

adolescents

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introduction

Population based studies have consistently shown cannabis to be the most widely used illicit drug in various communities around the world (European Monitoring Centre for Drugs and Drug Addiction, 2006; Substance Abuse and Mental Health Services Administration, 2006), particularly amongst young people. Similarly in Australia; data from the 2004 National Drug Strategy Household Survey indicate that approximately one quarter (26%) of 14-19 year olds have ever used cannabis and almost one fifth (18%) have used in the past year. This equates to approximately 300,000 young people in Australia who are recent cannabis users (Australian Institute of Health and Welfare, 2005).

It is now the case in Australia that young people (aged 14-19) are marginally more likely to be recent users of cannabis than recent users of tobacco (18% vs. 16.7%, respectively) (Australian Institute of Health and Welfare, 2005). In 2001, of those who had used in the past year, 35% of young males and 25% of young females reported using cannabis at least weekly (AIHW, 2002). These figures accord with those from the Australian School Student's Alcohol and Drugs Survey, a national study of secondary school students (n=21,800), with 18% of 12-17 year olds reporting having ever used cannabis and 14% past year use. More than one in ten (11%) 12 year old males in this sample reported lifetime use and 8% past year use. Prevalence rates increased with age up to 46% and 39% of 17 year old males for lifetime and recent use, respectively. Females reported lower, but still substantial, rates of use with 38% and 29% of 17 year old females reporting lifetime and recent use (White & Hayman, 2004).

Data from the USA are broadly comparable with 17% and 13% of 12-17 year olds in a general population sample reporting lifetime use and past year use, respectively (SAMHSA, 2006). The Monitoring the Future study provides data relating to substance use among secondary school students; data is collected annually and dates back over 30 years. The most recent dataset indicates that 46% of Grade 12 students had used cannabis at some time in their life and more than one third (34%) had done so in the past 12 months. One in five (20%) reported using

in the past month. Of even greater concern is that 5.6% of this group reported *daily* cannabis use in the past 30 days (Johnston, O'Malley, Bachman, & Schulenberg, 2005).

While there has been some apparent reduction in the annual prevalence of cannabis use among adolescents in both the USA and Australia in recent years (AIHW, 2006; SAMHSA, 2006) the figures reported still represent a very considerable population of young people who use cannabis, a sizable proportion of whom are using regularly or daily. Certainly, there has been no reduction in the prevalence of frequent use in this group (SAMHSA, 2006). At the population level, the large absolute number of young people using cannabis frequently is of concern given that a prospective cohort study of Australian adolescents found a greatly elevated risk of developing cannabis dependence (OR=4.9) by the age of 20 for those adolescents using cannabis weekly or more often (Coffey, et al., 2003). It should also be borne in mind that the dependence liability of cannabis is substantial; in the general population, an estimated 9% of those who ever use cannabis will go on to develop cannabis dependence (Anthony, Warner & Kessler, 1994), rising to an estimated one in three of more regular users (Hall, Degenhardt & Lynskey, 2001).

natural history of cannabis use

Cannabis use initiation peaks around 15-18 years of age (Wagner & Anthony, 2002) and use typically remains experimental or intermittent. The prevalence and frequency of use tends to increase over the mid to late teens before beginning to decline in the mid-20s (Coffey, Wolfe & Patton, 2000; Perkonig et al., 1999), a maturational effect that may be associated with the development of new professional responsibilities, marriage, parenthood, and other associated adult responsibilities (Chen & Kandel, 1995). Not all young people's cannabis use, however, conforms to this general pattern and a minority report earlier initiation and patterns of heavier use that increase the likelihood of, and exposure to, cannabis-related harms (Johnston et al., 2005; von Sydow et al., 2001).

It has been reported that an earlier age of initiation and more frequent use of cannabis predict the escalation and persistence of use (Coffey et al., 2000; DeWit, et al., 2000), and the later development of dependence (Winters & Lee, 2008; Fergusson et al., 2000). This is of considerable concern given that, in addition to the widespread use of cannabis among young people, there is clear evidence that the average age of initiation to cannabis use has been decreasing among successive birth cohorts over several decades (Degenhardt, Lynskey & Hall, 2000; SAMHSA, 2006). It has been reported that those who begin using cannabis prior to the age of 15 are 3.4 times more likely than those who start using over the age of 18 to report symptoms of dependence in adulthood (Dennis et al., 2002). Over the past decade, in the USA, approximately 40% of all new initiates to cannabis users were under the age of 15 years (Dennis et al., 2002), which may be indicative of a serious emergent problem.

harms associated with adolescent cannabis use

Experimentation and novelty-seeking are a normal part of adolescent development (Pumariega et al., 2004; Galvan et al., 2006), and indeed experimentation with some drugs (e.g., alcohol) is statistically normal, i.e., by late adolescence more young people have tried alcohol than have not (AIHW, 2006). Young people who regularly use cannabis, however, may risk negative effects at a time of rapid physical and psycho-social development. There is evidence that younger people (14–15 years) are more likely to suffer the adverse consequences of regular cannabis use than their 20–21 year old peers (Fergusson, Horwood & Swain-Campbell, 2002).

There are particular potential harms associated with cannabis use as an adolescent. And, as noted earlier, these may be associated with early age of initiation and frequency of use. Specifically, earlier and greater use of cannabis is associated with an increased risk of a range of problems including poorer mental health and psychosocial adjustment, lower educational achievement, school drop out, use of other illicit drugs, and criminal offending (Ellickson, Martino & Collins 2004; Lynskey, et al., 2003; Patton, et al., 2002; Arsenault, et al., 2002; Brook et al., 1999; Fergusson, Horwood & Beautrais, 2003; Fergusson & Horwood, 2000; Fergusson, Horwood & Swain-Campbell, 2002; Lynskey & Hall, 2000; Stenbacka & Stattin, 2007).

cannabis and adolescent brain development

It has been suggested that the development of the nervous system could be adversely affected by the use of cannabis, which could constitute a chemical insult at a potentially vulnerable point in neural development (Schweinsberg, Brown & Tapert, 2008; Lubman, Yucel & Hall, 2007; Beckson, 2005). Some preliminary evidence suggests that the use of cannabis during puberty may be associated with specific and persistent alterations in neurological function in humans (Ehrenreich, et al., 1999). Specifically, early onset cannabis use (onset before age 16) was found to be associated with an impairment in visual scanning in adult life. Visual scanning is known to undergo a major maturational process around ages 12-15 (Ehreneich, et al., 1999). It was hypothesised that the use of cannabis during this vulnerable period in the development of attention-related neuronal networks resulted in the development of a lasting impairment. In addition, Pope and colleagues found persistent verbal and memory deficits among detoxified adult cannabis users who had commenced cannabis use prior to the age of 17 years, but not in those who had started later in life (Pope, et al., 2003), i.e., only those people who initiated their cannabis use early showed lasting negative effects. (These effects appeared to be largely mediated by group differences in verbal IQ). Some further support for the notion of an age-related neurological vulnerability to cannabis use comes from a magnetic resonance imaging (MRI) study that found differential measures of brain volume as a function of age of initiation to cannabis use; those who started using prior to age 17 had smaller whole brain and grey matter volumes than those who commenced use later (Wilson, Mathew, Turkington, Hawk, Coleman, & Provenzale, 2000). It was suggested that early adolescence may be a critical period for adverse effects of cannabis that are not present when exposure begins later. While far from conclusive, these findings are suggestive of a potential role of cannabis in negatively influencing neurological development during a critical developmental phase.

