Table 31. Beta weights, R^2 , and ΔR^2 for regressions predicting Alcohol, Cigarette and Marijuana Use from Externalising Scores (block 1) and Externalising Scores, Alcohol Motives, Emotion Regulation, and Parent and Peer Attitudes (block 2) for males and females aged 16+.

| | Alcohol Use | Cigarette Use | Marijuana Use |
|--------------------|--------------------|----------------------|----------------------|
| Male | | | |
| Block 1: | | | |
| Externalising | $\beta = .12^*$ | $\beta = .18$ | $\beta = .08$ |
| | $R^2 = .02$ | $R^2 = .03$ | $R^2 = .01$ |
| Block 2: | | | |
| Externalising | $\beta = -.02$ | $\beta = .05$ | $\beta = .01$ |
| Motives | | | |
| Social | $\beta = .19$ | $\beta = .16$ | $\beta = .20$ |
| Coping | $\beta = -.03$ | $\beta = -.15$ | $\beta = .33^*$ |
| Enhancement | $\beta = -.19$ | $\beta = .06$ | $\beta = .11$ |
| Conformity | $\beta = -.20$ | $\beta = -.10$ | $\beta = -.25$ |
| Expansion | $\beta = -.01$ | $\beta = -.03$ | $\beta = .04$ |
| Emotion Regulation | $\beta = -.01$ | $\beta = -.19$ | $\beta = -.16$ |
| PAPA-TSU | $\beta = .41^{**}$ | $\beta = .18$ | $\beta = .18$ |
| | $R^2 = .23^{**}$ | $R^2 = .13$ | $R^2 = .11$ |

| | $\Delta R^2 = .22^{**}$ | $\Delta R^2 = .10$ | $\Delta R^2 = .11$ |
|--------------------|---|--|--|
| Female | | | |
| Block 1: | | | |
| Externalising | $\beta = .38^{**}$ $R^2 = .15^{**}$ | $\beta = .08$ $R^2 = .01$ | $\beta = .11$ $R^2 = .01$ |
| Block 2: | | | |
| Externalising | $\beta = .25^{**}$ | $\beta = .03$ | $\beta = -.01$ |
| Motives | | | |
| Social | $\beta = .13$ | $\beta = .05$ | $\beta = .07$ |
| Coping | $\beta = -.14$ | $\beta = -.10$ | $\beta = .20$ |
| Enhancement | $\beta = -.01$ | $\beta = -.02$ | $\beta = -.01$ |
| Conformity | $\beta = .07$ | $\beta = .04$ | $\beta = -.02$ |
| Expansion | $\beta = .07$ | $\beta = -.04$ | $\beta = -.18$ |
| Emotion Regulation | $\beta = .04$ | $\beta = .05$ | $\beta = -.07$ |
| PAPA-TSU | $\beta = .35^{**}$ $R^2 = .28^{**}$ $\Delta R^2 = .14^{**}$ | $\beta = .25$ $R^2 = .08$ $\Delta R^2 = .07$ | $\beta = .19^*$ $R^2 = .07$ $\Delta R^2 = .06$ |

* β significant at the 0.05 level. ** β significant at the 0.01 level.

3.3.4 Summary of Hierarchical Regression

Hierarchical regression analyses extended the results covered in the analysis of First and Second Indirect Effects. For the <13 age category, block one significantly predicted the variance associated with alcohol use in males, and the use of all three substances in females. The change in R^2 resulting from the addition of the second block of variables was non-significant, regardless of gender or substance in this age group. However, the R^2 that resulted from the addition of the second block of variables for females in this age group was significant for alcohol and marijuana use. For the 14-15 age category, block one significantly predicted the variance associated with tobacco use in males, and significantly predicted the variance associated with the use of all three substances in females. Both the R^2 and the change in R^2 that resulted from the addition of the second block of variables were significant, regardless of gender of substance. For the 16+ age category, block one significantly predicted the variance associated with tobacco use and marijuana use in males, and significantly predicted the variance associated with alcohol use in females. For males, both the R^2 , and the change in R^2 that resulted from the addition of the second block of variables were significant for each substance. However, the R^2 , and the change in R^2 that resulted from the addition of the second block of variables was only significant for females for alcohol and tobacco, but not marijuana.

3.4 STRUCTURAL MODELLING – TIME ONE

3.4.1 The Development of Structural Models.

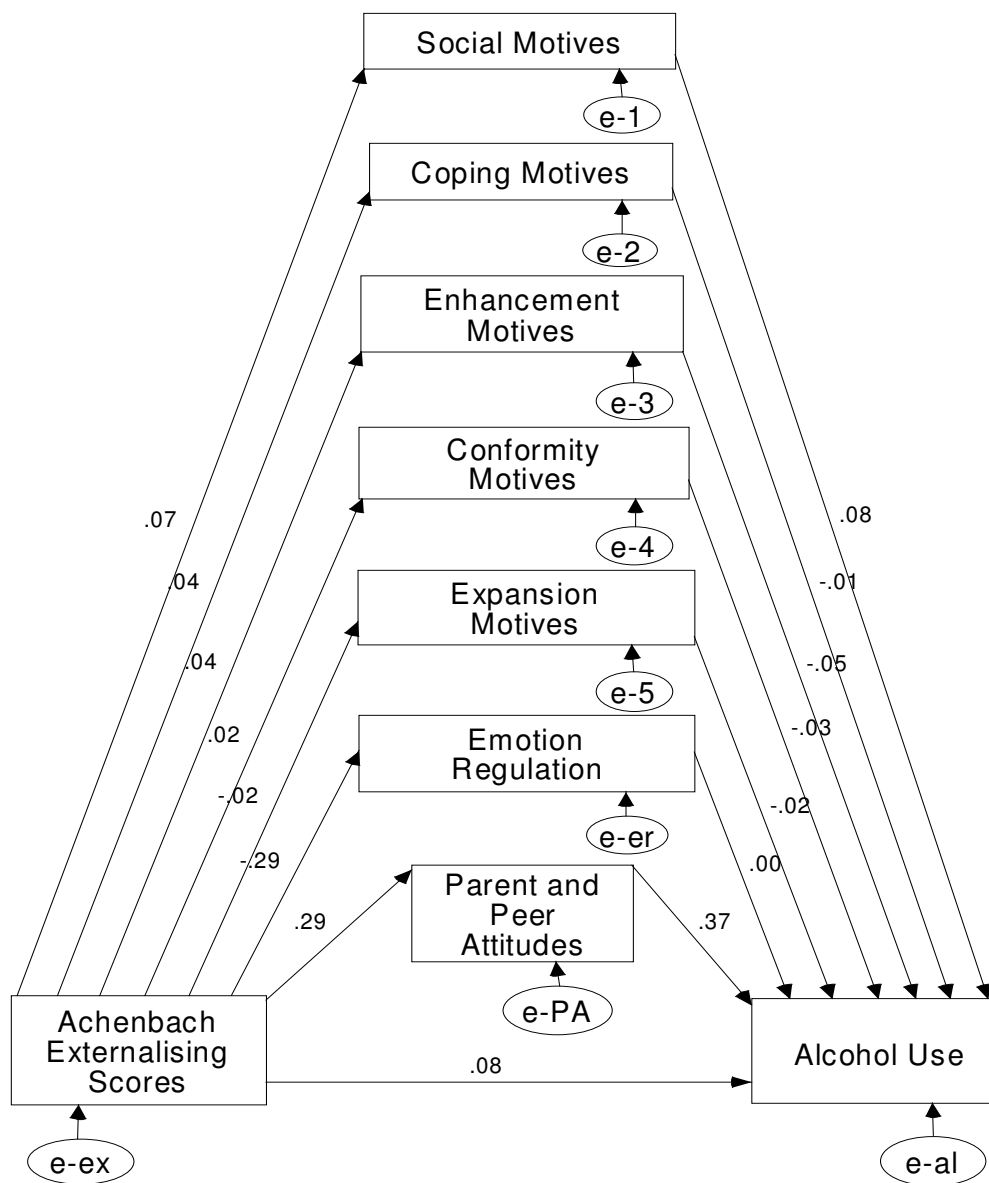
The results of the Hierarchical regression analyses, the assessment of mediational relations, and the results of screening analyses described above were used to develop structural models of substance use in adolescence. Correlational analyses suggested a statistically significant and positive association between Externalising scores and each of the three substances in question. Analyses of variance confirmed the significant and positive association between substance use and externalising scores, with main effects demonstrated for externalising score on each substance tested. Main effects were also demonstrated for age in analyses of variance undertaken between internalising/ externalising profile and substance, regardless of the age/gender group analysed. Internalising scores were dropped from the

analysis on the basis that they failed to demonstrate a significant relation with overall levels of substance use.

First and second indirect effects described in the mediational model were also assessed. In these analyses significant first and second indirect effects were demonstrated for Alcohol Motives, the Parent and Peer Attitudes, and for Emotion Regulation. For the latter, only two (alcohol and tobacco) of the second indirect effects were significant. On this basis a decision was taken to include Emotion Regulation as worthy of further analysis. Significant first and second indirect effects were not demonstrated for Cigarette or Marijuana Motives and on this basis were discarded from the analysis. Similarly, while a significant first indirect effect was demonstrated for Social Skills, the second indirect effect was not significant and Social Skills was discarded from the analysis.

On the basis of the results generated in the screening analyses described above, a hypothesised model of mediation was developed for each substance. Data relevant to each model were read into AMOS 5 (Arbuckle, 2003). The hypothesised models were initially tested across whole sample data, and in the first instance, where latent constructs existed (Overall Substance Use, Parent and Peer Attitudes) these were tested without their measured indicators. Any analyses and re-specification that was judged appropriate was undertaken next. Finally, the respecified models were tested for invariance across gender and age groups.

Hypothesised Alcohol Model – Goodness of Fit: Whole sample Goodness of Fit statistics for the hypothesised alcohol model indicated that the model did not fit the data well, $\chi^2=(21)$ 2361.08, CFI=0.155, RMSEA=0.307.



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Figure 6: Hypothesised model of the mediated relation between Externalising Scores and Overall Alcohol Use based on whole sample data, not including indicators to the latent variables, and including standardised weights.

The overall Chi-Square value suggested a lack of satisfactory fit of the model to the data. The CFI index indicated very poor co-variation between the null model and the data, a conclusion supported by the RMSEA value which was indicative of poor fit to the population and, given its expression per degree of freedom, an overall lack of parsimony. Standardised weights presented with the hypothesised alcohol model suggested that neither the Motives measures nor the Emotion Regulation measure were functioning to mediate the relation between Externalising Scores and Alcohol Use.

Hypothesised Alcohol Model - Model Misspecification: The Standardised Residual Covariation Matrix for the hypothesised alcohol model is presented in Table 32. This matrix assessed the discrepancy between the observed residual terms and the zero residuals that would appear if the model were a perfect fit to the data and, using a cut-off of 2.58 (Joreskog and Sorbom, 1988), thirteen of the observed residual covariances were considered excessive. Ten of the values represent covariances between residuals associated with Alcohol Motives measures and three represent covariances between Alcohol Motives measures and the Parent and Peer Attitudes. The extent to which deletion of the Motives measures from the model would result in a decrease in the misfit of the model can be gleaned from the Modification

Indexes and the associated Parameter Change statistics presented in Table 33. Four of these (all involving the residual term related to the Parent and Peer Attitudes measure) were relatively small and given the implications of respecification of the model without the inclusion of the motives measures, judged to be of minimal concern. The remaining ten (all related to residual terms of the five motives for use) were judged as excessive.

Table 32: Standardised Residual Covariance Matrix for the hypothesised mediational model of alcohol use based on whole sample data.

(Available from Authors)

Table 33: Modification Indexes and Parameter Change Statistics for the hypothesised structural mediational model of alcohol use.

| M.I. | | Par Change | | |
|------|---|------------|---------|---------|
| e1 | ↔ | e5 | 161.653 | 8.211 |
| e-PA | ↔ | e6 | 5.635 | -10.853 |
| e-PA | ↔ | e1 | 15.828 | 10.610 |
| e3 | ↔ | e5 | 276.304 | 10.214 |
| e3 | ↔ | e1 | 601.899 | 20.937 |
| e2 | ↔ | e5 | 253.816 | 9.889 |
| e2 | ↔ | e1 | 306.411 | 15.091 |
| e2 | ↔ | e-PA | 11.810 | -8.809 |
| e2 | ↔ | e3 | 350.301 | 15.352 |
| e4 | ↔ | e5 | 148.140 | 8.597 |
| e4 | ↔ | e1 | 208.647 | 14.169 |
| e4 | ↔ | e-PA | 25.278 | -14.664 |
| e4 | ↔ | e3 | 128.846 | 10.595 |
| e4 | ↔ | e2 | 395.876 | 18.760 |

On the basis of the results presented above, the hypothesised model of the mediated relation between externalising scores and overall alcohol use was rejected. Given the overall pattern of standardised weights, the poor goodness of fit statistics, the size and pattern of the discrepancy between the hypothesised covariances and those that would appear were the model a perfect fit to the data, and the extent to which discarding the parameters identified in the modification indexes would result in an overall improvement in model fit, a decision was taken to respecify the model. The nine highest covariances displayed in the modification indexes table (Table X) were assessed for the extent to which the overall Chi-Square value would decrease were they discarded from the model and parameter change statistics suggested that discarding them from the model would increase its substantive meaningfulness. In addition, given the lack of a second indirect effect demonstrated in the hypothesised model for the Emotion Regulation measure, a decision was also taken to discard this variable from the model on the basis that it was not acting to mediate the relation between externalising scores and alcohol use.

Re-specification of the Hypothesised Model of the Relation between Externalising Scores and Overall Alcohol Use.

Results indicate that a sample of 1182 was utilised in the model and that the minimum was achieved. The Goodness of Fit statistics ($\chi^2=(11) 57.7$, CFI= .986, RMSEA= .060) indicated that the respecified model fit the data well with CFI and RMSEA indices indicative of superior fit (Hu and Bentler, 1999) and a reasonable error of approximation in the population (Browne and Cudeck, 1993) respectively. Further re-estimation was therefore unjustified.

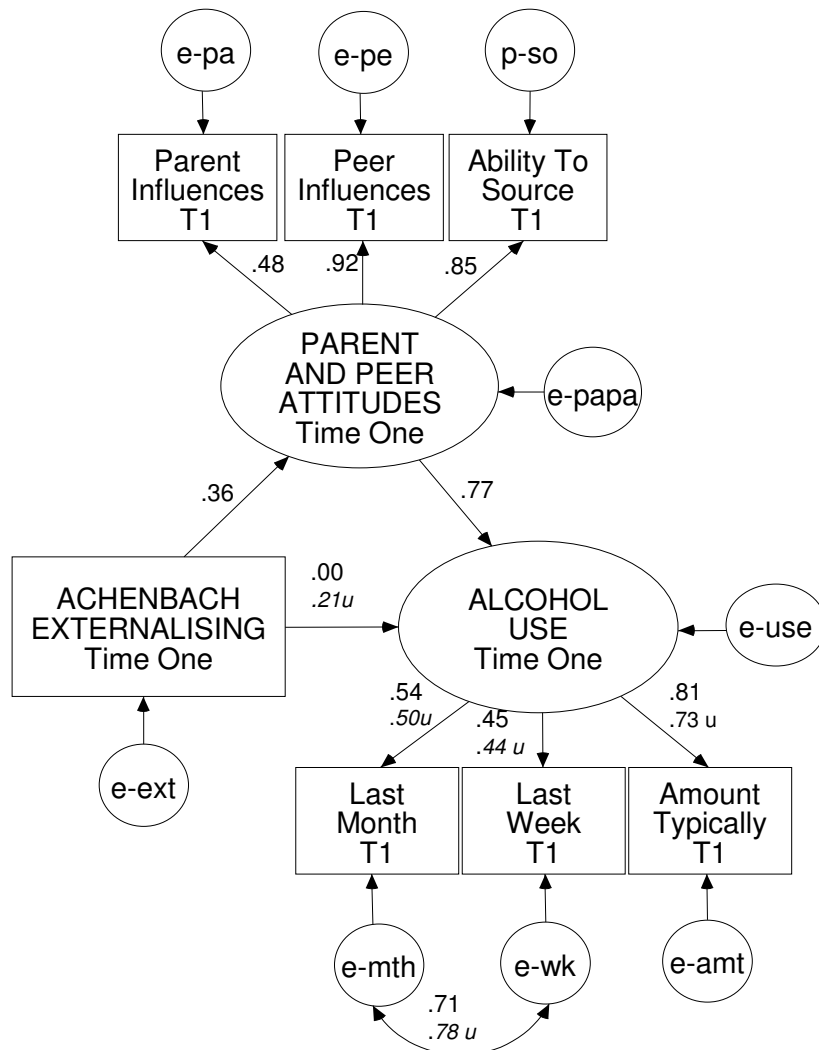


Figure 7: Respecified model of the mediated relation between Externalising Scores and Overall Alcohol Use including standardised weights and indicators to the latent variables Parent and Peer Attitudes and Alcohol Use. Standardised regression weights for the unmediated model are denoted by *italics u*.

