screening and assessment for cannabis use disorders

ncpic
national cannabis prevention and information centre

Jan Bashford

introduction

Cannabis use and misuse are serious public health concerns worldwide.[1] Estimated at 4% of the global population aged from 15 years[1] with much higher rates (up to 70%)[2] among adolescents aged 12-18 years, cannabis use is now widely regarded as 'normative' youth behaviour.[2,3] Several concurrent developments signal an upsurge in cannabis use disorders (CUD) and the whole spectrum of associated health, psychological, and social problems and harms: (a) cannabis' widespread social tolerance, availability and affordability (b) declining age of initiation with *pre*-adolescent use (less than age 10 years) increasingly common; (c) engineering for higher-potency products; (d) emerging evidence that the health risks of cannabis have been hitherto underestimated; and (e) marked growth in treatment demand for cannabis problems globally.[1,4-6] These concerns have prompted calls for stronger international investment in public health initiatives to prevent, minimize, or arrest progression of cannabis-related harms.[1,7-9]

Predicated on the *harm minimization/reduction* philosophy, the international response has been to "broaden the base" of interventions[10] to incorporate the entire spectrum of cannabis use and associated problems that exist along severity continua among the population of users. The far end of the continuum includes dependence, with a gradient of abuse/misuse and nondependent but at-risk use that encompasses the greater proportion of use-related problems.[10-11] This requires a matching spectrum of intervention responses, ranging from 'minimal' (advice, education), through brief motivational counseling, to intensive specialized psychological treatment.[12] Integrating population-based primary, secondary, and tertiary prevention interventions along the referral pathway, screening, brief intervention, referral and treatment is a new public health approach to cannabis-related problems under the rubric of 'shared' or 'stepped' care among generalist health, non-specialist, and drug treatment professionals.[12-17] This strategy permits a wide network of generalist health, school, employment, welfare, criminal justice and other social services practitioners with diverse training and experience to actively participate in cannabis assessment and intervention (A/I).[8, 11-15] Close collaboration and cooperation between A/I settings, opportunistic screening for both case-finding and risky use, and interventions targeted at earlier stages where prognosis is more favourable will have a major impact on the future incidence of cannabis-related mortality, morbidity and disability, enhance the overall efficiency and equity of health care delivery, and make substantial savings through avoided costs in health and social services.[12-17]

Currently, however, excessive cannabis users rarely present for help or are identified and referred to specialist treatment by health or other care professionals.[12, 21-26] As with alcohol, high cannabis use rates are likely among consumers of primary health and social services. Fleming (2002) estimates busy practitioners will detect more than 80% of drug users if they limit their initial screening to cannabis.[17] Adolescents and young adults presenting with respiratory problems, and those with symptoms of anxiety and depression should be opportunistically screened for cannabis use, because of the high rates of these disorders among cannabis disordered persons who seek help from family physicians.[12] Given the obvious disincentives to disclosure of *any* illegal drug use, compounded by the unique challenges in identifying problematic cannabis use,[27-30] without sensitive tools to assist with its recognition problem cannabis use is likely to remain undetected and undiagnosed along with co-occurring disorders of prognostic significance.[22,31,32]

Sound assessment is the key to recognition, evaluation, appropriate management and positive outcomes in A/I for cannabis use problems. Assessment is essential for expeditious detection of potentially harmful cannabis use and referral along the A/I pathway, fundamental to decisions regarding the need for intervention and the specific type, focus, duration, intensity and goals of treatment, and for objective outcomes evaluation. Further, feedback of assessment data may have direct effects on initiating self-change action by raising the user's awareness of cannabis' adverse impacts.[18,22] Distinction is drawn between the sequential information-gathering steps of assessment: *screening, diagnosis,* and *comprehensive, in-depth evaluation.* While in practice an integrated seamless process, each assessment

level has specific goals. Screening aims to identify cannabis users possibly with, and those at risk of developing, use-related problems, and thus warrant further assessment or an immediate preventive intervention, respectively.[17,19-20] Conducted among screen-positives, diagnosis aims to establish a formal diagnosis of cannabis dependence or abuse to confirm cases ('true positives') and eliminate non-cases ('false-positives') from subsequent evaluation. In-depth, comprehensive clinical assessment aims to obtain a detailed picture of the nature and extent of the individual's cannabis use problem, other drug use and treatment history, family history of drug addiction, co-occurring disorders, psychosocial functioning, readiness for change, environmental support, vulnerabilities and specific needs as a basis for developing an individualized treatment-matched plan.