Regardless of the potential neurobiological impact of early cannabis use, there are other important issues to consider. Adolescence is a time of crucial tasks of psycho-social development such as identity formation, individuation from the family, interpersonal and occupational skill acquisition, and the taking on of work and family responsibility (Pumariega, Rodriguez & Kligus, 2004; Dahl, 2004). Regular intoxication may interfere with the successful negotiation and completion of these tasks (Leccesse & Waldron, 1994).

cannabis and mental health: psychosis

The potential mental health impact of cannabis use that has caused the most public concern and research attention has been the relationship between cannabis use and psychotic disorders (Hall, 2006). A recent systematic review and meta-analysis of data from 11 prospective studies (Moore, et al., 2007) reported an increased risk of any psychosis in people who had ever used cannabis of about 40% (pooled adjusted OR=1.41, 95% CI=1.20-1.65). There was also evidence of a dose-response effect, with most studies showing a 50%-200% increase in risk (OR=2.09, 1.54-2.84) for those who had used cannabis more frequently.

Capsi et al. (2005) examined the effect of cannabis use by age 15, or regular use by age 18, on the diagnosis of schizophreniform disorder at age 26, after controlling for potentially confounding variables. It was found that of those young people carrying a variant of the catechol-o-methyltransferase (COMT) gene, and had used cannabis, had a risk of reporting psychotic symptoms that was ten times higher than those who did not have that variant and had used cannabis (OR 10.9, 2.2-54.1). This interaction was only observed in those who had used cannabis prior to the age of 18, with no evidence of interaction in those who first used it after age 18 (Capsi et al., 2005). This initial study provides further suggestive evidence of the potential hazards of early onset cannabis use.

cannabis and mental health: depression and anxiety

There is some evidence for a link between cannabis use and depression. A meta-analysis of prospective studies reported a pooled adjusted odds ratio of 1.49 (95% CI=1.15-1.94) for depression according to the most frequent cannabis use category in each of the individual studies examined (Moore et al., 2007). Results reported in this study for anxiety outcomes according to cannabis use were non-significant OR=1.4 (95% CI=0.96-2.04). While the data concerning depression and anxiety outcomes are less clear than those for psychosis, there remains reasonable evidence that cannabis use and, in particular, regular adolescent cannabis use, is a risk factor for developing depressive symptoms later in life.

cannabis and education

A major parental concern is that cannabis use in adolescents will impair educational performance and increase the risk of school failure by interfering with learning (Hall, 2006). There are considerable data from cross sectional studies showing that cannabis use is associated with poorer school performance, lower grades, more negative attitudes to school, poorer attendance, and early school drop-out (see Lynskey & Hall, 2000 for a review). The strength of these associations tends to be decreased in longitudinal studies when account is taken of potential confounding variables, but generally the associations have been found to persist. Using data from a New Zealand cohort, Fergusson, Horwood & Beautrais (2003) found a dose-response relationship between frequency of cannabis use by age 16 and the likelihood of leaving school with no qualifications. Those who had used cannabis 1-9 times by age 16 were 1.5 times (95%CI=1.2-2.0) more likely than non-users to leave school without qualifications, with the risk increasing to 3.7 times (95%CI=1.8-7.5) for those who had used 100+ times by age 16. Similar findings were reported by Lynskey et al. (2003) in an Australian cohort; young people who used cannabis weekly in year 10 (age 15) had an odds ratio of 5.7 (95%CI =2.0-15) of early school-leaving. In both of these prospective studies the negative effect of cannabis on education diminished with increasing age, i.e. the effect was most evident among the younger and more frequent users (Fergusson et al., 2003; Lynskey et al., 2003).

Given the centrality of education to occupational and later life opportunity, it is of serious concern that early and regular cannabis use is associated with poorer educational performance and, in particular, school drop-out.

cannabis and dependence

Young people are more likely to meet criteria for cannabis dependence (for a given exposure) than adults, possibly because of an increased susceptibility to the syndrome or the impact of age-cohort effects (Chen & Anthony, 2003; Dennis, et al., 2002). The population prevalence of cannabis dependence increases throughout adolescence, up to levels of 10% or more among young adults (Coffey et al., 2002; Fergusson & Horwood, 2000; Perkonig et al., 1999). In the Dunedin Multidisciplinary Health Study cohort, 8.6% of 18 year old males were reported to be cannabis dependent (Poulton et al., 1997). As noted, a relatively high proportion of young cannabis users continue to use cannabis at some

level over an extended period (Johnston et al., 2005). Given this high rate of dependence and relatively low rate of spontaneous cessation, there is a significant population of young people who may benefit from access to some form of intervention to prevent or overcome cannabis-related problems including both abuse and dependence.

treatment seeking

Treatment seeking rates for cannabis use problems have risen internationally over the past decade (see Copeland, 2004). The US Treatment Episode Data Set (SAMHSA, 2006) demonstrates that the proportion of total admissions for primary cannabis problems increased from 9% in 1994 to 16% in 2004. This was driven largely by the 115% increase in the number of primary cannabis admissions among adolescents, which grew from 43% of total adolescent admissions to 64% during this period (SAMHSA, 2006). Australia has also seen treatment seeking increase for cannabis disorders among young people, who account for 46% of primary cannabis-related admissions compared with 6% for those aged over 50 (AIHW, 2005). While the numbers of young people accessing treatment services for cannabis-related problems have increased in recent years, still relatively few young people who might benefit from professional assistance for their substance use choose to access treatment services. Self-referral is relatively uncommon, with most referred by a parent or other family member, a juvenile justice system official (e.g. judge or probation or parole officer), an education official, youth welfare worker, or a representative of some other community agency (Waldron, et al., 2007; Baer & Peterson, 2002). Increased judicial mandating of young people to attend treatment programs largely explains the evident increase in demand in the USA. In 2004 more than half (51%) of adolescent admissions in the US were referred to treatment through the criminal justice system. A further 11% were referred by schools, and just 17% were identified as self referrals (SAMHSA, 2006). The low proportion of self-referrals found in this dataset is consistent with the report by Dennis et al. (2002) that of the 600 young people inducted into the Cannabis Youth Treatment study, only 20% agreed that they were in need of treatment for a cannabis use disorder.

cannabis treatment: adult

Despite evident high rates of cannabis use in the general population, and rising rates of treatment seeking for cannabis use disorders (Copeland, 2004; AIHW, 2005; SAMHSA, 2006), it has only been in

the last 15 years that rigorous controlled studies of interventions for cannabis use disorders have appeared in the literature. Since the early 1990s just a handful of controlled trials have been conducted to evaluate psychological treatments for adult cannabis users (Stephens, Roffman & Simpson, 1994; Stephens, Roffman & Curtin, 2000; Budney, Higgins, Radonovich, & Novy, 2000; Copeland, Swift, Roffman, & Stephens, 2001; Babor/Marijuana Treatment Project Research Group (MTPRG), 2004; Budney, Moore, Rocha, & Higgins, 2006).