Hypothesised Cigarette and Marijuana and Models – Goodness of Fit:

Whole sample Goodness of Fit statistics for the hypothesised cigarette model ($\chi^2=(1)5.6$, CFI= .985, RMSEA= .063) and the hypothesised marijuana model ($\chi^2=(1)5.6$, CFI= .982, RMSEA= .063) indicate that both models fit the data well. In both cases the CFI indices indicative of superior fit (Hu and Bentler, 1999), and the RMSEA values representative of

good fit of the models to the population (Browne and Cudeck, 1993). On this basis of these goodness of fit statistics both models were judged to fit the data well.

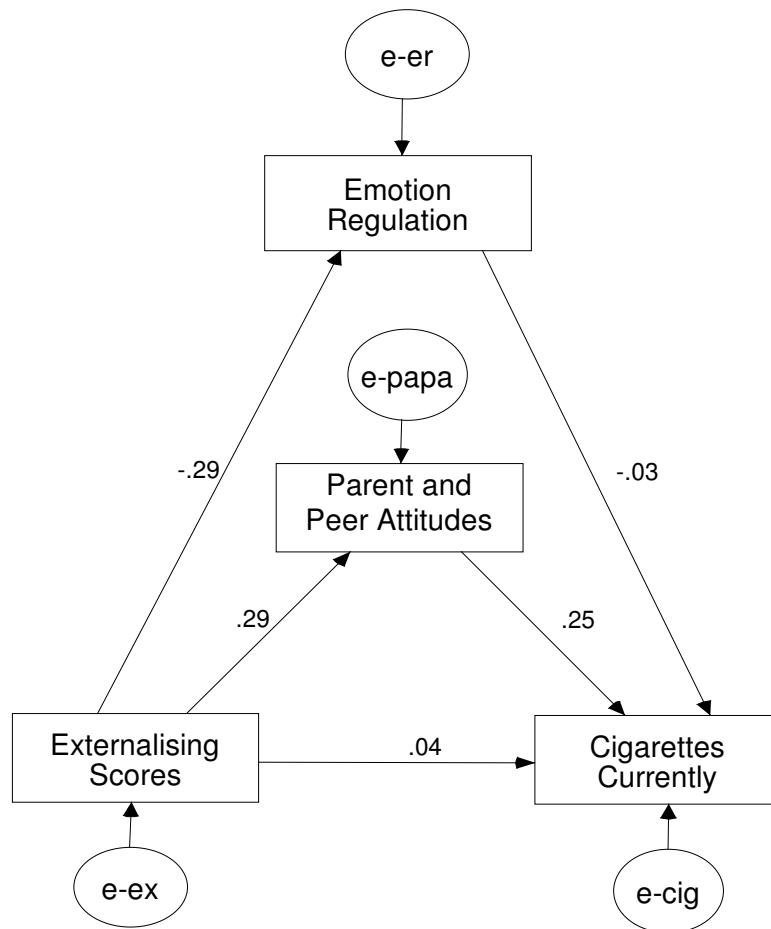


Figure 8: Hypothesised model of the mediated relation between Externalising Scores and current cigarette use based on whole sample data, not including indicators to the latent variables, and including standardised weights.

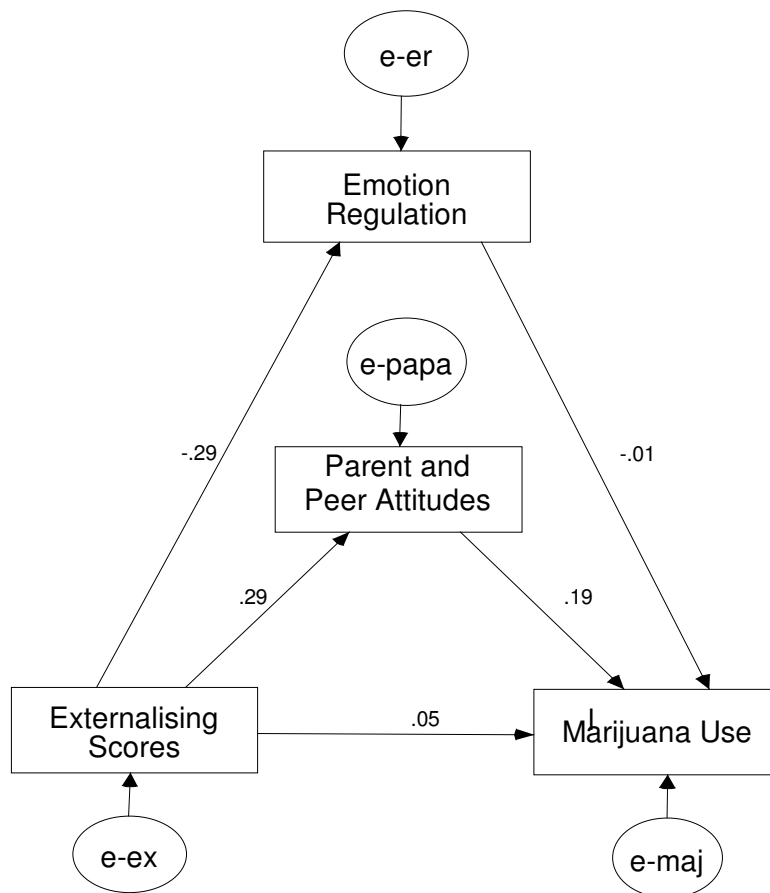


Figure 9: Hypothesised Model of the mediated relation between externalising scores and Overall Marijuana Use based on whole sample data, not including indicators to the latent variables, and including standardised weights.

Assessment of the hypothesised models of the mediated relation between externalising scores and cigarette and marijuana use indicated that no significant second indirect effect was evident in either model for the variable Emotion Regulation. A decision was therefore taken to discard this variable from both models on the basis that it was not acting to mediate the relation between externalising scores and use of the substance of interest in either. The re-estimated mediational model of cigarette use is presented in Figure X and the re-estimated mediational model of marijuana use is presented in Figure X together with their respective standardised weights. Whole sample Goodness of Fit statistics for the re-specified cigarette model ($\chi^2=(12)90.6$, CFI= .963, RMSEA= .074) and the hypothesised marijuana model ($\chi^2=(11)54.9$, CFI= .983, RMSEA= .058) indicate that both models fit the data well.

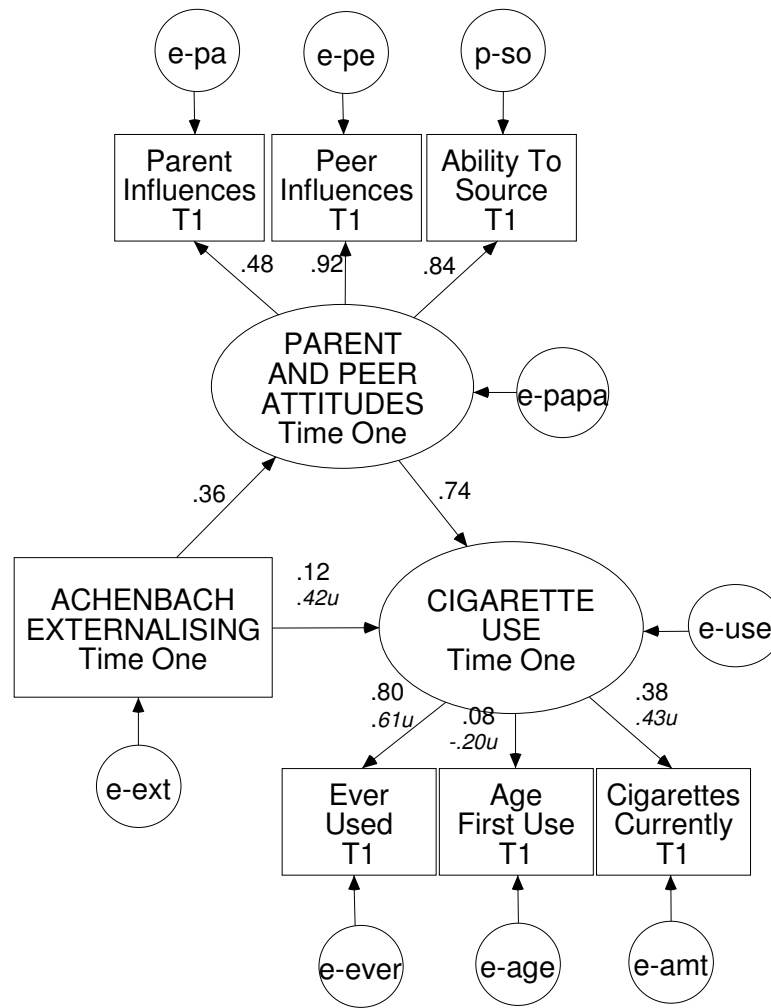


Figure 10: Figure X: Respecified model of the mediated relation between Externalising Scores and current cigarette use based on whole sample data and including standardised weights and indicators to the latent variable, Parent and Peer Attitudes. Standardised regression weights for the unmediated model are denoted by *italics u*.

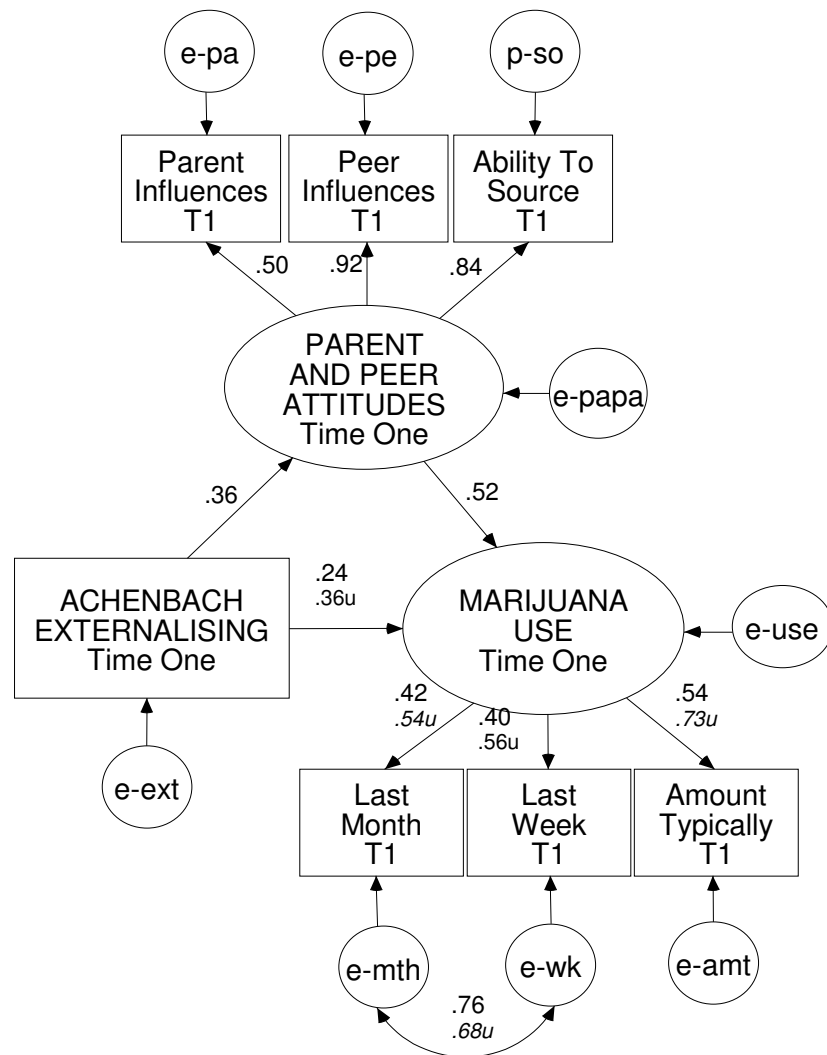


Figure 11: Respecified model of the mediated relation between Externalising Scores and Overall Marijuana Use based on whole sample data and including standardised weights and indicators to the latent variable, Parent and Peer Attitudes. Standardised regression weights for the unmediated model are denoted by *italics u*.

3.4.2 Tests For Structural Invariance Across Groups - Gender

In testing each of the respecified models described above for invariance across gender groups, a multi-group baseline model was initially established for each model as models specified for tests of structural invariance are done so across validation groups rather than for each validation group (Byrne, 2001). Each baseline model was tested across gender (males N = 538, female N = 642) groups and results are presented in Table 34. Results indicated that the fit of each of the models to the two groups in combination and with no equality constraints imposed was good. In each case the CFI statistics were indicative of superior fit (Hu and Bentler, 1999) and the RMSEA statistics suggested reasonable errors of approximation to the population (Brown and Cudeck, 1993). In all cases the minimum was achieved.

Equality constraints were then imposed across gender groups and analyses were re-run. Goodness of Fit statistics for each model undertaken across gender groups with equality constraints imposed are also presented in Table 34. Chi-Square differences tests were undertaken between Chi-Square values for Baseline and Validation models in order to test

structural invariance between males and females (Byrne, 2001, Arbuckle and Wothke, 1999). The results of the Chi-Square difference tests are presented in Table 34 as well. In the case of the alcohol and cigarette models, the Chi-Square difference value was statistically non-significant indicating that the causal structure accepted in the baseline model applied well (demonstrated invariance) across gender groups. However, the Chi Square difference value for the marijuana model was significant indicating that causal structure offered in this model did not hold across gender groups.

Table 34: Baseline Model and Validation Model Goodness of Fit Statistics for each substance model run across gender groups, and results of Chi-Square difference tests undertaken between Baseline and Validation Chi-Square values for each substance run across gender groups. .

| Baseline Model | <i>df</i> | χ^2 | CFI | RMSEA |
|------------------------------------|------------------|----------------------------|------------|--------------|
| Alcohol Model | 8 | 38.8 | .981 | .057 |
| Cigarette Model | 8 | 43.2 | .977 | .061 |
| Marijuana Model | 8 | 42.7 | .977 | .061 |
| Validation Model | <i>df</i> | χ^2 | CFI | RMSEA |
| Alcohol Model | 13 | 45.9 | .980 | .046 |
| Cigarette Model | 13 | 54.1 | .973 | .052 |
| Marijuana Model | 13 | 52.9 | .973 | .051 |
| Chi-Square Difference Tests | <i>df</i> | χ^2 | p | |
| Alcohol Model | 5 | 7.1 | p >.05 | ns |
| Cigarette Model | 5 | 10.9 | p >.05 | ns |
| Marijuana Model | 5 | 10.2 | p <.05 | |

In an effort to identify the source of non-invariance across gender groups for the marijuana model, the constrained analyses were re-run with parameters successively individually unconstrained. Goodness of fit statistics were generated for the model with successive parameters unconstrained, and Chi-Square difference tests undertaken between each of these and the Baseline model. The major source of inter-group non-invariance was identified. Goodness of Fit Statistics for the Validation Models with successive parameters unconstrained are presented in Table 35, and the results of Chi-Square difference tests

between Validation and Baseline analyses with the appropriate Validation parameters unconstrained are also presented in Table 35.