Assessment reliability (consistency) and sensitivity (accuracy) is enhanced by incorporating tools specifically developed and validated for this purpose.[19,31,35] Babor (2006) contrasts the "tremendous array" of easy to use, standardized drug assessment instruments available to assist with diagnosis and in-depth assessment of CUD with "considerably less progress in the development of valid and reliable instruments to measure cannabis-related problems" (p. 32).[33] Most of the existing measures are adaptations of alcohol or other drug assessments with limited (if any) direct testing of their psychometric properties for cannabis.[18] Many are too lengthy, complex, or otherwise inappropriate for time and cost-efficient administration in busy community settings by generalist health professionals and lay persons without formal training.[34,35] The developmental infancy of cannabis assessment tools derives from its historic neglect in the drug research literature fueled by beliefs that cannabis was a benign and non-addictive drug.[18,28] The timely emergence of a 'new generation' of cannabis screening and problem assessment instruments within the past five years has expanded the small armamentarium of cannabis-specific tools now in existence. These tools show promise for introducing more standardization to the cannabis assessment field while permitting a wide network of helping professionals to objectively participate in cannabis A/I. The diversity of cannabis users, settings, and practitioner backgrounds demands a range of well-validated cannabis tools from which they can choose according to their intended purpose (screening, diagnosis, problems, in-depth assessment), target population (adolescents, adults, ethnic/cultural groups), and context (generalist health, school, social services, specialist treatment). Currently, despite the dramatic growth in cannabis research over the past 15 years "…there is much work to be done" (Stephens & Roffman, 2005, p. 265).[18]

In order to provide a resource and practical guide to instrument selection, the primary aim of this paper is to review currently existing instruments that can assist in cannabis assessment. A secondary aim is to identify and briefly discuss several important issues in cannabis assessment that are directly related to the clinical utility of such tools.

This paper is organized into two sections. The first section provides an outline of the adverse health consequences of cannabis use to identify the major assessment domains and individuals most at risk. A brief discussion of contemporary measurement, diagnostic, and clinical issues in assessment of cannabis use and problems follows. The second section reviews available screening, diagnostic, problem severity, and other assessment instruments for cannabis use disorder and problems, describes their performance and other characteristics, and their various limitations. Finally, flowing directly from the review process, several recommendations for clinical practice and future research are made. A brief overall summary follows.

Instruments reviewed were identified through various search databases (PubMed, Medline, Cochrane, Psychlit, PsychInfo), texts/chapters, published research reports, articles and literature reviews, practice guidelines, treatment manuals, and consultation with cannabis addiction experts. This review is not exhaustive, but attempts to cover both the most widely-used and promising measures in this relatively nascent but rapidly-developing field. A special focus was on cannabis-specific assessment tools developed within the past decade, with preference for brief, low-cost instruments with good psychometric properties, and thus potentially useful for typically busy clinicians with large caseloads. The overall emphasis is on the multidimensional nature and heterogeneity of individuals' cannabis use problems and assessment needs, highlighting the importance of integrating well-validated instruments into the assessment process.

issues in assessment of cannabis use problems

domains for assessment

The acute and chronic harms associated with cannabis use have been well-reviewed.[36-53] This literature clearly confirms the applicability of

the *biopsychosocial* model to cannabis use and disorders.[18] Being multiply-determined and maintained by a complex array of biological, cognitive, psychological and sociocultural processes, cannabis use disorders require a range of intervention approaches to address problems in these areas. Thus all these domains must necessarily be targets of assessment.[18] The review literature is substantial, hence only a brief outline of identified domains and high-risk groups follows.

Biomedical

Experimental and occasional recreational users (i.e., the majority) are at relatively low risk of cannabis-related harms, apart from those associated with acute intoxication (e.g., driving vehicles, workplace injury, unwanted/unsafe sex and STDs). Acute effects that may cause problems include transient cardiovascular changes (bradycardia, tachycardia) and dysphoric effects (anxiety, panic attacks, persecutory delusions, visual hallucinations, and overt psychotic reactions) in vulnerable people.[36-37,40-44,46-48] Chronic, regular use increases the risk of experiencing adverse physiological and psychological outcomes. These include development of cannabis dependence characterized by inability to abstain or control use, tolerance and withdrawal; respiratory effects similar to those of (and exacerbated by) tobacco smoking, including bronchitis, cough, lung infections, decreased pulmonary function, and increased risk of aerodigestive tract cancer; immune system modulation and reproductive (reduced fertility) effects[36,37,40-48,51,52]; subtle cognitive impairment in memory, attention, and executive functions which may persist post-abstinence (perhaps irreversibly) with negative impact on academic achievement, occupational proficiency, interpersonal relationships, and daily functioning[50]; precipitation/exacerbation of some medical (cardiovascular, circulatory) and psychological symptoms (depression, anxiety, personality disorders, schizophrenia and other psychoses) in vulnerable individuals[36-38,42-48]. Foetal abnormalities and developmental defects are possible after *in utero* cannabis exposure.[37,39,50]