A recent Cochrane review (Denis, Lavie, Fatseas, & Auricombe, 2007) of psychotherapeutic interventions for adult cannabis users in an outpatient setting found a limited number of controlled studies, and concluded that while many cannabis-dependent adults respond well to MET, CBT and social support interventions, continuous abstinence is a less common positive outcome than reduced cannabis use. This is in keeping with earlier findings suggesting that complete abstinence is not always necessary to achieve clinically meaningful improvement and reductions in cannabis-related problems (Roffman, et al., 1994; Copeland et al., 2001). The studies reviewed in the Cochrane review (Denis et al., 2007) were, unfortunately, deemed too heterogeneous to allow a meta-analysis. Nonetheless, the studies reviewed demonstrate that cannabis use and dependence is amenable to treatment in adults, and also make it clear that specialist cannabis treatment services can attract people who are looking for assistance with their cannabis use issues, but may be less willing to engage with generalist drug and alcohol services.

cannabis treatment: adolescent

In Australia, the National Minimum Data Set indicates that in 2004-2005 people aged 19 years or under accounted for relatively few (12.2%) of all closed treatment episodes, but of these episodes cannabis was by far the most commonly nominated (50% overall; 53% for males, 43% for females) principal drug of concern (AIHW, 2006). To put this in some perspective, people under the age of 19 accounted for 17,604 closed treatment episodes (in publicly funded services) in Australia during this period, primarily for cannabis issues (AIHW, 2006).

The literature regarding interventions for cannabis use in adolescents is sparse. In recent years there has been increased attention given to developing general substance use treatment models that take cognizance of the issues and developmental stage

of young people, rather than simply generalising (potentially age-inappropriate) adult programs to this group (Pumariega, Rodriguez & Kligus, 2004; Williams, Chang & the Addiction Research Group, 2000). Manualised therapies have become available for dissemination to the field, and evidence is emerging for the efficacy of a number of treatment models including family-based therapies (Liddle, 2004; Santisteban, et al., 2003), motivational enhancement (Tevyaw & Monti, 2004; Grenard, et al., 2006), and cognitive behavioural interventions (Waldron & Kaimer; 2004). Prior to the late 1990s, the conclusions of the few published studies had been limited by methodological problems including lack of control groups and small sample sizes (Deas & Thomas, 2001).

As noted by Berghuis, et al. (2006), earlier treatment programs for young people have reported mixed success in reducing cannabis use. For example, the Treatment Outcome Prospective Study (TOPS) involved 87 adolescents whose frequency of cannabis use in the year prior to treatment was compared with their use in the year following treatment. The study found a reduction of 42% for those who received less than three months of treatment and an increase of 13% among those who received three or more months of treatment (Hubbard, Cavanaugh, Craddock, & Rachel, 1989), which is difficult to interpret and perhaps suggests some selective retention in treatment of young people with more entrenched problems.

In a nationally representative study of substance abuse treatment outcomes (inpatient and outpatient) in the USA, the Services Research Outcome Study found that cannabis use increased about 2% among the 156 adolescents in the study in the five years after they received any type of treatment (Office of Applied Studies, 1998). Treatment outcomes for adolescents in this study were generally quite poor, with a 13% increase in alcohol use and a 202% increase in crack cocaine use in the 5 years following treatment, although the crack use was starting from a low baseline prevalence. The Drug Abuse Treatment Outcome Study – Adolescents (DATOS-A) produced rather more encouraging findings. There was up to a 50% reduction in regular cannabis use among participants in the DATOS-A at a 12 month follow-up (Rounds-Bryant & Staab, 2001). It is difficult to draw firm conclusions about the influence of treatment in these studies due to the lack of untreated control groups. Evaluation is further complicated by the lack of definition of precisely what “treatment” has consisted of and how it has been delivered, i.e. the absence of documented treatment protocols. While

there is some indication that treatment is potentially helpful, relapse rates are reported to be high, and rates of retention in treatment poor (Chung & Maisto, 2006; Muck et al., 2001).

the Cannabis Youth Treatment study

The largest randomised trial for adolescent cannabis use to date, the Cannabis Youth Treatment (CYT) study, was a multi-site intervention study of 600 young cannabis users aged between 12 and 18 years who reported one or more DSM-IV cannabis abuse or dependence criteria (Dennis, et al., 2004). The baseline characteristics of the sample reported by Tims, et al. (2002) show the complex nature of young people entering substance use treatment. Participants typically presented with multiple problems, most commonly conduct disorder, ADHD and/or mental distress. Of the total sample, 75% reported at least one co-occurring problem, and 50% were referred by the criminal justice system.

Participants were randomised to receive one of five outpatient interventions of various types, ranging from a relatively brief 5 sessions (MET/CBT) to up to 22 sessions of Family Support Network therapy that included aspects of CBT, family therapy, and additional case management contact. For logistical reasons it was not possible to implement all five interventions at each of the sites so it was necessary to conduct two randomised trials, each of which compared three types of intervention. In outline, the five interventions were:

1. A six-week intervention comprising two sessions of individual motivational enhancement therapy plus three weekly sessions of group cognitive behavioural therapy (MET/CBT5).
2. The same intervention (MET/CBT5) plus an additional seven sessions of group CBT (MET/CBT12).
3. MET/CBT12, plus a Family Support Network therapy that included parent education, family therapy and case management over 20 sessions (FSN).
4. Twelve weeks of a 14 session intervention based on the Adolescent Community Reinforcement approach that aims to assist the young person and family in changing their environmental contingencies to support non substance using activities. This involved ten sessions with the young person and four with the parents (ACRA).

5. Up to 15 sessions of Multidimensional Family Therapy, with additional phone and case management contacts over a period of 12 weeks (MDFT). MDFT sees substance use disorders as part of a potentially deleterious lifestyle often including other problem behaviours. Therefore, in MDFT the therapist targets as many life domains and problem behaviours as possible. Sessions may be held in a variety of places including the home, treatment office, community settings (e.g., school, court), or by phone. The format of MDFT can be modified to suit the treatment needs of different clinical populations. An exclusive focus on substance is thought not to achieve lasting benefit.

Each of the interventions was manualised and treatment delivery was monitored and quality controlled. All participant groups were active treatment conditions; i.e., there was no “non-treatment” or “delayed treatment” control condition included in the design. Overall, the clinical outcomes were similar across all conditions. All five CYT interventions showed significant pre-post treatment effects; compared with baseline, at 12 months there was an increase in reported abstinence, and decreases in symptoms of cannabis abuse and dependence. Across all sites and interventions, the rate of abstinence from all drugs increased from 52 days in the three month period prior to randomisation to a mean of 65 days in the 90 days to 12 month follow-up (Dennis, et al., 2004). It is worth noting, however, at the 12 month follow-up two thirds of the participants were still reporting substance use or related problems. While there was little difference on outcomes between the treatment conditions, a cost-effectiveness analysis reported the briefer treatments to be more cost-effective (French et al., 2002).