Table 35: Goodness of Fit statistics resulting from unconstraining successive individual parameters for the Marijuana Validation model across gender groups

| Marijuana Model | Parameter | | (df) χ^2 | CFI | RMSEA | Difference (df) χ^2 | Sig |
|------------------|-----------|-------------------|---------------|------|-------|--------------------------|-------|
| Validation Model | | | | | | | |
| P1: Ext. Scores | ↔ | Overall Use | (28)65.3 | .987 | .034 | (6)5.9 | p>.05 |
| P2: Ext. Scores | ↔ | Parent/Peer | (28)70.1 | .986 | .036 | (6)10.7 | p>.05 |
| P3: Parent/Peer | ↔ | Overall Use | (28)72.2 | .985 | .037 | (6)12.8 | p<.05 |
| P4: Parent/Peer | ↔ | Peer Influences | (28)73.1 | .985 | .037 | (6)13.7 | p<.05 |
| P5: Parent/Peer | ↔ | Ability to Source | (28)73.8 | .984 | .037 | (6)14.4 | p<.05 |
| P6: Overall Use | ↔ | Last Month Use | (28)73.8 | .984 | .037 | (6)14.4 | p<.05 |
| P7: Overall Use | ↔ | Last Week Use | (28)73.2 | .985 | .037 | (6)13.8 | p<.05 |
| Baseline Model | | | (22)59.4 | .987 | .038 | | |

The major source of inter-group non-invariance for the marijuana model was found in the parameter P1, the parameter that pertained to the relation between Externalising Scores and Overall Marijuana Use. When the constraints on this parameter were removed, goodness of fit statistics generated, and Chi Square difference tests run, the Chi Square difference value was non-significant ($\chi^2 = (6) 5.9, p>.05$) indicating the values for each gender on this parameter were sufficiently different to allow the model to demonstrate invariance across gender groups. When the constraints on P2, the parameter that pertained to the relation between Externalising Scores and Parent and Peer Influences, were removed, goodness of fit statistics generated, and Chi Square difference tests run, the Chi Square difference value was non-significant ($\chi^2 = (6) 10.7, p>.05$) indicating the values for each gender on this parameter were also sufficiently different to allow the model to demonstrate invariance across gender groups.

3.4.3 Tests For Structural Invariance Across Groups - Age

In testing each of the respecified models described above for invariance across age (Young N = 411, Middle N = 461, Old N= 310) groups, a multi-group baseline model was established for each model. Results are presented in Table 36 and indicate that the goodness of fit of each of the models for the three groups in combination and with no equality constraints imposed was good. In each case the CFI statistics were indicative of superior fit (Hu and Bentler, 1999) and the RMSEA statistics suggested either good fit or reasonable errors of approximation to the population (Brown and Cudeck, 1993). In all cases the minimum was achieved.

Equality constraints were then imposed across age groups and analyses were re-run. Goodness of Fit statistics for each model undertaken across age groups with equality constraints imposed are presented in Table X. Chi-Square differences tests were then undertaken between Chi-Square values for Validation and Baseline models in order to test structural invariance between age groups (Byrne, 2001, Arbuckle and Wothke, 1999). The results of the Chi-Square difference tests are also presented in Table 36. For each substance, the Chi-Square difference value was statistically significant indicating that the causal structure accepted in the baseline model did not apply well (demonstrated non-invariance) across the three age groups.

Table 36: Baseline Model and Validation Model Goodness of Fit Statistics for each substance model run across age groups, and results of Chi-Square difference tests undertaken between Baseline and Validation Chi-Square values for each substance run across age groups.

| Baseline | df | χ^2 | CFI | RMSEA |
|-------------------|-----------|----------------------------|------------|--------------|
| Alcohol Model | 33 | 79.3 | .980 | .043 |
| Cigarette Model | 36 | 132.9 | .969 | .052 |
| Marijuana Model | 33 | 86.2 | .971 | .050 |
| Validation | df | χ^2 | CFI | RMSEA |
| Alcohol Model | 47 | 165.8 | .931 | .059 |
| Cigarette Model | 50 | 175.0 | .938 | .055 |
| Marijuana Model | 47 | 162.0 | .945 | .051 |
| | df | χ^2 | p | |
| Alcohol Model | 14 | 86.5 | p<.05 | |
| Cigarette Model | 14 | 42.1 | p<.05 | |
| Marijuana Model | 14 | 75.8 | p<.05 | |

In an effort to identify the source of non-invariance across age groups, the constrained analyses were re-run with parameters successively individually unconstrained. Goodness of fit statistics were generated for each model with successive parameters unconstrained, and Chi-Square difference tests undertaken between each of these and the Baseline model. The major source of inter-group non-invariance for each model was identified. Goodness of Fit Statistics for the Validation Models with successive parameters unconstrained are presented in Table 37, and the results of Chi-Square difference tests between Validation and Baseline analyses with the appropriate Validation parameters unconstrained are also presented in Table 37.

Table 37: Goodness of Fit statistics resulting from unconstraining individual successive parameters for each Validation model across age groups.

| Alcohol Model | Parameter | (df) χ^2 | CFI | RMSEA | Difference (df) χ^2 | Sig |
|----------------------|------------------|---------------------------------|------------|--------------|--|------------|
| Validation Model | | | | | | |
| P1: Ext. Scores | ↔ Overall Use | (45)158.4 | .956 | .046 | (12)79.1 | p<.05 |
| P2: Ext. Scores | ↔ Parent/Peer | (45)161.2 | .955 | .047 | (12)81.9 | p<.05 |

| | | | | | | | |
|-----------------|---|-------------------|-----------|------|------|----------|-------|
| P3: Parent/Peer | ↔ | Overall Use | (45)103.1 | .977 | .033 | (12)23.8 | p<.05 |
| P4: Parent/Peer | ↔ | Peer Influences | (45)165.8 | .953 | .048 | (12)86.5 | p<.05 |
| P5: Parent/Peer | ↔ | Ability to Source | (45)162.4 | .954 | .047 | (12)83.1 | p<.05 |
| P6: Overall Use | ↔ | Last Month Use | (45)163.6 | .955 | .047 | (12)80.9 | p<.05 |
| P7: Overall Use | ↔ | Last Week Use | (45) 73.2 | .954 | .047 | (12)84.3 | p<.05 |
| Baseline Model | | | (33)59.4 | .982 | .034 | | |

| Cigarette Model | Parameter | | (df) χ^2 | CFI | RMSEA | Difference (df) χ^2 | Sig |
|------------------------|------------------|-------------------|---------------------------------|------------|--------------|--|------------|
| Validation Model | | | | | | | |
| P1: Ext. Scores | ↔ | Current Use | (48)163.6 | .931 | .045 | (12)30.7 | p<.05 |
| P2: Ext. Scores | ↔ | Parent/Peer | (48)170.7 | .927 | .047 | (12)37.8 | p<.05 |
| P3: Parent/Peer | ↔ | Current Use | (48)142.3 | .944 | .041 | (12) 9.4 | p>.05 |
| P4: Parent/Peer | ↔ | Peer Influences | (48)174.9 | .924 | .047 | (12)42 | p<.05 |
| P5: Parent/Peer | ↔ | Ability to Source | (48)172.3 | .926 | .047 | (12)39.4 | p<.05 |
| P6: Current Use | ↔ | Last Month Use | (48)156.7 | .935 | .044 | (12)23.8 | p<.05 |
| P7: Current Use | ↔ | Last Week Use | (48)174.5 | .924 | .047 | (12)41.6 | p<.05 |
| Baseline Model | | | (36)132.9 | .942 | .048 | | |

| Marijuana Model | Parameter | | (df) χ^2 | CFI | RMSEA | Difference (df) χ^2 | Sig |
|------------------------|------------------|-------------------|---------------------------------|------------|--------------|--|------------|
| Validation Model | | | | | | | |
| P1: Ext. Scores | ↔ | Overall Use | (45)129.5 | .969 | .040 | (12)43.3 | p<.05 |
| P2: Ext. Scores | ↔ | Parent/Peer | (45)157.6 | .959 | .046 | (12)71.7 | p<.05 |
| P3: Parent/Peer | ↔ | Overall Use | (45)116.2 | .974 | .037 | (12)30 | p<.05 |
| P4: Parent/Peer | ↔ | Peer Influences | (45)161.8 | .957 | .047 | (12)75.6 | p<.05 |
| P5: Parent/Peer | ↔ | Ability to Source | (45)160.7 | .958 | .047 | (12)74.6 | p<.05 |
| P6: Overall Use | ↔ | Last Month Use | (45)156.4 | .959 | .046 | (12)20.2 | p<.05 |
| P7: Overall Use | ↔ | Last Week Use | (45)156.4 | .959 | .046 | (12)20.2 | p<.05 |
| Baseline Model | | | (33)82.6 | .982 | .036 | | |

In the case of each of the three substance use models, the parameter P3, which pertained to the relation between Parent And Peer Attitudes Toward Substance Use and level of use of the substance in question, was most heavily implicated in the inter-group non-invariance. Removal of the constraint on this parameter in the cigarette model was sufficient to allow the cigarette model to become invariant across age groups indicating that the variation in regression weights between Parent and Peer Indicators and Cigarette Use across age groups was responsible for the inter-group non-invariance. However, removal of constraints on this parameter in the alcohol and marijuana models was not sufficient to allow either of these models to demonstrate invariance across age groups. The P1 parameter, the parameter pertaining to the relation between Externalising Scores and use of the substance in question was the second most heavily implicated in the inter-group no-invariance in all three models. However, relaxation of this parameter, either alone or in combination with P3, was also insufficient to allow either the alcohol or marijuana models to become invariant across age groups. Finally, P2, the parameter pertaining to the relation between Externalising Scores and Parent And Peer Attitudes Toward Substance Use, was the third most heavily implicated parameter in each model. For the alcohol or marijuana models, relaxation of this parameter in combination with P3 and/or P1 was also insufficient to render the model invariant across age groups.

3.4.4 Summary of Time One Modelling

Results of screening analyses described above were used to develop structural models of substance use in adolescence. Having demonstrated a statistically significant and positive association between Externalising scores and each of the three substances in question, main effects for age, and first and second indirect effects for Alcohol Motives, Emotion Regulation, and the Parent and Peer Attitudes (on alcohol, alcohol and tobacco, alcohol tobacco and marijuana respectively), a hypothesised model of mediation was developed for each substance.

Data relevant to each model were read into AMOS 5 (Arbuckle, 2003). The hypothesised models were initially tested across whole sample data. In the first instance, where latent constructs existed (Overall Substance Use, Parent and Peer Attitudes) these were tested without their measured indicators. Any re-specification that was judged appropriate was undertaken next. On the basis of the goodness of fit statistics, the initial model of the hypothesised relation between Externalising Scores and Overall Alcohol Use was rejected. The Alcohol Motives and Emotion Regulation scores were discarded from the model, and the respecified model accepted. The initial models of the hypothesised relation between Externalising Scores and Overall Tobacco Use, and Overall Marijuana Use were also rejected. Again, on the basis of goodness of fit statistics, Emotion Regulation scores were discarded from the models and the respecified models accepted. In all cases, goodness of fit statistics indicated the models fit the data well.

Finally, the three respecified models were tested for invariance across gender and age groups. For gender, the causal structure accepted in the baseline alcohol and cigarette models demonstrated invariance across groups. However, due to differences between genders in the relation between Externalising Scores and Overall Marijuana Use, the marijuana model did not hold across gender groups. For age, none of the three models demonstrated invariance across groups. For the cigarette model, the non-invariance was demonstrated to result from differences in the standardised regression weights pertaining to the relation between Parent and Peer Attitudes and Current Cigarette Use. For the alcohol and marijuana models, relaxation of the three central parameters, either individually or in combination, was insufficient to allow the model to fit across groups.

Having completed data screening, assessment of mediation, assessment of model development, and assessment of model invariance across age and gender groups, attention was now moved to time two data. Again, initial screening analyses were proposed for time two data, followed by the development of structural models to assess the potential for time one data to predict ability of time one Externalising Scores to predict time two Substance Use.

3.5 TIME TWO DATA

3.5.1 Time Two Data

The demographic characteristics of the Time Two sample are presented in Table 38. The Time Two sample consisted of a total of N=560 (47.5% male, 52.5% female), representing 47.46% of the Time One sample (49.44% males retained, 45.49% of females retained). Participants were divided by age (thirteen years and younger, fourteen to fifteen years, and sixteen years and over) and gender for the purposes of reporting their demographic characteristics.

Table 38. Age and Gender characteristics of the Time Two sample utilised in the present study.

| Age Category (Yrs) | Gender (n) | Percent of Time Two sample | Percent of Age Category |
|--------------------|---------------|----------------------------|-------------------------|
| <13 | Male (n=107) | 19.1% | 48.2% |
| | Female(n=115) | 20.5% | 51.8% |
| 14-15 | Male (n=117) | 20.9% | 49.2% |
| | Female(n=121) | 21.6% | 50.8% |

| | | | |
|--------------|-------------|-------|-------|
| 16+ | Male (n=42) | 7.5% | 42.0% |
| Female(n=58) | 10.4% | 58.0% | |

3.5.2 Retention At Time Two

Multivariate analysis of variance was used to determine whether significant differences existed on a range of dependant variables between the portion of the sample who were retained for assessment at time two and those for whom only time one data were available. The dependant variables included demographic characteristics, measures of substance use, emotion regulation, parent and peer influences, social skills, and mental health.

Gender: The portion of participants that were retained for time two data collection did not differ significantly by gender from those who were not retained for time two analysis, $\chi^2(1) = 1.562, p > .05$.

Demographic Characteristics: A one-way between subjects multivariate analysis of variance was performed on three dependant variables related to the demographic characteristics of the sample: Age, Father's Level of Education, and Mother's Level of Education. The independent variable was Retention at Time Two. A significant multivariate main effect was evident on Retention at Time Two $F(3, 849)=9.402, p<0.001$. Univariate analyses revealed significant main effects for Age $F(1, 851)=21.417, p<0.01$, such that those retained for time two analysis were significantly younger than those retained only for time one analysis, and Father's Education $F(1, 851)=7.106, p<0.01$, such that the fathers of those retained were more highly educated.

Analysis of Variance

A one-way between subjects multivariate analysis of variance was performed on three dependant variables related to the substance use: Overall Alcohol Use, Current Cigarette Use, and Overall Marijuana Use. The independent variable was Retention at Time Two. A significant multivariate main effect was evident on Retention at Time Two $F(3, 1178)=10.199, p<0.001$. Univariate analyses revealed significant main effects for Overall Alcohol Use $F(1, 1182)=20.322, p<0.01$, such that those retained for time two data collection drank significantly less than those not, Cigarettes Currently $F(1, 1182)=20.322, p<0.01$, such that those retained for time two data analysis smoked significantly less than those not, and Overall Marijuana Use $F(1, 1182)=20.322, p<0.01$, such that those retained for time two data analysis used significantly less marijuana than those not retained.