A physical examination focusing on these possible comorbid medical complications of cannabis use should routinely be conducted.[18,46] Similarly, a focused mental state assessment is indicated when psychiatric symptoms and neurological deficits are evident.[18,46]

Negative consequences

Although more serious harms are associated with dependent use, cannabis-related negative consequences can occur across the entire consumption spectrum.[46,54] Problems commonly reported by users across this spectrum include loss of memory, motivation, energy and wellbeing, psychological distress (anxiety and depression), physical health problems (respiratory, nausea, headaches, sleeping disturbances), strange thoughts, paranoia, lowered self-perception (self-esteem and confidence), and multiple social (relationship, familial, school, employment, financial, criminal/legal) problems.[3,18,28,46,54,105] While higher consumption levels generally predict greater problem severity, even irregular users can evidence substantial psychosocial impairment.[28,46,54]

Assessment of the specific types of adverse health and psychosocial consequences, their number, frequency, and severity is crucial for understanding the nature and extent of impact on the individuals' life, and planning appropriately targeted intervention strategies.[18,54]

High risk groups

Groups identified as especially vulnerable to cannabis' adverse effects include adolescents (and increasingly, children) and young adults, with earlier initiators and heavy users at greatest risk; women of reproductive age; indigenous persons; persons with pre-existing medical (respiratory, cardiovascular) and mental health conditions (especially depression, anxiety, psychosis, suicidal behaviour, antisocial personality and disruptive behaviour disorders); and various other marginalized or disenfranchised population subgroups, such as adult and juvenile criminal justice clients, the unemployed, homeless, persons of lower educational and socioeconomic level, diverse ethnic and other culturally-diverse groups, e.g., gay and lesbian individuals. Special efforts should be made in detection and intervention for cannabis use problems in these high-risk groups and individuals.[4-20,24-28]

specific issues in cannabis assessment

Several issues pertain to assessing the bio-psycho-social domains outlined above. Since these have the potential to impact on the clinical utility of existing methods and tools for measuring cannabis problems in these areas, they need consideration when selecting among the instruments that are available. These encompass measurement, diagnostic, clinical and ethical issues.

Measurement issues

cannabis consumption

Assessment of cannabis consumption is fundamental to intervention need decisions. Determining the pattern or intensity (*frequency*) and extent (*quantity*) of use are the two major components. While assessment has typically focused on simple summary questions to determine frequency of use during a specified period (e.g., "During the past 12 months [90 days, 30 days, week], on how many days did you use cannabis?"),[18] quantification of cannabis consumption remains a conceptual, empirical, and practical challenge.[54] The many difficulties include variability in the potency of the most psychoactive constituent 9-delta-hydrocannabinol (THC) in cannabis preparations (herbal cannabis/marijuana, resin/hashish, hash oil), and lack of 'standardization' for cannabis quantity units (conversion of joints, pipes, cigar-type "blunts", water-pipes/bongs, to a 'standard' unit), consumption methods (smoking, spotting, eating) and practices (mixing with tobacco, group sharing, using alone).[54-56] While estimates vary, a rough ordering of the potency of products by percentage of THC typically is marijuana (0.5-14%), hashish (2-20%) and hash oil (15-60%).[18,37,38,42]

To complicate the picture, various other factors determine THC bioavailability, such as plant strain and genetics, cultivation process (with popular hydroponic varietals such as "skunk" more potent), product used, amount smoked/ingested, titration (adjustments made by experienced users to compensate for varying THC potency in products used), deep or shallow inhalation, degree of intoxication sought and attained.[54-56] Inter-individual factors further increase this complexity, with substantial variation in outcomes at similar consumption levels dependent on the user's age, physiology (weight and metabolism), personality, general and mental health, smoking experience and social milieu (set and setting) in which cannabis consumption occurs.[54-56] Accordingly, a universally-accepted threshold THC consumption level *unequivocally* associated with hazardous/risky use, negative consequences, or the development of dependence, remains unknown[18,54-56]

Awareness of these complex issues is critical for health professionals to communicate knowledgeably with users and assess the risks of each individual (see Stephens & Roffman, 2005, for discussion).[18] Approaches to assessing cannabis consumption are presented in a later section. In addition to these unresolved quantification issues, obtaining a precise measure of cannabis consumption is overlaid with the general problem of the accuracy of users' self-reports.