This study provides evidence that cannabis use disorders are treatable in an adolescent population (although the absence of a delayed treatment control group makes it impossible to entirely exclude regression to the mean as explanatory factor). In addition, it indicates that relatively brief treatments can be effective with this group. The finding of no difference in cannabis use outcomes across treatment types is in keeping with a study by Agosti and Levin (2007) who examined 12-month follow-up data from the DATOS-A study. They reported that completing treatment was a stronger predictor of reduced cannabis use than any particular treatment modality.

Support for the effectiveness of Multidimensional Family Therapy in reducing cannabis use comes from a randomised trial (n=182) comparing MDFT with

adolescent group therapy (AGT), and multi-family educational intervention (MEI) (Liddle et al., 2001). Results showed improvement among young people in all three treatments, with MDFT showing superior improvement overall in relation to drug use (primarily cannabis) and psychosocial functioning more generally including family function and academic performance. Rates of clinical improvement in substance use at the 1-year follow-up, were 45% in MDFT, 32% in AGT, and 26%. A significant difference in treatment drop-out rates was found; 30% (MDFT) to 47% (AGT). The positive findings suggest that MDFT may be particularly useful for young people with co-existing behavioural problems.

Studies of other implementations of family-based systemic therapies have returned promising results. A four year follow-up (n=118) of a randomised trial comparing Multisystemic Therapy (MST) with usual community services (UCS) found that self reported cannabis use did not differ between groups but biologically confirmed abstinence was significantly higher in the MST group (55% vs 28% of participants (Henggeller et al., 2002).

Santisteban and colleagues (2003) examined the efficacy of Brief Strategic Family Therapy (BST) compared with a group treatment control (GTC). The results showed a significantly greater reduction in cannabis use at treatment completion in the BST group. The effect size was $\eta^2 = .09$. Greater reductions were also found in observer ratings and self reports of family functioning, and parent ratings of adolescent conduct problems and delinquency.

Waldron et al. (2001) compared the efficacy of four interventions; functional family therapy, CBT, joint FFT and CBT, and a psychoeducational group treatment (FFT, CBT, joint and group). Follow-ups were conducted four and seven months post treatment and the principle outcome measures were percentage of days of use in the past 90, and percentage of adolescents using at minimal level (defined as less than 10% of days in the past 90). At four months, significant reductions in days of use were found for the FFT (from 55%–25%) and joint (from 56%–38%) conditions and a significant proportion of participants had achieved minimal use levels in the FFT, CBT and joint groups. At seven months, significant reductions in days of use were evident for in the joint and group conditions, but not in the CBT or FFT. These results suggest superior efficacy for combined FFT and CBT than either modality alone with this population of young people, most of who were mandated to treatment by court order.

The studies above relate to adolescents who present for treatment. This population represents a very small percentage of young people who use substances (Tims et al., 2002), and may constitute a more troubled population. There is a need for active secondary prevention efforts targeting young people at an early stage of their cannabis using career in an effort to minimise problematic use, promote problem recognition, and facilitate informed choice regarding cannabis use and its potential consequences.

secondary prevention

In response to the widespread use of cannabis among young people and limited treatment seeking, a small number of recent studies have examined the feasibility and effectiveness of brief interventions in reducing cannabis use and cannabis-related problems among adolescents who were not necessarily seeking treatment or attempting to moderate their cannabis use.

Two feasibility studies, the Teen Marijuana Check-up (Bergius et al., 2006) and the Adolescent Cannabis Check-up (Martin, Copeland & Swift, 2005) employed similar brief (two – three session) motivational enhancement therapies. The studies targeted non-treatment seeking adolescents and focussed recruitment efforts on schools and the general community, respectively. The Adolescent Cannabis Check-up study included a separate education and communication skills session for concerned parents as a means to aid recruitment of young people, which proved a successful addition to the model with 60% of participating parents successfully recruiting their young person. Both studies reported significant reductions in the frequency of cannabis use at three month follow-up. The absence of control groups, however, precluded drawing causal inferences regarding the impact of the intervention. Nonetheless, it was demonstrated that this type of cannabis-specific intervention could attract young cannabis users and was rated positively by them.

While not a cannabis-specific intervention, McCambridge and Strang (2004) describe a cluster randomised trial of a single session of motivational interviewing designed to reduce illicit drug, alcohol and cigarette consumption among non-treatment seeking young people (n=200) recruited by peers from further education colleges in London. The mean frequency of cannabis use declined by 66% in the intervention group, from 15.7 times per week to 5.4 times. In contrast, there was an increase of 27% in the control group, from 13.3 – 16.9 (McCambridge &

Strang, 2004). This is encouraging given the brevity of the intervention and the opportunistic recruitment of a non-treatment seeking sample of participants. A subsequent report of 12 month follow-up data, however, showed these between-group differences to have largely, but not entirely, disappeared. This was primarily due to unexpected improvements in the control group rather than deterioration in the intervention group (McCambridge & Strang, 2005). It was suggested that this may reflect some reactivity in the control group resulting from the in-depth three month follow-up interview.

A randomised trial of the school-based Teen Marijuana Check-up (Walker et al., 2006) examined a two session brief motivational intervention compared with a three month delayed treatment control group, and returned a null finding. Participants (n=99) were recruited directly via classroom presentations on cannabis issues, at the end of which students were invited to anonymously express their interest in participating in the study. The individual sessions lasted 30-60 minutes, were conducted during school time, and volunteer participants were compensated with gift certificates to the value of \$US15 for each of the two intervention sessions attended. While overall, participants significantly reduced their cannabis use during the follow-up period, there were no between group differences found. It may be the case that the observed reductions in the control group were the result of assessment reactivity, as all participants received a full baseline assessment including reporting the pros and cons of cannabis use and pros and cons of change, which may have, in itself, prompted a self-evaluation among participants similar to a motivational enhancement intervention. In this way the assessment itself may have constituted a form of brief intervention. It may also be the case that relatively poor treatment compliance (only 77% of the intervention group completed the second session) played a role in the lack of group differences.

A further study based on the Adolescent Cannabis Check-up (ACCU) intervention randomised participants recruited from the general community to a brief intervention or a three month waitlist condition (Martin & Copeland, in press). Although the sample (n=40) were largely non-treatment seekers, the overwhelming majority (95%) met DSM-IV criteria for cannabis dependence. At the three month follow-up, significant between group differences, in favour of the ACCU group, were found on the change scores for days of use (-19.6 vs -1.2; $F=4.97$, $p=0.032$), mean cones used per week (-29.0 vs -14.0; $U=111.0$,

$p=0.021$), and the number of DSM-IV dependence criteria reported (-2.1 vs -0.6 ; $F=4.63$, $p=0.04$). The between group effects sizes were moderate for the days-of-use ($d=.71$) and number of dependence symptoms ($d=.70$), and small for the mean quantity of use measure ($d=.22$). Reflecting the reduction in the number of dependence symptoms reported, there was a substantial change in the proportion of the ACCU group meeting DSM-IV criteria for dependence at follow-up, with a reduction of 35% (from 100%–65%), as compared with the DTC group's reduction from 85%–80%. This change represents the resolution of dependence in seven of the 20 participants in the intervention group, all of whom met dependence criteria at baseline. As in the earlier feasibility study, a large majority (87%) reported the intervention was helpful, and in terms of their overall satisfaction with their participation, 90% reported they were “very” or “extremely” satisfied.

summary and discussion

Despite some recent decline in the prevalence of cannabis use among adolescents, it remains widespread and the age at which young people are initiating their use has been declining. It appears that adolescents are a particularly vulnerable population with respect to the negative effects of cannabis use; earlier and more frequent use is clearly associated with more negative effects than later onset use. The potential impact of cannabis use on adolescent neuromaturational processes is an issue of concern but is not yet clearly understood. There is, however, consistent evidence of associations of cannabis use with a range of psychosocial problems including negative mental health effects, substance use disorder, poorer educational performance, and school drop-out, which may have lifelong impact on the individual.