A one-way between subjects multivariate analysis of variance was performed on two dependant variables related to the mental health: Internalising Scores and Externalising Scores. The independent variable was Retention at Time Two. A significant multivariate main effect was evident on Retention at Time Two $F(2, 1030)=4.026, p<0.05$. Univariate analyses revealed significant main effects for Externalising Scores $F(1, 1033)=6.780, p<0.01$, such that those retained for time two data collection demonstrated significantly lower Externalising Scores than those not retained.

A one-way between subjects multivariate analysis of variance was performed on three dependant variables related to the Emotion Regulation: The independent variable was Retention at Time Two. No multivariate main effects were evident on any of the three dependant variables.

A one-way between subjects multivariate analysis of variance was performed on four dependant variables related to the Social Skills: Co-operation, Assertion, Empathy and Self Control. The independent variable was Retention at Time Two. A significant multivariate main effect was evident on Retention at Time Two $F(4, 962)=3.531, p<0.01$. Univariate analyses revealed a significant main effect for Co-operation $F(1, 965)=9.979, p<0.01$, such that those retained for time two data collection demonstrated significantly higher Social Skills Co-operation scores than those not retained.

A one-way between subjects multivariate analysis of variance was performed on three dependant variables related to the Parent and Peer Influences on Substance Use: Parent Influences, Peer Influences and Ability to Source Substances. The independent variable was Retention at Time Two. A significant multivariate main effect was evident on Retention at Time Two $F(3, 1066)=22.00, p<0.01$. Univariate analyses revealed significant main effects for Parent Influences, $F(1, 1068)=42.446, p<0.01$, such that those retained for time two data collection reported significantly lower parental influence than those not retained, Peer Influences, $F(1, 1068)=51.269, p<0.01$, such that those retained for time two data collection reported significantly lower peer influence than those not retained, and Ability to Source Substances $F(1, 1068)=33.778, p<0.01$, such that those retained for time two data collection reported significantly less ability to source the substances in question than those not retained. All the analysis of variance results are presented in Table 39.

Table 39. Numbers, means, standard deviations, and ranges of responses to dependant variables related to the Gender, Age, parent's education, substance use, mental health, emotion regulation, social skills and parent and peer influences on substance use.

| N | Mean (SD) | Not Retained at Time Two | | Retained at Time Two | |
|-----------------------------|-----------|--------------------------|---------------|----------------------|---------------|
| | | N | Mean (SD) | N | Mean (SD) |
| Age | | 619 | 14.68 (1.67) | 560 | 14.18 (1.44) |
| Gender | Male | 272 | | 266 | |
| | Female | 348 | | 294 | |
| Parent's Level of Education | | | | | |
| Father | | 478 | 2.30 (0.92) | 435 | 2.46 (0.86) |
| Mother | | 489 | 2.21 (0.94) | 435 | 2.32 (0.91) |
| Substance Use | | | | | |
| Overall Alcohol Use | | 621 | 5.41 (13.62) | 561 | 2.42 (8.30) |
| Current Cigarette Use | | 621 | 0.34 (1.58) | 561 | 0.06 (0.47) |
| Overall Marijuana Use | | 621 | 1.00 (5.72) | 561 | 0.27 (2.56) |
| Mental Health | | | | | |
| Internalising Scores | | 576 | 13.44 (10.29) | 590 | 13.06 (8.30) |
| Externalising Scores | | 476 | 13.05 (9.58) | 510 | 11.71 (7.61) |
| Emotion Regulation | | | | | |
| Equanimity | | 602 | 9.67 (4.79) | 533 | 10.15 (4.50) |
| Regulation | | 585 | 13.83 (4.00) | 527 | 13.79 (4.05) |
| Appropriate Affect | | 600 | 14.47 (3.87) | 528 | 14.76 (3.84) |
| Social Skills | | | | | |
| Cooperation | | 588 | 13.22 (3.05) | 540 | 13.88 (2.98) |
| Assertion | | 566 | 12.28 (3.23) | 505 | 11.95 (3.52) |
| Empathy | | 592 | 15.57 (3.07) | 529 | 15.66 (2.83) |
| Self Control | | 554 | 11.01 (2.91) | 521 | 11.27 (2.83) |
| Parent and Peer Influences | | | | | |
| Parent Influences | | 601 | 7.22 (5.76) | 539 | 5.21 (4.56) |
| Peer Influences | | 581 | 17.49 (12.43) | 528 | 12.37 (11.24) |
| Ability to Source | | 610 | 3.67 (3.10) | 556 | 2.65 (2.77) |

Participants retained for testing at time two were assessed for the degree to which they were similar to those not retained for testing at time two. No significant differences were apparent between the groups in terms of Age or Gender. In addition, mother's Level of Education and participants Internalising Scores were not significantly different. There was no

significant difference between the groups on any of the three Emotion Regulation subscales, Equanimity, Regulation or Appropriate Affect, and no significant difference between the groups on three of the four Social Skills subscales, Assertion, Empathy or Self Control.

However, significant differences did exist on several variables. Father's Level of Education was significantly higher in those retained for testing at time two. Overall Alcohol Use, Current Cigarette Use, and Overall Marijuana Use were all significantly lower in the portion of the sample retained for testing at time two compared with those not retained at time two. Externalising Scores, and the Cooperation subscale of the Social Skills measure were also significantly different, with those retained at time two demonstrating lower Externalising Scores and higher levels of Cooperation. Finally, those retained for testing at time two showed significantly lower parental and peer influence in their substance use, and significantly less ability to source substances than those not retained for testing at time two.

3.5.3 Change Over Time

Participants who were retained for testing at time two were assessed for the extent to which their indices of Mental Health, Substance Use, Emotion Regulation, Social Skills and Parent and Peer Attitudes Toward Substance Use changed over the year since their initial testing at time one. For all analyses the Between Subject factors were Age Category and Gender, and the Within Subjects factor was Time. Because age and gender effects were examined previously, they will be ignored unless they are found to interact with the within subjects variable, Time. The results of these analyses are presented in Table 40.

Repeated measures MANOVA was performed on two dependant variables related to the mental health: Internalising Scores and Externalising Scores. Table X presents the numbers, means and standard deviations for responses on the dependent variables. Significant multivariate main effects were evident for Gender, $F(2,422)=13.356$, $p<.01$, and for the Time by Age interaction, $F(4,846)=4.634$, $p<.01$. Follow-up univariate analyses revealed a significant time by age interaction for both Internalising Scores $F(2, 423)=6.225$, $p<.05$, and Externalising Scores $F(2, 423)=8.325$, $p<.05$. From the means in Table 40, it can be seen that while both the Internalising and Externalising Scores means for the younger age group and the middle age group increase over time, the Internalising and Externalising Scores means for the older group decrease over time. However, follow-up analyses showed that despite their univariate significance, there were no significant changes across time for any of the age groups.

Repeated measures MANOVA was performed on three variables related to substance use: Overall Alcohol Use, Current Cigarette Use, and Overall Marijuana Use. Table X presents the numbers, means and standard deviations for responses on the dependent variables. Significant multivariate main effects were evident for Gender, $F(3,523)=2.995$, $p<.05$, Age, $F(6,1048)=10.582$, $p<.01$, and Time, $F(3, 523)=8.791$, $p<.01$. Follow-up univariate analyses revealed a significant main effect for Time on Overall Alcohol Use only, $F(1,525)=25.812$, $p<.01$. The means in Table 40 indicate that Overall Alcohol Use increased from time one to time two, and follow-up analyses confirmed the increase over time was significant.

Repeated measures MANOVA was performed on three variables related to Emotion Regulation: Equanimity, Regulation and Appropriate Affect. Table X presents the numbers, means, and standard deviations for responses on the dependent variables. Significant multivariate main effects were evident for Gender, $F(3,482)=17.444$, $p<.01$, Age, $F(6,962)=2.815$, $p<.01$, and Time, $F(3, 482)=72.350$, $p<.01$. Follow-up univariate analyses revealed a significant main effect for Time on Regulation, $F(1,484)=162.346$, $p<.01$. From the means in Table 40, it can be seen that Regulation decreased from time one to time two, and follow-up analyses confirmed the decrease over time was significant.

Repeated measures MANOVA was performed on four variables related to Social Skills: Co-operation, Assertion, Empathy and Self Control. Table X presents the numbers, means and

standard deviations for responses on the dependent variables. Significant multivariate main effects were evident for Gender, $F(4, 427)=27.479, p<.01$, Age, $F(8,856)=3.820, p<.01$, and Time, $F(4, 427)=2.604, p<.01$, the Time by Gender interaction, $F(4, 427)=2.485, p<.05$, and the Time by Gender by Age interaction, $F(8,856)=2.350, p<.05$. Follow-up univariate analyses revealed that the Time by Gender by Age interaction was significant on Co-operation, $F(2,430)=3.727, p<.05$, Assertion, $F(2,430)=5.850, p<.01$, and Empathy, $F(2,430)=3.716, p<.05$. Despite the significant univariate results, follow-up analyses revealed no significant changes over time. The means presented in Table 40 demonstrate general stability in these measures of Social Skills over time.

Repeated measures MANOVA was performed on three variables related to Parent and Peer Influences on Substance Use: Parent Influences, Peer Influences and Ability to Source Substances. Table X presents the numbers, means and standard deviations for responses on the dependent variables. Significant multivariate main effects were evident for, Age, $F(9,492)=31.105, p<.01$, Time, $F(3,470)=36.579, p<.01$, and the Time by Gender by Age interaction, $F(6, 942)=2.498, p<.01$. Follow-up univariate analyses revealed significant main effects for Time on Parent Influences, $F(1, 472)=6.769, p<.01$, Peer Influences, $F(1, 472)=88.288, p<.01$ and Source, $F(1, 472)=70, 428, p<.01$, the Time by Gender interaction on Source $F(1, 472)=4.980, p<.05$, and the Time by Gender by Age interaction on Parent Influences, $F(2, 472)=4.497, p<.05$. The means presented in Table 40 indicate increases in Parent Influences, Peer Influences and Ability to Source Substances over time. Follow-up analyses confirmed significant increases over Time for Peer Influences and Ability to Source Substances, and a significant Gender by Time interaction for females in their Ability to Source Substances. However, follow-up analyses also revealed the Gender by Age by Time interaction on Parental Influences was not significant.

Table 40. Numbers, means and standard deviations of Time One and Time Two responses to the two Achenbach Mental Health dimensions, Internalising Scores and Externalising Scores, the three substance use dimensions, Overall Alcohol Use, Current Cigarette Use, and Overall Marijuana Use, the three Emotion Regulation dimensions; Equanimity, Regulation and Appropriate Affect, the four Social Skills dimensions; Co-operation, Assertion, Empathy and Self Control, and the three Parent and Peer Influences: Parent Influences, Peer Influences and Ability to Source Substances.

| | Male | | | Female | | | | |
|----------------------------|------|-------|-------|--------|-------|-------|-------|-------|
| | <13 | 14-15 | 16+ | <13 | 14-15 | 16+ | | |
| N | | | 81 | 83 | 36 | 86 | 96 | 47 |
| Internalising | | | | | | | | |
| Time One | | | | | | | | |
| Mean | | | 10.33 | 12.03 | 11.72 | 12.85 | 15.13 | 17.62 |
| S.D. | | | 7.23 | 10.34 | 10.47 | 9.01 | 9.01 | 11.67 |
| Time Two | | | | | | | | |
| Mean | | | 10.75 | 12.33 | 10.72 | 17.44 | 15.30 | 16.40 |
| S.D. | | | 8.67 | 1.00 | 7.80 | 10.76 | 9.89 | 10.33 |
| Externalising | | | | | | | | |
| Time One | | | | | | | | |
| Mean | | | 11.35 | 11.93 | 11.19 | 10.62 | 12.75 | 12.89 |
| S.D. | | | 6.79 | 7.88 | 6.22 | 7.71 | 7.77 | 9.34 |
| Time Two | | | | | | | | |
| Mean | | | 12.31 | 12.43 | 9.50 | 14.45 | 13.40 | 12.19 |
| S.D. | | | 8.40 | 8.26 | 5.63 | 9.68 | 7.68 | 7.99 |
| Overall Alcohol Use | | | | | | | | |
| Time One | | | | | | | | |
| Mean | | | 0.16 | 3.40 | 6.62 | 0.50 | 2.07 | 5.66 |
| S.D. | | | 0.50 | 12.07 | 9.82 | 1.93 | 7.41 | 11.68 |

| | | | | | | |
|------------------------------|-------|-------|-------|-------|-------|-------|
| Time Two | | | | | | |
| Mean | 1.00 | 7.48 | 11.08 | 1.88 | 2.79 | 8.21 |
| S.D. | 4.23 | 12.95 | 15.87 | 6.26 | 8.31 | 14.70 |
| Current Cigarette Use | | | | | | |
| Time One | | | | | | |
| Mean | 0.01 | 0.03 | 0.05 | 0.01 | 0.11 | 0.23 |
| S.D. | 0.10 | 0.17 | 0.32 | 0.10 | 0.17 | 0.32 |
| Time Two | | | | | | |
| Mean | 0.02 | 0.18 | 0.00 | 0.16 | 0.13 | 0.23 |
| S.D. | 0.14 | 0.93 | 0.00 | 1.44 | 0.64 | 1.18 |
| Overall Marijuana Use | | | | | | |
| Time One | | | | | | |
| Mean | 0.00 | 0.30 | 0.00 | 0.01 | 0.45 | 0.59 |
| S.D. | 0.00 | 2.35 | 0.00 | 0.05 | 3.24 | 3.66 |
| Time Two | | | | | | |
| Mean | 0.35 | 0.52 | 0.27 | 0.26 | 0.10 | 0.12 |
| S.D. | 2.28 | 2.91 | 1.07 | 2.77 | 0.62 | 0.66 |
| <hr/> | | | | | | |
| N | 95 | 110 | 49 | 187 | 214 | 89 |
| Equanimity | | | | | | |
| Time One | | | | | | |
| Mean | 11.50 | 10.77 | 10.17 | 10.43 | 8.91 | 7.37 |
| S.D. | 4.16 | 4.35 | 4.04 | 3.83 | 4.81 | 4.38 |
| Time Two | | | | | | |
| Mean | 11.07 | 9.96 | 10.28 | 9.52 | 8.47 | 7.88 |
| S.D. | 4.14 | 4.50 | 5.18 | 4.38 | 5.01 | 4.79 |
| Regulation | | | | | | |
| Time One | | | | | | |
| Mean | 14.59 | 14.80 | 15.10 | 13.76 | 12.44 | 12.67 |
| S.D. | 3.85 | 3.91 | 4.17 | 4.13 | 3.80 | 3.84 |
| Time Two | | | | | | |
| Mean | 12.96 | 12.28 | 12.10 | 10.93 | 10.70 | 9.82 |
| S.D. | 4.23 | 3.91 | 4.06 | 4.05 | 3.99 | 3.69 |
| Appropriate Affect | | | | | | |
| Time One | | | | | | |
| Mean | 14.86 | 15.12 | 15.25 | 15.13 | 14.45 | 13.24 |
| S.D. | 3.78 | 4.13 | 3.96 | 3.21 | 3.72 | 4.74 |
| Time Two | | | | | | |
| Mean | 14.99 | 15.15 | 15.25 | 14.67 | 14.25 | 14.08 |
| S.D. | 3.65 | 4.51 | 4.98 | 4.53 | 4.34 | 4.47 |
| <hr/> | | | | | | |
| N | 77 | 93 | 38 | 86 | 100 | 42 |
| Co-operation | | | | | | |
| Time One | | | | | | |
| Mean | 14.25 | 13.76 | 13.82 | 14.18 | 13.25 | 13.50 |
| S.D. | 2.97 | 2.79 | 2.73 | 3.17 | 2.75 | 3.11 |
| Time Two | | | | | | |
| Mean | 13.77 | 13.35 | 12.81 | 13.41 | 13.62 | 14.12 |
| S.D. | 3.15 | 3.05 | 2.54 | 3.37 | 2.97 | 2.72 |
| Assertion | | | | | | |
| Time One | | | | | | |
| Mean | 11.79 | 12.42 | 12.50 | 11.50 | 11.51 | 11.88 |
| S.D. | 3.03 | 3.03 | 2.91 | 3.31 | 3.51 | 2.62 |
| Time Two | | | | | | |
| Mean | 12.25 | 12.46 | 11.92 | 11.27 | 12.62 | 12.55 |
| S.D. | 3.31 | 3.24 | 3.15 | 3.51 | 3.28 | 2.92 |
| Empathy | | | | | | |
| Time One | | | | | | |
| Mean | 14.30 | 14.85 | 15.53 | 15.98 | 16.73 | 17.12 |
| S.D. | 3.11 | 2.76 | 3.26 | 2.96 | 2.16 | 1.81 |
| Time Two | | | | | | |

| | | | | | | |
|-------------------------------------|-------|-------|-------|-------|-------|-------|
| Mean | 14.47 | 14.78 | 14.74 | 15.67 | 17.49 | 17.62 |
| S.D. | 3.19 | 3.21 | 3.01 | 2.92 | 1.96 | 2.07 |
| Self Control | | | | | | |
| Time One | | | | | | |
| Mean | 11.62 | 11.14 | 11.55 | 11.84 | 10.78 | 10.64 |
| S.D. | 2.85 | 2.34 | 2.67 | 3.35 | 2.39 | 2.74 |
| Time Two | | | | | | |
| Mean | 11.09 | 10.96 | 11.03 | 10.95 | 10.86 | 10.93 |
| S.D. | 3.29 | 2.64 | 2.63 | 2.85 | 2.83 | 2.66 |
| <hr/> | | | | | | |
| N | 91 | 101 | 36 | 95 | 106 | 49 |
| Parent Influences | | | | | | |
| Time One | | | | | | |
| Mean | 4.51 | 5.12 | 5.64 | 4.09 | 5.36 | 6.10 |
| S.D. | 3.78 | 4.15 | 4.53 | 3.67 | 4.38 | 5.72 |
| Time Two | | | | | | |
| Mean | 4.52 | 5.70 | 6.25 | 5.52 | 5.27 | 6.33 |
| S.D. | 5.29 | 4.24 | 5.60 | 4.38 | 5.01 | 4.79 |
| Peer Influences | | | | | | |
| Time One | | | | | | |
| Mean | 5.68 | 15.85 | 21.56 | 4.88 | 13.18 | 20.04 |
| S.D. | 6.03 | 10.73 | 12.46 | 6.43 | 10.68 | 11.58 |
| Time Two | | | | | | |
| Mean | 9.20 | 18.66 | 25.06 | 9.19 | 18.31 | 22.63 |
| S.D. | 8.78 | 10.69 | 11.11 | 9.06 | 12.24 | 11.02 |
| Ability to Source Substances | | | | | | |
| Time One | | | | | | |
| Mean | 1.00 | 3.12 | 5.00 | 1.24 | 2.80 | 4.29 |
| S.D. | 1.80 | 2.65 | 2.96 | 1.96 | 2.55 | 2.88 |
| Time Two | | | | | | |
| Mean | 1.66 | 3.92 | 5.47 | 2.22 | 4.11 | 5.35 |
| S.D. | 2.35 | 2.87 | 2.69 | 2.46 | 3.04 | 3.05 |

3.5.4 Summary Of Change Over Time

Participants who were retained for testing at time two were assessed for the extent to which their responses to measures of Mental Health, Substance Use, Emotion Regulation, Social Skills and Parent and Peer Attitudes Toward Substance Use changed over the year between testing. Despite univariate significance, analyses revealed no significant change in measures of mental health over time. Overall alcohol use increased significantly over time, however neither cigarette use nor overall marijuana use changed significantly over time. Analysis of Emotion Regulation revealed a significant decrease in Regulation over time, however no changes in measures of Equanimity or Appropriate Affect were in evidence over time. Similarly, despite some univariate significance, analyses revealed no significant changes over time for any of the subscales related to Social Skills. Finally, both Peer Influences on Substance Use and Ability to Source Substances increased significantly over time. However, the influence of parents on participant's substance use behaviour did not show significant change over time.

3.6 STRUCTURAL MODELLING – TIME TWO

3.6.1 The Development of Time Two Structural Models.

On the basis of the data generated from assessment at time two, structural models were developed to assess the relationship between Mental Health and the use of the three substances of interest over time. Given that a significant cross sectional association was demonstrated between Externalising Scores and use of each substance of interest at Time One, and that this relation was demonstrated to be mediated across substances only by scores on the PAPA-TSU,

similar structural models were employed to assess the development of substance use over time.

Data relevant to each model were read into AMOS 5 (Arbuckle, 2003) and the models were initially tested across whole sample data. The predictive relation between Externalising Scores at time one and Substance Use at time two was initially assessed. The influence that PAPA-TSU at time one had in mediating the relation between Externalising Scores at time one and Substance Use at time two was tested next, and this relationship was finally assessed controlling for the influence of substance use at time one on substance use at time two.

3.6.2 The Relation Between Time One Externalising Scores and Time Two Substance Use

Models accounting for the extent to which scores on the PAPA-TSU mediated the relation between Externalising Scores at time one and substance use at time two were tested for each of the three substances of interest with whole sample data. These models, together with the unmediated values for the relation between Externalising Scores at time one and substance use at time two are presented in Figures X, X and X. Goodness of fit statistics for the alcohol model ($\chi^2=(11)59.8$, CFI= .979, RMSEA= .061), cigarette model ($\chi^2=(12)75.1$, CFI= .962, RMSEA= .067) and the marijuana model ($\chi^2=(11)44.8$, CFI= .984, RMSEA= .051) suggest that the models fit the data well. In each case the CFI indices are indicative of superior fit (Hu and Bentler, 1999), and the RMSEA values representative of reasonable errors of approximation in the population (Browne and Cudeck, 1993). On this basis of these goodness of fit statistics both models were judged to fit the data well.

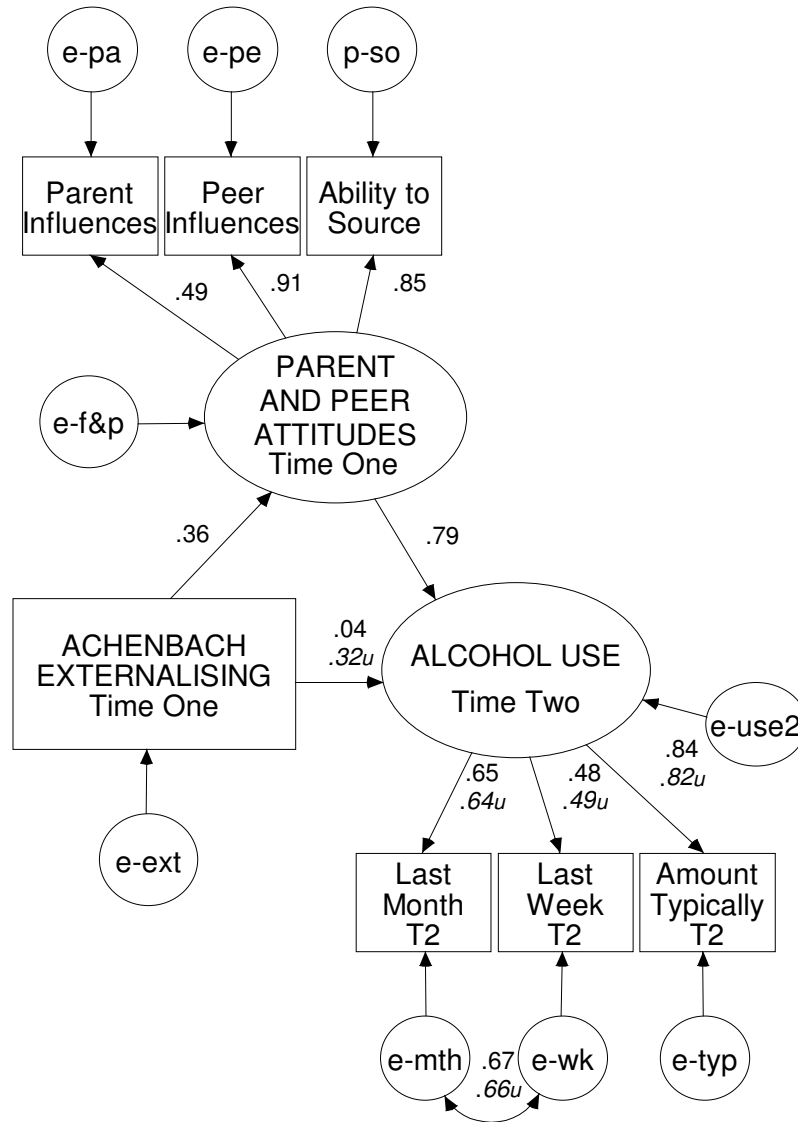


Figure 12: Model of the mediated relation between Externalising Scores at Time One and Overall Alcohol Use at Time Two based on whole sample data and including standardised weights and indicators to the latent variables, PAPA-TSU and Overall Alcohol Use. Standardised regression weights for the unmediated association between Externalising Scores at Time One and Overall Alcohol Use at Time Two are denoted by *italics u*.

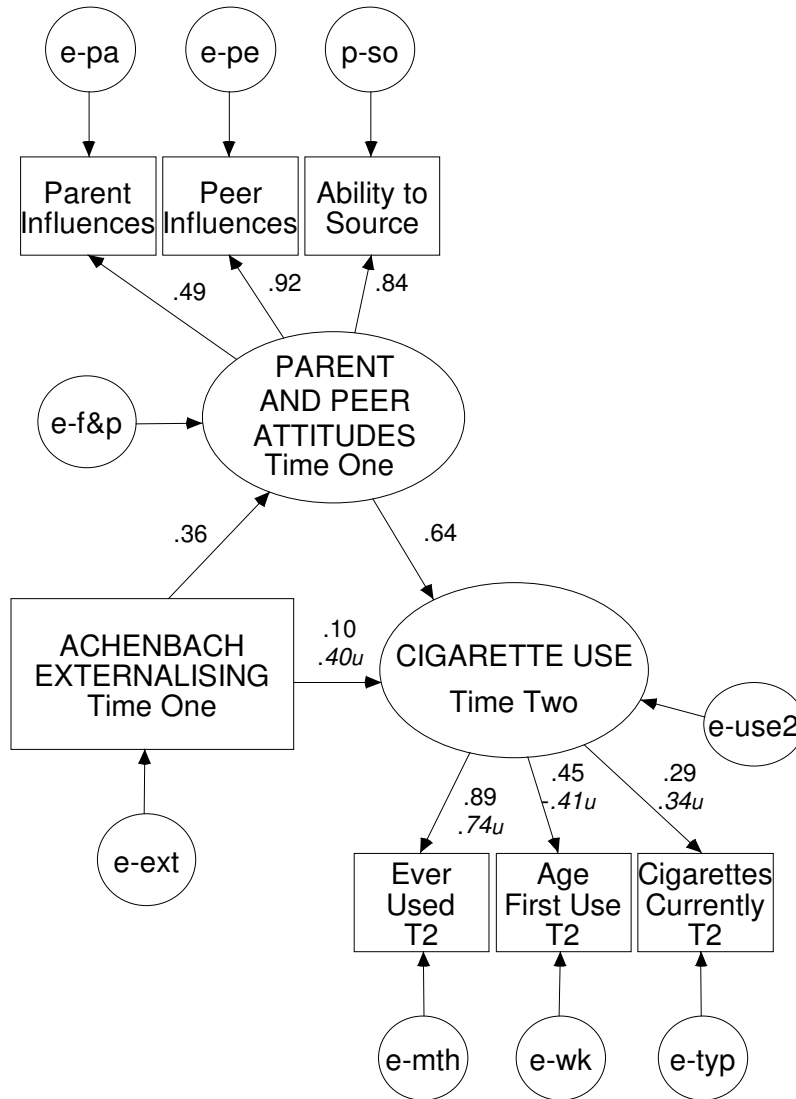


Figure 13: Model of the mediated relation between Externalising Scores at Time One and Overall Cigarette Use at Time Two based on whole sample data and including standardised weights and indicators to the latent variables, PAPA-TSU and Overall Cigarette Use. Standardised regression weights for the unmediated association between Externalising Scores at Time One and Overall Cigarette Use at Time Two are denoted by *italics u*.

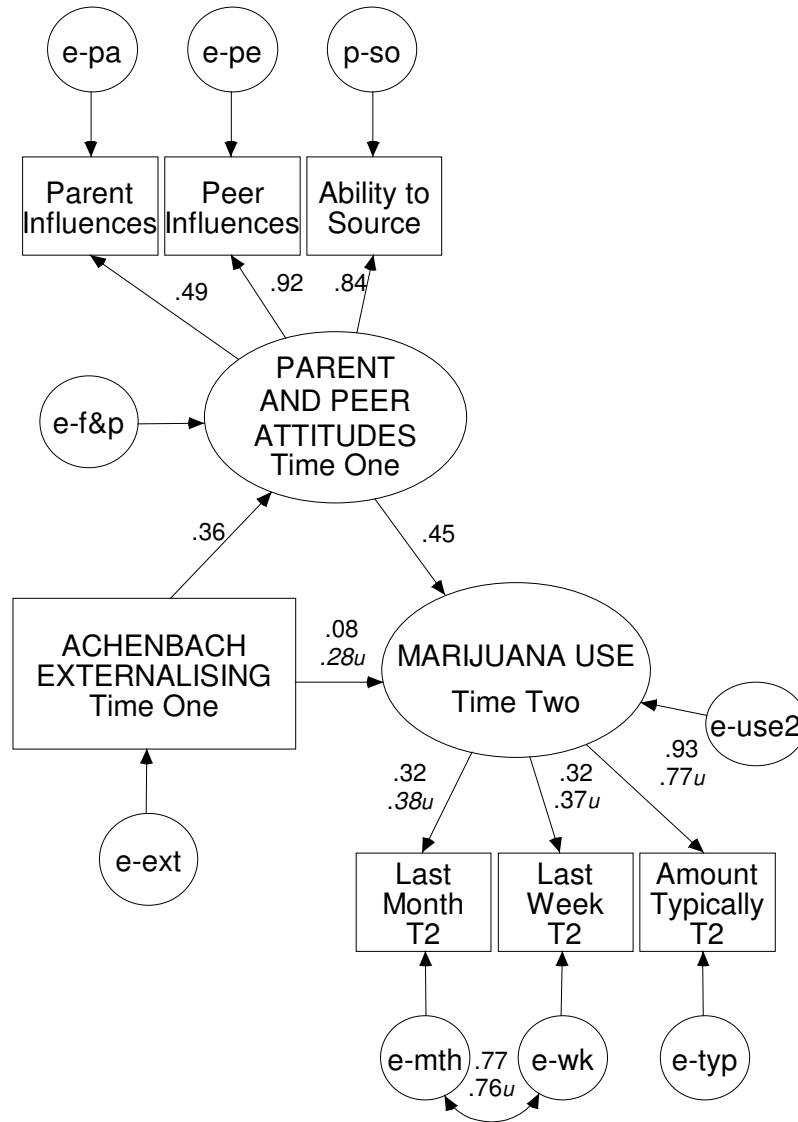


Figure 14: Model of the mediated relation between Externalising Scores at Time One and Overall Marijuana Use at Time Two based on whole sample data and including standardised weights and indicators to the latent variables, PAPA-TSU, Overall Marijuana Use. Standardised regression weights for the unmediated association between Externalising Scores at Time One and Overall Marijuana Use at Time Two are denoted by *italics u*.