Despite widespread use and evident problems with cannabis abuse and dependence amongst young users, treatment seeking rates for this population are low. Those who do enter treatment are typically referred by a third party (such as parents or the juvenile justice system) and commonly present with multiple and complex co-occurring problems such as conduct disorder, ADHD and mental/emotional distress.

The need for effective intervention responses is clear but to date the evidence base is limited. Even so, existing evidence indicates that treatment (of various types) is effective in reducing cannabis use and cannabis-related problems. The findings are,

however, inconsistent with a simple dose–response relationship, as the findings of the Cannabis Youth Treatment study revealed that the efficacy of briefer treatment (i.e. MET/CBT5) and more intensive treatments (e.g. MET/CBT12 + FSN) were all equally supported. The briefer interventions were, however, found to be among the most cost-effective. It is unclear on the current evidence the extent to which sub-groups of adolescents may respond differentially to different treatment types.

Current evidence supports the use of MET and CBT approaches in addition to a range of systemic family therapy approaches. There is evidence that the family therapies are more effective in reducing cannabis use than adolescent group treatment and that Multidimensional Family Therapy is more effective in promoting treatment retention than group therapy. Given its focus on multiple systems and behaviours, and its effectiveness in producing improvement across a range of domains, it may be that MDFT is particularly suited to young people with more serious psychosocial and behavioural problems such as conduct disorder.

There are two questions addressed in the intervention literature: the adequacy of particular treatment models for the tertiary treatment sector, and the viability and effectiveness of secondary prevention efforts. The CYT has demonstrated that various treatment models are effective, including brief MET/CBT and more intensive systemic therapies. In relation to active secondary prevention and early intervention the evidence, while mixed, provides cause for optimism. It has been demonstrated that targeting non-treatment seeking young people is a feasible method of early intervention and has been associated with significant reductions in cannabis use and related problems, including symptoms of dependence. It has also been shown that including a session for parents in a cannabis-specific brief intervention provides an effective additional means to encourage young cannabis users to participate in the intervention.

It has been noted that early intervention in adolescent substance use is a priority issue and that such intervention has the potential to reduce the risk of transition of an individual to dependent use (Winters & Lee, 2008) and prevent the spread of use to others (Hall & Swift, 2006). Treatment seekers will, by definition, seek out treatment (or have it sought out for them), non-treatment seekers must actively be pursued. Given the very low rates of self-recognition of problematic cannabis use, even among dependent

young people, the majority of those with problems are unlikely to present for treatment. Alternative ways of engaging them need to be considered. As demonstrated by McCambridge & Strang, (2005) and Martin & Copeland (in press) active recruitment strategies can effectively attract non-treatment seeking users into a brief intervention.

Part of the Check-up approach is to identify potential problems early by expanding the focus of intervention out from the specialist tertiary alcohol and other drug treatment services and into the community. A key to the ability to achieve this is dissemination and implementation of the intervention in novel ways, e.g., online. While web-based delivery of brief intervention has been reported with young alcohol users (e.g. Kypri et al., 2004), to date no study has examined such applications with young cannabis users. (Cannabis-specific web interventions have been developed in the UK and Germany, but they do not specifically target adolescents and no formal evaluation has yet been published).

A virtue of the Check-up approach is that the young person need not identify themselves as having a cannabis use problem (or potential problem) in order to participate in the intervention, which may aid the engagement of young people who do not see their behaviour as problematic (Tevyaw & Monti, 2004). Meeting the young person where they are in relation to their cannabis use obviates any need for disagreement over the extent to which their current use is problematic and may make it easier to engage a resistant or oppositional young person in discussion of current circumstances and potential change.

A limitation of the current brief intervention literature is that follow-up periods have been relatively short and it remains unclear whether multiple iterations of the intervention over a relatively long period would aid to entrench, or support, the short-term gains observed. This is an issue for further research.

Adolescents who use cannabis may be encountered in a number of settings and by a range of professionals; from primary health care workers to youth workers, to school counsellors, juvenile justice officers and specialist alcohol and other drug treatment providers. Appropriate intervention responses to cannabis use will differ across some settings but in other cases there may be considerable overlap in the general approach.

recommendations

1. secondary prevention/early intervention

Brief motivational enhancement interventions (e.g., the Adolescent Cannabis Check-up) should be disseminated to a range of potential audiences who have contact with young people and may opportunistically identify cannabis users and invite them to participate. The range of settings where this type of intervention may be appropriate includes: social work; youth work; juvenile justice; mental health settings; juvenile justice; school counsellors.

Given the evident association of adolescent cannabis use with mental health issues, the Check-up model could be combined with (or included as an optional module of) a community-based brief mental health intervention, such as the “Mental Health First Aid” package that has been developed by ORYGEN Youth Health Services in Victoria, and is to be rolled out nationally.

Structured self-contained brief intervention packages (i.e., manual, worksheets, assessment forms) designed for use by non-specialists should be produced and made available.

Novel means of youth-oriented case finding (e.g., online screening and intervention) should be developed and evaluated.

2. treatment

Training in the delivery of MET and CBT approaches to cannabis use treatment providers should be made widely available to ensure that treatment workers have access to current evidence based approaches. This training effort should be sustained to ensure its availability to new treatment staff.

Intervention manuals describing current evidence based treatments, including those produced for the Cannabis Youth Treatment Project should be promoted and made available to interested treatment providers.

While it is not clear from the literature, it may be the case that stepped care models of treatment would be useful. Young people showing no improvement with relatively brief treatment (e.g. MET/CBT5) may respond to more intensive treatment, or a different type of treatment.

Treatment seeking young people commonly present with complex clinical profiles and co-occurring disorders. Cannabis treatment providers should have reliable screening or assessment instruments to detect these conditions and a means of addressing them, or referring appropriately.

3. research

While the number of intervention studies has increased in recent years there remain considerable gaps in the evidence base. The following areas for future research are suggested.

Collaboration with Indigenous researchers is required to determine the appropriateness and effectiveness of current treatment models with Indigenous populations. Adaptations or the development of new models of intervention may be required.

The extant research on the effectiveness of brief interventions for adolescents is marred by short follow-up periods. The adult brief intervention literature shows a considerable reduction in effect size by 12 month follow-up (Hettinga, Steel & Miller, 2003). Studies looking at the impact of assertive follow-up and repeated iterations of the intervention over a longer period would be useful to determine whether short term gains could be maintained with repeated exposure.

Online intervention research is a matter of urgency to broaden the base of treatment provision. Varying levels of intensity of intervention could be offered to capture the widest range of young cannabis users. Other technological approaches (e.g. via mobile phone) might also be considered.

references

- Agosti, V. & Levin, F.R.** (2007). One year post-treatment outcome of cannabis dependent adolescents. *Addictive Disorders and Their Treatment* 6, 61-66.
- Anthony, J.C., Warner, L.A. & Kessler, R.C.** (1994). Comparative epidemiology of dependence on tobacco, alcohol, controlled substances, and inhalants. *Experimental and Clinical Psychopharmacology* 2, 264-268.
- Australian Institute of Health and Welfare.** (2002). *2001 National Drug Strategy Household Survey: First results* (Drug Statistics Series No. 9). Canberra: AIHW.
- Australian Institute of Health and Welfare.** (2005). *Alcohol and other drug treatment services in Australia. Findings from the National Minimum Data Set 2003-04*. Canberra: AIHW.
- Australian Institute of Health and Welfare.** (2006). *Alcohol and other drug treatment services in Australia. Findings from the National Minimum Data Set 2004-05*. Canberra: AIHW.
- Australian Institute of Health and Welfare.** (2005). *2004 National Drug Strategy Household Survey: Detailed Findings*. AIHW cat. no. PHE 66. (Drug Statistics Series No.16). Canberra: AIHW.
- Babor, T., Carroll, K., Christiansen, K., Kadden, R., Litt, M., McRee, B., Miller, M., Roffman, R., Solowij, N., Steinberg, K., Stephens, R., Vendetti, J., Donaldson, J., & Herrell, J.** (2004). Brief treatments for cannabis dependence: Finding from a randomised multi-site trial. *Journal of Clinical and Consulting Psychology* 72, 455-466.
- Baer, J.S. & Peterson, P.L.** (2002). Motivational interviewing with adolescents and young adults. **In W.R. Miller & S. Rollnick.** *Motivational interviewing: Preparing people for change*. New York: Guilford Press.
- Beckson, M.** (2005). Adolescent substance use and addiction. *Adolescent Psychiatry* 29, 3-17.
- Berguis, J., Swift, W., Copeland, J., Roffman, R.A., & Stephens, R.S.** (2006). The Teen Cannabis Check-up. **In R.A. Roffman & R.S. Stephens (eds.)**. *Cannabis dependence: Its nature, consequences and treatment* (International Research Monographs in the Addictions). Cambridge: Cambridge University Press.
- Brook, J.S., Balka, E.B. & Whiteman, M.** (1999). The risks for late adolescence of early adolescent marijuana use. *American Journal of Public Health* 89, 1549-1554.
- Budney, A.J., Higgins, S.T., Radonovich, K.J., & Novy, P.L.** (2000). Adding voucher-based incentives to coping skills and motivational enhancement improves outcomes during treatment for marijuana dependence. *Journal of Consulting and Clinical Psychology* 68, 1051-1061.
- Budney, A.J., Moore, B.A., Rocha H.L., & Higgins, S.T.** (2006). Clinical trial of abstinence-based vouchers and cognitive-behavioral therapy for cannabis dependence. *Journal of Consulting and Clinical Psychology* 74, 307-316.
- Capsi, A., Moffit, T., Cannon, M., McClay, J., Murray, R., Harrington, H., Taylor, A., Arsenuit, L., Williams, B., Braithwaite, A., Poulton, R., & Craig, I.** (2005). Moderation of the effect of adolescent-onset cannabis use on adult psychosis by a functional polymorphism in the catechol-o-methyltransferase gene: Longitudinal evidence of a gene x environment interaction. *Biological Psychiatry* 57, 1117-1127.

- Chen, C. & Anthony, J.C. (2003). Possible age-associated bias in reporting of clinical features of drug dependence: Epidemiological evidence on adolescent-onset marijuana use. *Addiction* 98, 71-82.
- Chen, K. & Kandel, D.B. (1995). The natural history of drug use from adolescence to the mid-thirties in a general population sample. *American Journal of Public Health* 85, 41-47.
- Chung, T. & Maisto, S.A. (2006). Relapse to alcohol and other drug use in treated adolescents: Review and reconsideration of relapse as a change point in clinical course. *Clinical Psychology Review* 26, 149-161.
- Coffey, C., Wolfe, R. & Patton, G.C. (2000). Initiation and progression of cannabis use in a population-based Australian adolescent longitudinal study. *Addiction* 95, 1679-1690.
- Coffey, C., Carlin, J.B., Degenhardt, L., Lynskey, M., Sanci, L., & Patton, G.C. (2002). Cannabis dependence in young adults: An Australian population study. *Addiction* 97, 187-194.
- Coffey, C., Carlin, J.B., Lynskey, M., Ning, L., & Patton, G. (2003). Adolescent precursors of cannabis dependence: Findings from the Victorian Adolescent Health Cohort Study. *British Journal of Psychiatry* 182, 330-336.
- Copeland, J. (2004). Developments in the treatment of cannabis use disorder. *Current Opinion in Psychiatry* 17, 161-167.
- Copeland, J., Swift, W., Roffman, R., & Stephens, R. (2001). A randomized trial of brief cognitive-behavioral interventions for cannabis use disorder. *Journal of Substance Abuse Treatment* 21, 55-64.
- Dahl, R.E. (2004). Adolescent brain development: A period of vulnerabilities and opportunities. *Annals of the New York Academy of Sciences* 1021, 1-22.
- Deas, D. & Thomas, S.E. (2001). An overview of controlled studies of adolescent substance abuse treatment. *The American Journal on Addictions* 10, 178-189.
- Degenhardt, L., Lynskey, M. & Hall, W. (2000). Cohort trends in the age of initiation of drug use in Australia. *Australian and New Zealand Journal of Public Health* 24, 421-426.
- Denis, C., Lavie, E., Fatséas, M., & Auriacombe, M. (2006). Psychotherapeutic interventions for cannabis abuse and/or dependence in outpatient settings, *Cochrane Database of Systematic Reviews* 3.
- Dennis, M., Babor, T.F., Roebuck, M.C., & Donaldson, J. (2002). Changing the focus: The case for recognizing and treating cannabis use disorders. *Addiction* 97, 4-15.
- Dennis, M., Godley, S.H., Diamond, G., Tims, F.M., Babor, T., Donaldson, J., Liddle, H., Titus, J.C., Kaminer, Y., Webb, C., Hamilton, N., & Funk, R. (2004). The Cannabis Youth Treatment (CYT) study: Main findings from two randomized trials. *Journal of Substance Abuse Treatment* 27, 197-213.
- Dennis, M., Titus, J.C., Diamond, G., Donaldson, J., Godley, S.H., Tims, F.M., Webb, C., Kaminer, Y., Babor, T., Roebuck, M.C., Godley, M.D., Hamilton, N., Liddle, H., Scott, C.K., & the CYT Steering Committee. (2002). The Cannabis Youth Treatment (CYT) experiment: Rationale, study design and analysis plans. *Addiction* 97, 16-34.
- DeWit, D.J., Hance, J., Offord, D.R., & Ogborne, A. (2000). The influence of early and frequent use of marijuana on the risk of desistance and progression to marijuana-related harm. *Preventive Medicine* 31, 455-464.
- Ehrenreich, H., Rinn, T., Kunert, H.J., Moeller, M.R., Poser, W., Schilling, L., Gigerenzer, G., & Hoeche, M.R. (1999). Specific attentional dysfunction in adults following early start of cannabis use. *Psychopharmacology* 142, 295-301.
- Ellickson, P.L., Martino, S.C. & Collins, R.L. (2004). Marijuana use from adolescence to young adulthood: Multiple developmental trajectories and their associated outcomes. *Health Psychology* 23, 299-307.
- European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). (2006). *Annual report on the state of the drug problem in the European Union and Norway*. Luxembourg. EMCDDA. <http://ar2006.emcdda.europa.eu/>
- Fergusson, D.M. & Horwood, L.J. (1997). Early onset cannabis use and psychosocial adjustment in young adults. *Addiction* 92, 279-296.
- Fergusson, D.M. & Horwood, L.J. (2000). Cannabis use and dependence in a New Zealand birth cohort. *New Zealand Medical Journal* 113, 156-158.