3.6.3 The Relation Between Time One Externalising Scores and Time Two Substance Use Controlling for Time One Substance Use

Models accounting for the extent to which scores on the PAPA-TSU mediated the relation between Externalising Scores at time one and substance use at time two were extended for each substance of interest by accounting for the potential for substance use at time one to influence substance use at time two. In the first instance a model for each substance of interest was run with whole sample data, and the results are presented in Figures X, X and X. All three models include standardised weights and indicators to the latent variables, PAPA-TSU at Time One and Overall Use at Time One and Time Two. However, as two of the indicators to Overall Cigarette Use, Ever Used and Age at First Use, remained constant across Time One and Time Two, Current Cigarette Use at Time One was used as an observed Time One index of cigarette use. Goodness of fit statistics for the alcohol model ($\chi^2=(29)108.9$ CFI = .982 RMSEA = .048, the cigarette model ($\chi^2=(17)127.7$, CFI= .940, RMSEA= .074) and the marijuana model ($\chi^2=(29)90.9$, CFI= .983, RMSEA= .043) suggest that the models fit the data well. In each case the CFI indices are indicative of superior or good fit (Hu and Bentler, 1999), and the RMSEA values representative of good fit or reasonable errors of approximation in the population (Browne and Cudeck, 1993). On this basis of these goodness of fit statistics the models were judged to fit the data well.

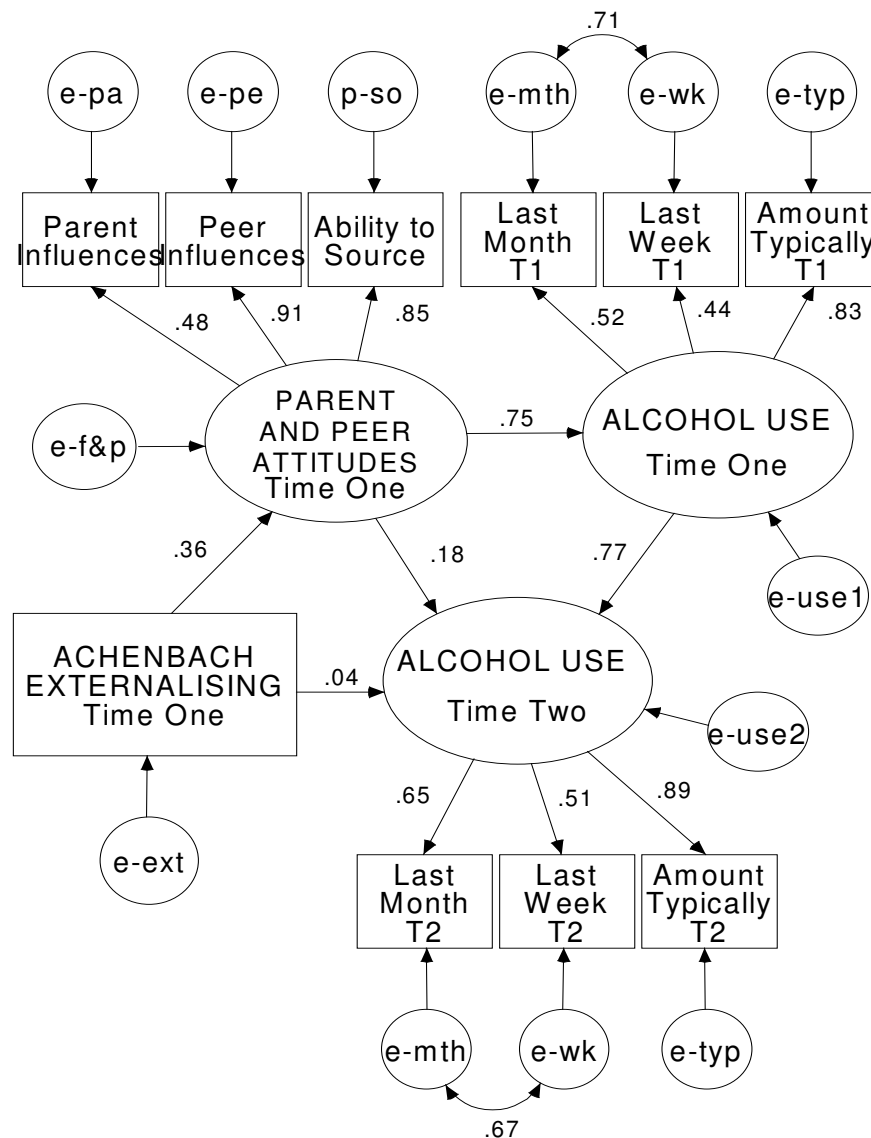


Figure 15: Model of the mediated relation between Externalising Scores at Time One and Overall Alcohol Use at Time Two controlling for Alcohol Use at Time One. The model is based on whole sample data and

includes standardised weights and indicators to the latent variables, PAPA-TSU at Time One and Overall Alcohol Use at Time One and Time Two.

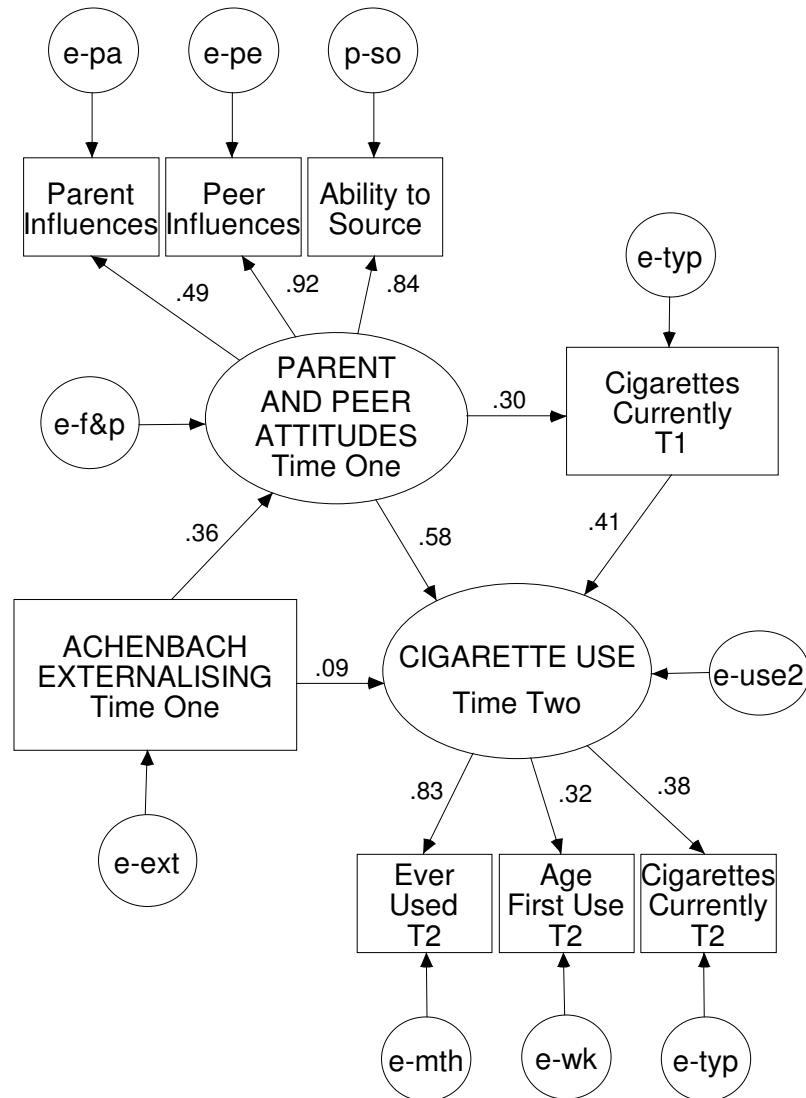


Figure 16: Model of the mediated relation between Externalising Scores at Time One and Overall Cigarette Use at Time Two controlling for Cigarette Use at Time One. The model is based on whole sample data and includes standardised weights and indicators to the latent variables, PAPA-TSU at Time Two. As two of the indicators to Overall Cigarette Use at Time Two, Ever Used and Age at First Use, were also used for Time One, Current Cigarette Use at Time One was used as an observed Time One index of cigarette use.

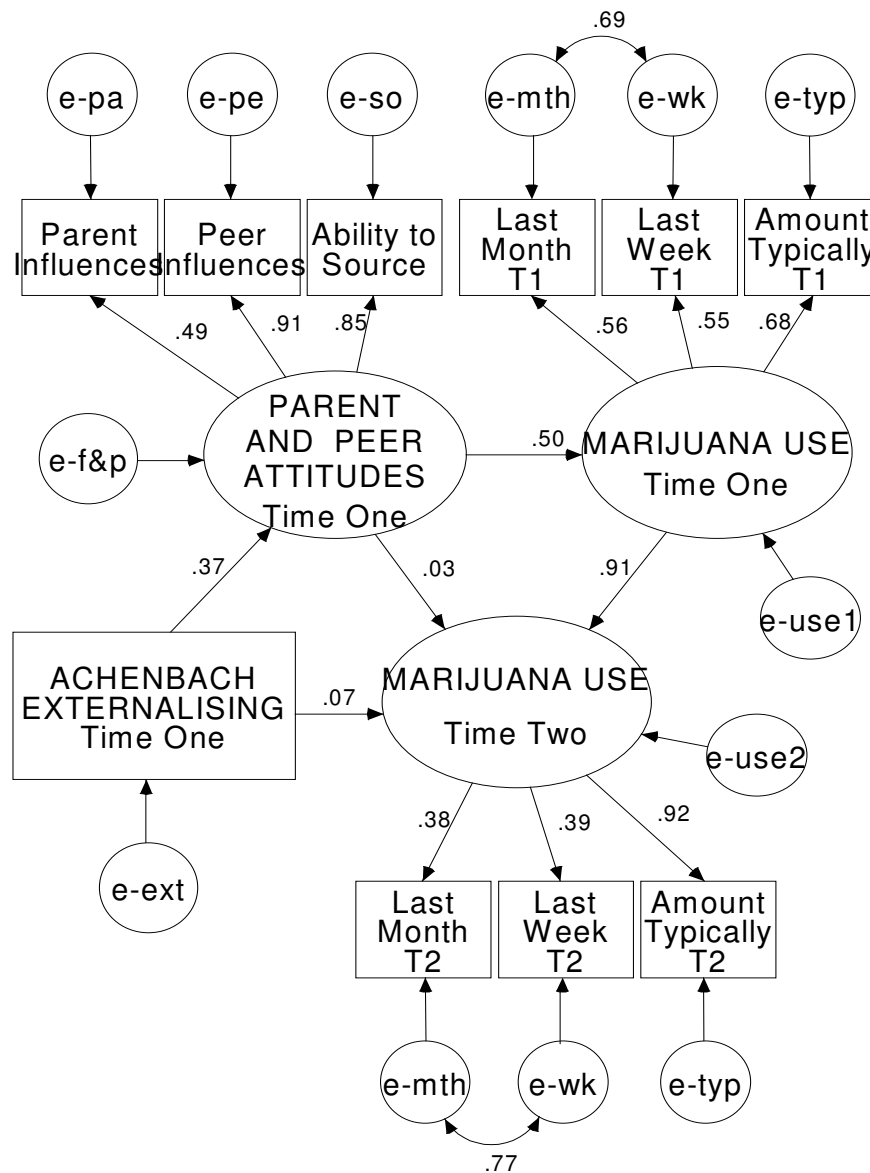


Figure 17: Model of the mediated relation between Externalising Scores at Time One and Overall Marijuana Use at Time Two controlling for Marijuana Use at Time One. The model is based on whole sample data and includes standardised weights and indicators to the latent variables, PAPA-TSU at Time One and Overall Marijuana Use at Time One and Time Two.

The models that account for the influence of substance use at time one on time two substance use suggest a substance specific pattern of relation among the variables of interest. In the case of the alcohol model, the addition of Overall Alcohol Use at Time One reduced the initial standardised regression weight between Family and Peer Influences at Time One and Overall Alcohol Use at Time Two from .79 to .18. Thus, while the addition of Overall Alcohol Use at Time One did not render the original relation non significant, it did serve to add a substantial amount of new variance to the existing model, partially mediating the initial relation between PAPA-TSU at Time One and Overall Alcohol Use at Time Two as a result. For this reason, together with sufficient prevalence in alcohol use at time two, further analysis of the alcohol model across gender and age category groups was deemed appropriate and is reported below.

In the case of the cigarette model, the addition of Cigarettes Currently at Time One reduced the initial standardised regression weight between PAPA-TSU at Time One and Overall Cigarette Use at Time Two from .64 to .58. Thus, the addition of the addition of Overall Cigarette Use at Time One could not be taken to mediate the original relation between PAPA-TSU at Time One and Overall Cigarette Use at Time Two and therefore brought little new variance to the cigarette model. For this reason, together with an overall lack of prevalence of cigarette use in the time two sample, further analysis of this model across gender or age category groups was not undertaken.

In the case of the marijuana model, the addition of Overall Marijuana Use at Time One reduced the initial standardised regression weight between PAPA-TSU at Time One and Overall Marijuana Use at Time Two from .45 to .03. The addition of Overall Marijuana Use at Time One therefore added a substantial amount of new variance to the existing model, and in rendering the original relation non significant almost completely mediated the initial relation between PAPA-TSU at Time One and Overall Marijuana Use at Time Two. However, despite these findings, the rate of prevalence in marijuana use was too low to allow structural models to run when split by age or gender. Thus, no further analysis was undertaken with this model.

3.6.4 Testing for Structural Invariance of the Time Two Alcohol Model Across Groups - Gender

In the final analyses, the fit of the above time 2 models was checked for applicability across gender and age categories. To do this, model fit indices produced for the whole sample were compared to those when the sample was split by gender and age category respectively, with and without the individual regression weights constrained to be equal across groups. The results are shown in Table 41. For each of the substances, there is a consistent trend of small increases in Chi-square as testing moves whole sample to age and gender categories, to completely constrained models. Given the large sample size, many of the changes in Chi-square are statistically significant, however, the actual changes in model fit are trivial and remain excellent across whole sample, gender and age categories, even with all regression weights constrained to be equal. Thus, the structural models presented above for each substance appear to hold well across age and gender.

Table 41: Fit statistics for models tested for the whole sample, then across gender and age categories with regression weights free and constrained.

| | | | (df) χ^2 | CFI | RMSEA |
|-------------|--------------|---------------|---------------|------|-------|
| Alcohol | Whole Sample | | (29) 108.95 | .982 | .048 |
| | Gender | Unconstrained | (58) 124.42 | .985 | .031 |
| | | Constrained | (63) 165.11 | .977 | .037 |
| | Age Category | Unconstrained | (87) 162.71 | .978 | .027 |
| Constrained | | (97) 192.34 | .972 | .029 | |
| Cigarettes | Whole Sample | | (17) 127.76 | .940 | .074 |
| | Gender | Unconstrained | (34) 133.27 | .946 | .050 |
| | | Constrained | (39) 138.74 | .946 | .047 |
| | Age Category | Unconstrained | (51) 129.79 | .949 | .036 |
| Constrained | | (61) 195.08 | .914 | .043 | |
| Marijuana | Whole sample | | (29) 90.94 | .983 | .043 |
| | Gender | Unconstrained | (58) 483.91 | .901 | .079 |
| | | Constrained | (63) 348.88 | .934 | .062 |
| | Age Category | Unconstrained | (87) 206.08 | .968 | .034 |
| Constrained | | (97) 253.04 | .958 | .037 | |

4.0 Discussion

In general terms, the literature review presented above indicated that mental health was positively and significantly related to the development of substance use in adolescence. However, when mental health was categorised in terms of externalising versus internalising disposition, the literature indicated a significant and positive association between indices of externalising behaviour and the development of substance use. The nature of the association between indices of internalising behaviour and mental health, while present, was less clear. Further, a lack of clarity remained about the developmental sequencing of many of the characteristics of both externalising and internalising problems and their association with the use of substances in adolescence. This lack of clarity is particularly apparent when the association between specific forms of psychopathology and the development of substance use in adolescence are explored, and pertains both to the developmental sequencing of psychopathology relative to substance use problems, as well as to the mechanisms that are responsible for their association. The review also identified a number of variables that may be significant in contributing to the development of substance use in adolescence. An individual's social acumen, their motivation to use substances, their ability to regulate emotional response, and the parental and peer context in which they developed have all been demonstrated to have the potential to mediate development towards as well as subsequent use of substances.