- Fergusson, D.M., Horwood, L.J. & Beautrais, A.L. (2003). Cannabis use and educational achievement. *Addiction* 98, 1681-1692.
- Fergusson, D.M., Horwood, L.J. & Swain-Campbell, N. (2002). Cannabis use and psychosocial adjustment in adolescence and young adulthood. *Addiction* 97, 1123-1135.
- French, M.T., Roebuck, C., Deniis, M.L., Diamond, G., Godley, S.H., Tims, F., Webb, C., & Herrell, J.M. (2002). The economic cost of outpatient marijuana treatment for adolescents: Findings from a multi-site field experiment. *Addiction* 97, 84-97.
- Galvan, A., Hare, T.A., Parra, C.E., Penn, J., Voss, H., Glover, G., & Casey, B.J. (2006). Earlier development of the accumbens relative to orbitofrontal cortex might underlie risk-taking behavior in adolescents. *Journal of Neuroscience* 26, 6885-6892.
- Grenard, J.L., Ames, S.L., Pentz, M.A., & Sussman, S. (2006). Motivational interviewing with adolescents and young adults for drug related problems. *International Journal of Adolescent Medical Health* 18, 53-67.
- Hall, W. (2006). Cannabis use and the mental health of young people. *Australian and New Zealand Journal of Psychiatry* 40, 105-113.
- Hall, W., Degenhardt, L. & Lynskey, M. (2001). *The health and psychological effects of cannabis use*. Monograph Series No. 44. Canberra: Commonwealth of Australia.
- Hall, W. & Swift, W. (2006). The policy implications of cannabis dependence. In R.A. Roffman & R.S. Stephens (eds.). *Cannabis dependence: Its nature consequences and treatment*. (pp. 315-331). Cambridge: Cambridge University Press.
- Henggeller, S.W., Clingempeel, W.G., Brodino, M.J., & Pickrel, S.G. (2002). Four-year follow-up of multisystemic therapy with substance-abusing and substance-dependent juvenile offenders. *Journal of the American Academy of Child and Adolescent Psychiatry* 41, 868-874.
- Hettema, J., Steele, J. & Miller, W.R. (2005). Motivational interviewing. *Annual Review of Clinical Psychology* 1, 91-111.
- Hubbard, R.L., Marsden, M.E., Rachal, J.V., Harwood, H.J., Cavanaugh, E.R., & Ginzburg, H.M. (1989). *Drug abuse treatment: A national study of effectiveness*. Chapel Hill, NC: University of North Carolina Press.
- Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J.E. (2005). *Monitoring the future: National survey results on drug use, 1975-2004: Volume 1, Secondary school students*. (NIH Publication No. 05-5727). Bethesda, MD: National Institute on Drug Abuse.
- Kypri, K., Saunders, J.B., Williams, S.M., McGee, R.O., Langley, J.D., Cashell-Smith, M.L., & Gallagher, S.J. (2004). Web-based screening and brief intervention for hazardous drinking: A double-blind randomized controlled trial. *Addiction* 99, 1410-1417.
- Leccese, M. & Waldron, H.B. (1994). Assessing adolescent substance use: A critique of current measurement instruments. *Journal of Substance Abuse Treatment* 6, 553-563.
- Liddle, H. (2004). Family-based therapies for adolescent alcohol and drug use: Research contributions and future research needs. *Addiction* 99, 76-92.
- Liddle, H., Dakof, G.A., Parker, K., Diamond, G.S., Barrettt, K., & Tajeda, M. (2001). Multidimensional family therapy for adolescent drug abuse: Results of a randomized clinical trial. *The American Journal of Drug and Alcohol Abuse* 27, 651-688.
- Lynskey, M. & Hall, W. (2000). The effects of adolescent cannabis use on educational attainment: A review. *Addiction* 95, 1621-1630.
- Lubman, D.I., Yucel, M. & Hall, W. (2007). Substance use and the adolescent brain: A toxic combination? *Journal of Psychopharmacology* 21, 792-794.
- Martin, G. & Copeland, J. (in press). The Adolescent Cannabis Check-up: Randomised trial of a brief intervention for young cannabis users. *Journal of Substance Use Treatment*.
- Martin, G., Copeland, J. & Swift, W. (2005). The Adolescent Cannabis Check-up: Feasibility of a brief intervention for young cannabis users. *Journal of Substance Use Treatment* 29, 207-213.
- Macleod, J., Oakes, R., Copello, A., Crome, I., Egger, M., Hickman, M., Oppenkowski, T., Stokes-Lampard H., & Davey Smith, G. (2004). Psychological and social sequelae of cannabis and other drug use by young people: A systematic review of longitudinal, general population studies. *Lancet* 363, 1579-1588.