The potential also exists for the association between substance use and mental health to be demonstrated both cross sectionally and over time. The demonstration of a cross sectional association allows conclusions to be drawn about the nature of the association at a number of developmental points in time across adolescence, the manner in which the association changes over time, and the nature of influences that co occur. It also allows for comparisons to be made across a variety of substances commonly used in adolescence. When demonstrating an association between mental health and substance use over time, it is possible to address questions about the relative importance of factors that mediate the association, and about the potential to predict future substance use on the basis of characteristics that precede it.

4.1 Mental Health and Substance Use:

The first aim of the present study was to assess the relation between mental health and substance use in a normative sample of adolescent school children. Two hypotheses were drawn in this regard. Firstly, it was hypothesised that a significant and positive association would be demonstrated between Externalising Scores (as derived from the YSR) and use of each of the three substances in question. Secondly, it was hypothesised that a significant and positive association would be demonstrated between Internalising Scores (as derived from the YSR) and use of each of the three substances in question.

Results from the present study offered support for the first hypothesis. Correlational analyses performed on the whole sample suggested a statistically significant and positive association between Externalising scores and substance use, for each of the three substances of interest. This association was demonstrated regardless of whether bivariate correlations were performed between Externalising score and use of each substance, or whether partial correlations were employed and variance attributable to Internalising Score was partialled out of the correlation. When the sample was split by gender and substance, highly significant partial and bivariate associations were demonstrated between use of each substance and externalising scores for both genders. When split by age, gender and substance, highly significant partial and bivariate associations between alcohol use and externalising scores were demonstrated for all female age categories, but only for the 14-15 male age category and alcohol use. Both male and female 14-15 age categories demonstrated highly significant partial and bivariate associations between externalising scores and cigarette use, and the male 14-15 age category demonstrated highly significant partial and bivariate associations between marijuana use and externalising scores.

ANOVA confirmed the significant and positive association between substance use and externalising score with main effects demonstrated for externalising score on each substance tested. The association was underscored by a lack of main effect for gender in any analysis of variance undertaken between substance use and externalising scores. This pattern of results was further supported by a main effect for age in each analysis of variance undertaken between externalising profile and substance use. Thus, as expected, a significant and positive association between externalising profile and substance use was confirmed.

The results of the present study are consistent with the strength and direction of findings in existing research regarding the association between adolescent substance use and externalising disposition (Weinberg & Glantz, 1999; Loeber et al, 1999; Upadhyaya et al, 2002; Rhode et al, 2001; Sung et al, 2004; Brook et al, 1998). Specifically, level of CD, ODD, ADHD, and violence in adolescence has been found to predict level of adolescent alcohol use (White et al, 1999). Strong associations between cigarette use and the presence of psychopathology have also been demonstrated (Boys et al, 2003, Degenhardt et al, 2001), with some evidence that degree of prevalence of tobacco use may operate as a function of disorder type (Joun, Ensminger & Sydnor, 2002; Upadhyaya et al, 2002). Significant cross sectional associations have also been found between cannabis use and psychopathology (McGee et al, 2000) with level of CD, ADHD and violence all predictive of level of marijuana use (White et al, 1999).

While beyond the scope of the present research, the potential for causal processes to exist between substance use and externalising psychopathology have also been investigated in the literature. For instance, in young adolescence, the causal direction of the association between marijuana use and psychopathology appears to be from mental health/externalising behaviour to substance. However, evidence suggests that the reverse may be true of both the causal direction, and the nature of the resulting psychopathology in older adolescence (McGee et al, 2000). Other work has begun to attest to a causal process that places early tobacco use ahead of the development of psychopathology (McGee et al, 2000; Brook et al, 1998). However sufficient evidence has not yet been amassed in this regard and the direction of causality and its mechanisms remain unclear (McGee et al, 2000).

A number of accounts of the association between externalising disposition and substance use have been offered. Given the strength and consistency of the association demonstrated both in the present context and in the literature generally, continued support is provided for a number of these. For instance, the results of the present study may be taken in support of the thesis that a distinct variant of adolescent externalising behaviour may exist. It has been suggested that such a variant is characterised by an underlying externalising spectrum (Krueger et al, 2002) which has the potential to account for disorders characterised by conduct, opposition, defiance and a particular form of associated substance abuse in adolescence. Behaviours characterised by antisocial features and use of substances are hypothesised to be indicative of the spectrum in adults (Iacono et al, 1999; Krueger et al, 2002).

Such models build on earlier conceptualisations of externalising pathology as indicative of a homogeneous group characterised by common genetic and environmental factors of risk (Moffitt, 1993). On balance however, current evidence suggests that externalising pathology, including substance use behaviour, may not be well accounted for by broad classifications of homogeneity (Babor, Webb, Burlison, Kammer, 2002; Fergusson, Lynskey, Horwood, 1996). While results from the present study may be taken in support of such a model, the present study did not demonstrate invariance across substances, and did not assess distinct forms of externalising pathology in relation to use of any of the substances of interest.

A body of emerging evidence does however suggest that while common characteristics may be mapped between different forms of externalising psychopathology and the use of different substances, the patterns of substance use and trajectories of development associated

with particular forms of psychopathology are distinct. CD has been demonstrated to be associated with substance use early in adolescence, however, as normative levels of use increase, the ability for CD to predict substance use decreases (Sung et al, 2004). It may therefore only hold limited predictive ability (Henry et al, 1993). It has also been suggested that any association between CD and substance use, and any association between ODD and substance use, may differ on that basis that the former is characterised by a behavioural association and the later is characterised by a temperamental relation (Sung et al, 2004).

The distinction is further drawn when characteristics of attentional disorders are considered in relation to substance use. Despite a range of findings on the relation between ADHD and substance use (Glantz, 2002; Armstrong & Costello, 2002; Fergusson, 1998), one study in particular underscored the problem of representing externalising pathology as a single cluster by finding that substance use in adolescents diagnosed with ADHD varied as a function of type and severity of externalising problem (Chilcoat & Breslau, 1999). Given its overall lack of consistency, evidence appears to suggest that features that are common across externalising dispositions cannot override the distinctions between them. While findings from the present study offer evidence in support of the association between externalising disposition and substance use, it is beyond the scope of the present study to attempt to add to the debate regarding the distinctiveness or relatedness of particular forms of externalising behaviour.

In contrast to the first hypothesis drawn on the relation between mental health and substance use, results from the present study did not offer substantial support for the second hypothesis. In general terms, the present study failed to demonstrate a statistically significant and positive association between internalising scores and substance use. When whole sample data was considered, or when the sample was split by gender, two patterns of results emerged. Regardless of substance, either highly significant positive bivariate associations were demonstrated, or when the externalising variance was removed, negative partial associations were demonstrated between internalising scores and substance use. This pattern held for all but overall marijuana use for which a significant but negative partial correlation was demonstrated between use and Internalising score.

When the sample was split by gender, and externalising variance accounted for, partial correlations either failed to reach significance (female – alcohol, male – cigarettes, female – cigarettes, female - marijuana), or were significant but negative (male – alcohol, male – marijuana). No main effect was demonstrated for gender in any analysis of variance undertaken between substance use and internalising profile. When the sample was split by age and gender, and externalising variance removed from significant bivariate correlations between Internalising score and substance use, the resulting partial correlations generally failed to reach significance. An age effect was apparent with a main effect for age evident in each analysis of variance undertaken between internalising profile and substance, regardless of the age category or gender group analysed. Thus, a lack of statistical significance characterised the association between internalising profile and substance use.

Consistent with recent hypotheses conceptualising a variant of adolescent substance use characterised by externalising pathology and behavioural disinhibition (Lilienfeld, 2003; Krueger, Hicks, Patrick, Carlson, Iacono, McGue, 2002; Iacono, Carlson, Taylor, Elkins, McGue, 1999), some evidence has been offered to suggest that internalising behaviours and substance use in adolescence may be indicative of a syndrome of behaviours that may already be in evidence in childhood (Compas and Oppedisano, 2000; Zahn-Waxler et al, 2000; Hanna et al, 2001). Evidence in support of this position may be taken from the finding that comorbidity between internalising disorders in both children and adolescents is more prevalent than individual internalising disorders in their pure form (Zahn-Waxler et al, 2000; Vasey and Ollendick, 2000). A second but related position suggests that categorical distinctions may exist between internalised disorders, holding for instance that anxiety and depression are in fact

distinct disorders which have the potential to share a considerable proportion of their clinical features. It may be taken that the present study offers limited support for both positions.

When investigated on the basis of individual disorders however, the relation between internalising psychopathology and substance use remains much less clear (Grant, Stinson, Dawson, Chou, Dufour, Compton, Pickering, & Kaplan, 2004; Dierker et al, 2002; Grant et al, 2004; Weinberg & Glantz, 1999; Woodward & Fergusson, 2001). While a review of the literature suggests that in treatment samples the direction of progression in adolescence is from psychopathology to substance use problem, the normative literature offers a less clear account of the direction of, and the mechanisms inherent in, such a progression (Armstrong & Costello, 2002). Of considerable interest is the unique contribution that various subtypes of internalising disorders have been shown to play in adolescent acquaintance with substance use.

Regardless of gender, symptoms of anxiety in childhood and adolescence have been demonstrated to be unrelated to the onset of alcohol use (Kaplow, Curran, Angold, & Costello, 2001), however symptoms of generalized anxiety placed children and young adolescents at increased risk for initiation into alcohol use four years after initial assessment, and symptoms of separation anxiety in children and young adolescents decreased their risk of initiation into alcohol use (White et al, 2001; Kaplow, Curran, Angold, & Costello, 2001). When taken together, the avoidant features that often characterise internalising disposition may act to protect against the development of later substance use problems while the negative affect that also often characterises internalising disposition may be positively related to adolescent substance use (Myers et al, 2003; Windle, 1993).

It is possible that a positive relation between internalising disorders and substance use might be found when broad classifications are discarded (Babor, Webb, Burlinson, Kaminer, 2002; Fergusson, Lynskey, Horwood, 1996) and investigation is carried out at the symptom level (Fergusson, 2003; Kaplow, Curran, Angold, & Costello, 2001). The present study failed to address this necessity, instead demonstrating a lack of association between an overarching internalising disposition and use of the three substances of interest. In so doing, and in light of evidence discussed above, it is plausible to argue that the present research offers evidence contrary to the suggestion that internalising disorders emanate from a common underlying spectrum.

The overall pattern of results with regard to substance use and internalising disposition in the present study is of interest. It was with remarkable consistency that either non significant positive, or non significant negative associations were demonstrated between internalising score and use of substance. This pattern of association was evident regardless of gender or the manner in which the sample was split. Consistent with existing research, no main effect for gender was demonstrated for any substance of interest (Brook et al, 2002; Brook et al, 1998). However, the potential to derive implications from the present research on the subject of individual substances and their relation to psychopathology are limited given the existing findings in relation to the association between adolescent use of substances and distinct forms of internalising psychopathology.

4.2 Mediating Factors:

The second aim was to assess mediation between mental health and substance use. A literature review identified four factors that were commonly associated with the development of substance use in adolescence and a hypothesis concerning the potential of each to mediate the relationship between mental health and substance use was drawn. Given that a statistically significant association between YSR internalising scores and substance use was not demonstrated above, internalising scores were discarded from further analysis and potentially mediating variables were only assessed in relation to externalising scores. Four mediational hypotheses were therefore tested.

4.2.1 Social Skills:

Social skills, as indicated by scores on the SSRS, did not mediate the relationship between whole sample externalising scores and use of any of the three substances of interest. While a significant and negative first indirect effect was demonstrated between externalising scores and social skills, the second indirect effect, the relation between the hypothesised mediator and each of the substances of interest was, for all three substances, negative and non-significant. Social skills was therefore discarded as a mediating variable in the relation between externalising scores and substance use and excluded from further analysis.

The failure of social skills to mediate the relation between mental health and substance use is interesting for a number of reasons. On the face of it, the failure of social skills to function as a mediator in the present context appears consistent with the loss of internalising scores as a result of their failure to demonstrate a significant association with substance use. The use of substances to aid social interaction and to cope with or alleviate aversive life events or situations (Windle & Windle, 1996; Cooper, 1994; Cooper et al, 1995) is relatively well established. Social motives and coping motives have been studied in relation to the use of alcohol, tobacco and marijuana in adolescents (Comeau et al, 2001; Simons et al, 1998; Cooper, 1994; Cooper et al, 1995). Also of interest is evidence that adolescents and young adults who report avoiding dealing with daily problems have a tendency for increased alcohol use (Godshall & Elliott, 1997; Herrick & Elliot, 2001; Slavkin et al, 2002). Conversely, adolescents who abuse substances may come from families that lack problem solving and coping skills (Hops et al, 1990).

However, evidence also suggests that limitations in social skills ability may be implicated in the development and maintenance of externalising behaviour, and in the present context, a significant relation was demonstrated between externalising scores and the use of each of the three substances in question. Social-cognitive formulations of substance use behaviour hold that both cognitive and biological factors have the potential to predispose to maladaptive social learning. Inappropriate social response may result from inability to identify situational demands, inability to generate response options, or inability to undertake and evaluate the possible consequences of a proposed response (Spence, 2003). Substance use, therefore, may occur within such a context in an attempt to compensate for a lack of appropriate or functional social behavioural repertoire (Mackay, Donovan, Marlatt, 1991). As such, substance use occurs as part of a compensatory behavioural repertoire (Mckay et al, 1991) undertaken in the absence of appropriate social behaviour (Herrick & Elliot, 2001; Marlett, Baer, Donovan & Kiviahah, 1988).

The development of social cognition in particular has been demonstrated as an important factor of risk for the development of CD. Evidence has been offered to suggest that CD disordered adolescents develop a social cognitive style that is markedly different from non CD individuals. Expectation of hostility, over-detection and elicitation of hostility, and recourse to aggression as a problem solving strategy typically characterise the social cognitive behaviour of conduct disordered adolescents (Dadds, 1996; Craig and Pelper, 1997). Further, both CD and anxious children, and their families, have been demonstrated to hold a greater propensity to interpret ambiguous situations as hostile, and to respond to the perceived threat in such situations with aggressive strategies (Barrett et al, 1996). Importantly, reciprocal relationships have been demonstrated to exist between the level of hostility inherent in parental responses and the behavioural strategies children endorse (Barrett et al, 1996).

Cognitive and biological factors have also been implicated in the behaviour of individuals suffering attentional problems. A causal relationship has been hypothesised between deficiencies in monoamines and the development of ADHD (Campbell, 2000; Essau et al, 1997), between the reticular activating system and the development of ADHD (Essau et al, 1997), and between the adrenaline formation imbalance and the development of ADHD (Essau et al, 1997). Further, a range of cognitive and behavioural deficits characteristic of prefrontal cortical dysfunction have also been implicated in the development of ADHD

(Barkley, 1997). For instance, executive function was found to be significantly related to ADHD in young adults with significant differences between ADHD participants and controls on measures inhibition, interference control and non-verbal working memory (Murphy et al, 2001).

The present study offers limited evidence in support of research undertaken by Griffin et al (2002), who found that adolescents who demonstrated greater social confidence, increased assertiveness, and good communication skills, reported less consumption of alcohol and tobacco. Research has also indicated that use of alcohol may be accounted for in terms of social skills, either independently of, or in combination with, expectations about alcohol use (Gaffney et al, 1998; Barkin et al, 2002). Further research by Botvin (2000) extended these findings and concluded that targeting individuals during the beginning of adolescence and teaching social/drug resistance skills represented the most efficacious form of intervention against substance use.

One reason that social skills was not demonstrated to mediate the relation between internalising scores and substance use, yet was demonstrated to mediate the relation between externalising scores and substance use, may be found in the relation between internalising profile and substance use. Research has indicated that, while externalising characteristics in childhood can predict substance use behaviour in adolescence (White et al, 1999; Boys et al, 2003, Degenhardt et al, 2001; McGee et al, 2000), avoidant characteristics may act to protect against later substance use problems (Myers et al, 2003; Windle, 1993). Consistent with the present research, when symptoms of anxiety in childhood and adolescence were taken together they were demonstrated to be unrelated to the onset of alcohol use (Kaplow, Curran, Angold, & Costello, 2001). When differentiated on the basis of disorder, symptoms of generalized anxiety placed children and young adolescents at increased risk for initiation into alcohol use four years after initial assessment, while symptoms of separation anxiety in children and young adolescents decreased their risk of initiation into alcohol use (White et al, 2001; Kaplow, Curran, Angold, & Costello, 2001). These findings were equally strong for boys and girls. Although direct comparison with the present research is not possible, these results suggest that avoidant characteristics in childhood may act to protect against the development of later substance use problems, while negative affect may be positively related to adolescent substance use (Myers et al, 2003; Windle, 1993). Were the present research able to differentiate internalising profile on the basis of individual disorder, clarification of the results regarding social skills may be possible.

4.2.2 Motives..

Results from the present study offered limited support for the second mediational hypothesis, that motivation for substance use would mediate the relationship between mental health and substance use for each of the three substances of interest. As previously reported, when whole sample data were analysed, only externalising scores were demonstrated to be associated with substance use. Thus, Internalising Scores were not analysed in the present context. When the alcohol motives measure was analysed as a single measure, and not broken down into subscales, a positive and significant first indirect effect was demonstrated between Externalising Scores and Alcohol Motives, and a positive and significant second indirect effect was demonstrated between Alcohol Motives and Overall Alcohol Use. Positive but non significant first indirect effects were demonstrated between Externalising Scores and both Tobacco Motives and Marijuana Motives, and positive but non significant second indirect effects were demonstrated between Tobacco Motives and Marijuana Motives and Current Cigarette Use and Overall Marijuana Use respectively.

The present results demonstrated that alcohol motives, acted to mediate the relation between Externalising Scores and Overall Alcohol Use. When the alcohol motives measure was analysed as a unitary construct, and whole sample data drawn upon, positive and significant first and second indirect mediational effects were evident between Externalising

Scores and Alcohol Motives. However, given that the motives measure utilised in the present context is comprised of Cooper's four (1993, 1994) subscales together with Simons et al's (2000) expansion subscale, treating the motives measure as a unitary construct offers little substantive meaning. With the sample split by age category and gender, hierarchical regression analyses were employed to assess the unique ability of each of the motives subscales to predict adolescent use of alcohol from Externalising Scores. With one exception, individual motives were unable to significantly add to the predictive ability of the relation between Externalising Scores and alcohol use. The exception was conformity motives which significantly and positively predicted the alcohol use of 14-15 year old males. This finding was contrary to existing research which found conformity motives would display a negative relation to quantity and frequency of use (Comeau et al, 2001; Cooper, 1994).

When the Tobacco Motives and the Marijuana Motives measures were analysed as unitary constructs, and whole sample data drawn upon, the motives measures failed to mediate the relation between Externalising Scores and use of either tobacco or marijuana. Further, when the sample was split by Age Category and Gender, hierarchical regression analyses generally failed to demonstrate a significant pattern association between individual motives and the use of either tobacco or marijuana. Three exceptions to this pattern association were evident; Expansion Motives positively and significantly predicted 13< Age Category females' use of marijuana, Coping Motives negatively and significantly predicted 13< Age Category males' use of Cigarettes, and Coping motives positively and significantly predicted 16+ Age Category males' use of marijuana. This lack of clear association is also contrary to existing research (Simons et al, 2000; Comeau et al, 2001). The failure to mediate the relation between whole sample Externalising Scores and use of each of these substances may, in part, be explained in terms of prevalence. A greater proportion of the present sample reported alcohol use than either marijuana or tobacco use. In addition, and in contrast of some of the literature reviewed previously, the present research drew on a normative and relatively young sample. The combination of young age, normative sample and low prevalence of use of tobacco and marijuana may offer insight into the lack of significant findings.

The general failure of internalising scores to demonstrate a significant relation with use of any of the three substances of interest when tested with whole sample data is of interest, particularly given the literature on the relation between affect and substance use. One exception, a negative and significant association between males' Internalising Scores and Overall Alcohol Use, was evident. Motivation toward substance use has been demonstrated to result, at least in part, from regulation of affect (Leigh, 1989; Wills & Shiffman, 1985; Cooper, 1995). A strong positive association between negative affect and elevated use of substances has been reported (Wills et al, 1999) and use of substances has been demonstrated to result from desire to enhancing positive affective states and/or to reducing negative affective states (Leigh, 1989; Wills & Shiffman, 1985). In addition, studies drawing on clinical samples have demonstrated that adolescents who use illicit substances have elevated rates of major depression and of anxiety disorders (Clark et al, 1997; Kandel et al, 1997).

Evidence has suggested that psychopathology characterised by internalising features may act to protect against initiation into of the development of substance use behaviour (Myers et al, 2003; Windle, 1993). As discussed above, when taken together, symptoms of anxiety in childhood and adolescence have been demonstrated to be unrelated to the onset of alcohol use (Kaplow et al, 2001), however, when differentiated on the basis of disorder, differential patterns of association were demonstrated between distinct profiles characterised by internalising characteristics and risk for initiation into alcohol use (White et al, 2001; Kaplow et al, 2001). One explanation for the present results may be that adolescents returning high internalising scores were, by-en-large, characterised by avoidant features as opposed to features of negative affect. Thus, their trajectory into substance use would, on the basis of previous evidence, be averted or allayed. Similarly, given that the present research drew on a

normative sample, the prevalence of negative affect necessary to propel an adolescent into substance use would be expected to be small and potentially overshadowed by characteristics more prevalent in such a sample (for instance low level internalising or externalising features). Again, were the present research able to differentiate internalising profile on the basis of individual disorder, clarification of the results regarding motives for substance use may be offered.

On the basis of the present results, and the examination of the relative contributions of individual motives toward substance use, little support can be offered for the thesis that people engage in substance use to attain certain outcomes (Cox & Klinger, 1988) or that implicit or explicit assumptions characterise their motivation toward use (Cutter & O'Farrell, 1984). Again, however, the age of the present sample, its normative status, and the levels of prevalence of use of substances may explain the present findings. Levels of substance use behaviour, particularly with regard to the use of tobacco and marijuana, were not high in the present sample. To the extent that prevalence is low, and the behaviour of interest has not yet been established, motivation for use may also be expected to be low. Thus, motivation for alcohol use was generally demonstrated to mediate the relation between externalising scores and alcohol use because alcohol use had been widely established across the sample utilised in the present study.

While the relation between externalising behaviour and substance use is relatively well established in the literature, the relation between the one's desire to induce, increase, or maintain positive affect and the use of substances is not yet clear (Wills et al, 1999; Cooper 1994; Stewart et al, 1996). The lack of significant effect demonstrated by the individual motives measures in relation to externalising scores stands at odds with research suggesting that substance use will be motivated by a desire to enhance positive emotion (Wills & Shiffman, 1985), as well as research that provides evidence for an inverse relation between positive emotion and substance use (Wills et al, 1999, Cooper, 1994; Newcomb et al, 1988). Wills and Shiffman (1985) argued that enhancement of positive emotion would result in enhancement motivated drinking. However, the distinction between enhancement of current affective state and alteration of current affective state remains unclear. Positive emotions are not generally associated with behavioural responding, and if alcohol use is an appetitive behaviour it would be characterised by a desire to alter the current affective state (Cooper, et al, 1995), as distinct from enhancing or maintaining it. Clarification of these two positions may be offered by Colder and Connor (2002) who suggested that the inhibition of behaviour would decrease to the extent that the behaviour was associated with the expectation of reward. Thus, both frequent alcohol use and the associated enhancement of affect were strongly related to reward cues and disinhibited behaviour and, therefore, appetitive responding (Colder and Connor; 2002).

4.2.3 Emotion Regulation

The third mediational hypothesis that emotion regulation would mediate the relationship between mental health and substance use for each of the three substances of interest was partially supported.

Regression analyses suggested that significant first and second indirect effects were evident for whole sample data for alcohol and tobacco, but not marijuana. However, when analysed within the context of the development of a structural model, whole sample goodness of fit statistics indicated that the alcohol model did not fit the data well. A lack of any relationship between emotion regulation scores and alcohol use indicated that emotion regulation was not functioning to mediate the relation between externalising scores and the use of alcohol. Similarly, while regression analyses suggested that significant first and second indirect effects were present for whole sample tobacco data, whole sample goodness of fit statistics indicated that the tobacco model did not fit the data well. The standardised regression weight for the relation between emotion regulation scores and tobacco use was non-significant

indicating that emotion regulation was not functioning to mediate the relation between externalising scores and the use of tobacco. A decision was therefore taken to discard emotion regulation from further analysis, and the third mediational hypothesis was rejected.

4.2.4 Parent and Peer Attitudes Toward Substance Use.

Finally, it was hypothesised that parent and peer attitudes toward substance use, as indicated by scores on the PAPA-TSU, would mediate the relationship between mental health and substance use for each of the three substances of interest. Regression analyses revealed strong and statistically significant first and second indirect effects. When analysed within the context of the development of a structural model, whole sample goodness of fit statistics indicated that the models for each of the three substances fit the data well. In each case, the original relation between externalising scores and use of the substance was either completely or partially mediated by scores on the PAPA-TSU. The final mediational hypothesis, that parent and peer attitudes toward substance use, as indicated by scores on the PAPA-TSU () would mediate the relationship between mental health and substance use for each of the three substances of interest was, therefore, upheld.

4.3 A Comprehensive Cross-Sectional Structural Model

A structural model was developed to account for the mediated relationship between mental health and substance use. Again, as Internalising Scores were demonstrated to bear little significant relation to the use of any of the three substances of interest, they were discarded from inclusion in the structural models. Assessment of the four potential mediators (above) also led to the exclusion of Social Skills, motivations for substance use, and emotion regulation from further analysis. Thus, the final model tested was that Parent and Peer Attitudes Toward Substance Use would mediate the relationship between mental health and substance use for each of the three substances of interest, was also supported. Regression analyses revealed strong and statistically significant first and second indirect effects. A positive and highly significant relation was established between Externalising Scores and PAPA-TSU Scores, and positive and highly significant second indirect effects were demonstrated between scores on the PAPA-TSU and use of Alcohol, Tobacco and Marijuana. When the PAPA-TSU data were read into AMOS 5 (Arbuckle, 2003), and analysed within the context of the development of a structural model, whole sample goodness of fit statistics indicated that the models for each of the three substances hypothesised on the basis of results generated from the regression analyses, fit the data well. In each case, the original relation between externalising scores and use of the substance was either completely or partially mediated by scores on the PAPA-TSU. Thus, the final mediational hypothesis, that parent and peer attitudes toward substance use, as indicated by scores on the PAPA-TSU (Dadds and McAloon, unpublished) would mediate the relationship between mental health and substance use for each of the three substances of interest was, therefore, upheld.

4.4 Longitudinal Structural Model

The above conclusion about the role of Parent and Peer attitudes in mediating the relationship between mental health problems and substance use, is based on cross-sectional data. Thus, no conclusions about the predictive nature of the relationships can be made. Thus, in the final stage of the research, the relationships were tested across time to check whether they actually predicted change in each other. Thus, the final stage of the research looked at the whether mental health problems at time 1 predicted substance use at time 2 after controlling for substance use at time 1, and then whether this relationship was mediated by Parent and Peer attitudes.

As expected, time 1 externalising problems were significantly predictive of time 2 substance use for alcohol (regression weight = .32), cigarettes (regression weight = .40) and marijuana (regression weight = .28). For each substance, this relationship was mediated by Parent and Peer attitudes such that the relationships between externalising scores and substance use were no longer significant when the Parent and Peer measure was added in. Of

critical importance was the final test of whether this mediation remained significant when time 1 substance use was controlled. For alcohol and cigarettes, this held, but for marijuana, the mediation path from Parent and Peer attitudes to time 2 use was no longer significant. These results held across genders and age groups.

Thus, high externalising behaviour problems at time 1 were significantly predictive of higher levels of alcohol, cigarette and marijuana use 12 months later. The effects of the time 1 behaviour problems were, however, mediated by Parent and Peer attitudes. Thus, externalising problems at time 1 were likely to lead to increased use at time 2 to the extent that the individual reported their parents and peers were facilitating their substance use. This held for alcohol and cigarettes, but not for marijuana; the latter was marked by stability across time. That is, time 2 use was solely predicted by time 1 use, which was in turn related to externalising problems and parent and peer attitudes.

4.5 Summary

The above findings lead to the following general conclusions:

- Alcohol, cigarette, and marijuana use in this sample of Australian youth was significantly associated with mental health problems in the form of externalising problems, viz., outward aggression, antisociality, and impulsiveness.
- Mental health problems of anxiety and depression were not associated with substance use once their shared variance with externalising problems were controlled.
- The relationship of these externalising problems to substance use was largely mediated by the social milieu, that is, the attitudes that the adolescent's parents and peers held toward substance use. Thus, externalising problems were associated with increased usage to the extent that the individual was in a social environment that facilitated drug use.
- There was no evidence that social skills, emotion regulation, or the motives reported for substance use, had roles in mediating the relationship between mental health and substance use.
- The influence of mental health problems and the mediation by parent and peer attitudes, on substance use, is predictive. That is, higher externalising problems in the context of a facilitative social environment predictive increase in substance use over time. Thus, these relationships are likely to be critical in the development of substance use.

Overall, these results show that behaviour problems in early adolescence are predictive of substance use problems over time. Further, this predictive relationship works largely via social mechanisms such that adolescents with behaviour problems are likely to show increased substance use if they inhabit a world in which substance use is facilitated. The implications for early intervention are that efforts should be directed toward the remediation of externalising behaviour problems, and providing protective mechanisms that buffer the negative effects of parental and peer influences on substance use.

4.6 Limitations of the Current Design

Some strengths and limitations of the current study should be noted. The sample was a reasonable size and reasonable retention rates from time 1 to time 2 were achieved. Considerable effort was made to ensure the sample was representative of the general population. The extent to which the findings generalise to all sections of the population however, is not known and it should be noted that the sample had insignificant representation by rural, indigenous, and other groups that make up Australian communities. Considerable effort was also put into measure development and validation, however, it should be noted that all measures were self-reported by the adolescents. Thus, the results need to be read throughout as referring to the adolescents' perceptions of the construct under investigation.

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