-
- McCambridge, J. & Strang, J.** (2004). The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people. *Addiction* 99, 39-52.
- McCambridge, J. & Strang, J.** (2005). Deterioration over time in the effect of Motivational Interviewing in reducing drug consumption and related risk among young people. *Addiction* 100, 470-478.
- Moore, T.H.M., Zammit, S., Lingford-Hughes, A., Barnes, T.R.E., Jones, P.B., Burke, M., & Lewis, G.** (2007). Cannabis use and risk of psychotic or affective mental health outcomes: A systematic review. *Lancet* 370, 319-328.
- Muck, R., Zempolich, K.A., Titus, J.C., Fishman, M., Godley, M.D., & Schwebel, R.** (2001). An overview of the effectiveness of adolescent substance abuse treatment models. *Youth and Society* 33, 143-168.
- Office of Applied Studies (OAS).** (1995). *Services Research Outcome Study (SROS)*. Rockville, MD: SAMHSA. [On-line]. Available: <http://www.samhsa.gov/oas/sros/htoc.htm>
- Perkonig, A., Lieb, R., Höfler, M., Schuster, P., Sonntag, H., & Wittchen, H.U.** (1999). Patterns of cannabis use, abuse and dependence over time: Incidence, progression and stability in a sample of 1228 adolescents. *Addiction* 94, 1663-1678.
- Pope, H.G., Gruber, A.J., Hudson, J.I., Heustis, M.A., & Yurgelun-Todd, D.** (2001). Neuropsychological performance in long-term cannabis users. *Archives of General Psychiatry* 58, 909-915.
- Pope, H.G., Gruber, A.J., Hudson, J.I., Cohane, G., Heustis, M.A., & Yurgelun-Todd, D.** (2003). Early onset cannabis use and cognitive deficits: What is the nature of the association? *Drug and Alcohol Dependence* 69, 303-310.
- Poulton, R.G., Brooke, M., Moffitt, T.E., Stanton, W.R., & Silva, P.A.** (1997). Prevalence and correlates of cannabis use and dependence in young New Zealanders. *New Zealand Medical Journal* 110, 68-70.
- Pumariega, A.J., Rodriguez, L. & Kilgus, M.D.** (2004). Substance abuse among adolescents: Current perspectives. *Addictive Disorders and Their Treatment* 3, 145-155.
- Roffman, R.S. & Stephens, R.A.** (2006). The Marijuana Check-up. In **R.A. Roffman & R.S. Stephens (eds.)**. *Cannabis dependence: Its nature, consequences and treatment*. Cambridge: Cambridge University Press.
- Rounds-Bryant, J.L. & Staab, J.** (2001). Patient characteristics and treatment outcomes for African American, Hispanic and white adolescents in DATOS-A. *Journal of Adolescent Research* 16, 624-641.
- Santisteban, D.A., Coatsworth, J.D., Perez-Vidal, A., Kurtines, W.M., Schwartz, S.J., LaPerriere, A., & Szapocznik, J.** (2003). Efficacy of brief strategic family therapy in modifying Hispanic adolescent behaviour problems and substance use. *Journal of Family Psychology* 17, 121-133.
- Schweinsberg, A.D., Brown, S.A. & Tapert, S.F.** (2008). The influence of marijuana on neurocognitive functioning in adolescents. *Current Drug Abuse Reviews* 99, 111.
- Stenbacka, M. & Stattin, H.** (2007). Adolescent use of illicit drugs and adult offending: A Swedish population study. *Drug and Alcohol Review* 26, 397-403.
- Stephens, R.S., Roffman, R.A. & Curtin, L.** (2000). Comparison of extended versus brief treatment for marijuana use. *Journal of Consulting and Clinical Psychology* 68, 898-908.
- Stephens, R.S., Roffman, R.A. & Simpson, E.E.** (1994). Treating adult marijuana dependence: A test of the relapse prevention model. *Journal of Consulting and Clinical Psychology* 62, 92-99.
- Stephens, R.S., Roffman, R.A., Fearer, S.A., Williams, C., Picciano, J.F., & Burke, R.S.** (2004). The Marijuana Check-up: Reaching users who are ambivalent about change. *Addiction* 99, 1323-1332.
- Substance Abuse and Mental Health Services Administration.** (2006). *Treatment Episode Data Set (TEDS): 1994-2004. National admissions to substance abuse treatment services*, DASIS Series: S-33, DHHS Publication No. (SMA) 06-4180, Rockville, MD.
- Substance Abuse and Mental Health Services Administration.** (2006). *Results from the 2005 National Survey on Drug Use and Health: National findings* (Office of Applied Studies, NSDUH Series H-30, DHHS Publication No. SMA 06-4194). Rockville, MD.
- Tevyaw, T.O. & Monti, P.M.** (2004). Motivational enhancement and other brief interventions for adolescent substance abuse: Foundations, applications and evaluations. *Addiction* 99, 63-75.

- Tims, F.M., Dennis, M.L., Hamilton, N., Buchan, B.J., Diamond, G., Funk, R., & Brantley, L.B.** (2002). Characteristics and problems of 600 adolescent cannabis abusers in outpatient treatment. *Addiction* 97, 46-57.
- Von Sydow, K., Lieb, R., Pfister, H., Höfler, M., Sonntag, H., & Wittchen, H.U.** (2001). The natural course of cannabis use, abuse and dependence over four years: A longitudinal community study of adolescents and young adults. *Drug and Alcohol Dependence* 64, 347-361.
- Von Sydow, K., Lieb, R., Pfister, H., Höfler, M., & Wittchen, H.U.** (2002). What predicts incident use of cannabis and progression to abuse and dependence? A 4-year prospective examination of risk factors in a community sample of adolescents and young adults. *Drug and Alcohol Dependence* 68, 49-64.
- Waldron, H.B., Kern-Jones, S., Turner, C.W., Peterson, T.R., & Ozechowski, T.J.** (2007). Engaging resistant adolescents in drug abuse treatment. *Journal of Substance Abuse Treatment* 32, 133-142.
- Waldron, H.B. & Kaimer, Y.** (2004). On the learning curve: The emerging evidence supporting cognitive-behavioural therapies for adolescent substance abuse. *Addiction* 99, 93-105.
- Waldron, H.B., Slesnick, N., Brody, J.L., Turner, C.W., & Peterson, T.R.** (2001). Treatment outcomes for adolescent substance abuse at 4 and 7 month assessments. *Journal of Consulting and Clinical Psychology* 69, 802-813.
- Walker, D.D., Roffman, R.A., Stephens, R.S., Berghuis, J., & Wakana, K.** (2006). Motivational enhancement therapy for adolescent marijuana users: A preliminary randomised controlled trial. *Journal of Consulting and Clinical Psychology* 74, 628-632.
- White, V. & Hayman, J.** (2004). *Australian secondary school students use of over-the-counter and illicit substances in 2002*. National Drug Strategy Monograph Series No. 56. Canberra: Australian Government Department of Health and Ageing.
- Williams, R.J., Chang, S.Y. & the Addiction Centre Adolescent Research Group.** (2000). A comprehensive and comparative review of adolescent substance abuse treatment outcome. *Clinical Psychology: Science and Practice* 7, 138-166.
- Wilson, W., Mathew, R., Turkington, T., Hawk, T., Coleman, R.E., & Provenzale, J.** (2000). Brain morphological changes and early marijuana use: Magnetic resonance and positron emission tomography study. *Journal of Addictive Disorders* 19, 1-22.
- Winters, K.** (1999). Treating adolescents with substance use disorders: An overview of practice issues and treatment outcomes. *Substance Abuse* 20, 203-223.
- Winters, K.** (2003). Assessment of alcohol and other drug use behaviours among adolescents. In **J.P. Allen & V.B. Wilson (eds.)**. *Assessing alcohol problems* 2nd Ed, pp.101-123. NIH Publication No. 03-3745. National Institute on Alcohol Abuse and Alcoholism, Bethesda.
- Winters, K.C. & Leitten, W.** (2007). Brief intervention for drug-abusing adolescents in a school setting. *Psychology of Addictive Behaviors* 21, 249-254.
- Winters, K. & Lee, C.Y.S.** (2008). Likelihood of developing an alcohol and cannabis use disorder during youth: Association with recent use and age. *Drug and Alcohol Dependence* 92, 239-247.