reliability/validity of self-reports

The use of questionnaires and interview schedules assumes that self-report is valid. Common to all self-report health data, reliability and validity of self-reported drug use is a perennial and complex issue.[57-60] Unlike alcohol or tobacco, relatively unique disincentives to divulge cannabis use derive from its illegal status in the context of its social acceptability, widespread consumption, and confusing mixed messages emanating from (sensationalized) legal, medical, scientific and clinical debate on its 'medical benefits', risks, and harm liability.[27] Cannabis users tend to view their use as harmless and congruent with their 'alternative' lifestyle, have little interest in quitting or lack motivation to accurately recall their use patterns.[61,62] Adolescents pose special challenges. Immaturity or lack of insight can interfere with ability or motivation to introspect objectively, while normal adolescence attributes (e.g., risk-taking, anti-authoritarianism, defiance, conformity with peer group) can curb motivation to cooperate, especially when under coercion to disclose.[63-65,114] Equally implicated are interviewer factors such as lack of awareness and training in cannabis problem recognition and intervention resulting in failure to enquire, or frame questions appropriately, to minimize denial and distortion.[27,66] Clinical under-detection may also be due to other factors such as perceived role incompatibility, skepticism about treatment effectiveness, discomfort discussing illegal drug use, time and fiscal constraints, and a judgmental attitude towards drug-related problems.[13,21,23,66]

Despite these barriers to open and frank reporting, adult self-reported cannabis use is generally reliable and valid, with greater consistency found for cannabis than for other drugs.[65] Adolescent self-reported cannabis use is also generally reliable across diverse contexts, with many adolescents *over*-reporting their cannabis use compared to rigorous laboratory tests or parental reports.[28,61,67-71] Among persons with psychosis, self-reported cannabis use can also be more sensitive than collateral and laboratory reports and medical examinations.[73,74] Factors influential in reliability/validity of self-reported drug use include: the assessment context and persons present (especially parents); interviewer characteristics; information collection method (personal interview vs. self-administered questionnaire); user characteristics

(intelligence, cognitive deficits, motivation); perceived threat to confidentiality, and contingencies operating; recency of drug use (acute intoxication or withdrawal states may compromise validity); strategic use of corroborating data (e.g., advising that collateral or toxicology reports will be collected); and the complexity and duration of the recall task.[31,57,58,72,75,76]

Ultimately, as Stephens and Roffman acknowledge, "users' own reports of cannabis-related problems are our most sensitive and clinically useful indices of negative consequences" (p. 260).[18] The important question for assessment is thus: *what conditions* produce reliable and valid information for the intended purpose?[57-59] Self-reported drug use and problems are generally reliable and valid when respondents are assured of confidentiality/anonymity, trust and safety in non-coercive contexts, when they are not intoxicated, and when aware that their reports will be checked against other sources.[76,77,116] Cannabis questions will be less threatening and likely to produce more candid responses when embedded in a general health interview or 'lifestyle risks' framework.[19,57-59,65-67,77,78] Recall accuracy is enhanced by using questions pertaining to recent, rather than typical or historical, use and seeking broad categorical responses rather than exact, continuous data.[57-59] Memory errors and response distortion are minimized by use of skilful interviewer probes, memory aids, clear and simple instructions, and aided recall such as fixed-choice responses.[75] Validated procedures employing these techniques are reviewed in a later section.

Diagnostic issues

The two dominant standard systems used worldwide to classify and diagnose CUD are current versions of the American Psychiatric Association's *Diagnostic and Statistical Manual*[54,79] and the World Health Organization's *International Classification of Diseases*.[80] The more comprehensive DSM was designed for use by psychiatrists, and the ICD by general medical practitioners. Successive editions of these disparate approaches have seen the diagnostic criteria, classification rules, and nomenclature for psychoactive substance use disorders (PSUD) increasingly converge for enhanced diagnostic precision.[33,83] Both systems identify a cannabis dependence syndrome with common criteria: (1) inability to control consumption, or abstain (2) continued use despite significant health problems (3) preoccupation with obtaining and using cannabis (4) significant interference with important social and occupational roles and responsibilities. While both systems also include criteria for (5) tolerance and (6) withdrawal, a diagnosis can be made in the absence of these features. A diagnosis of dependence is made if three or more of 7 (DSM) or 6 (ICD) symptoms have been experienced within the past 12 months. A second partially overlapping (residual) syndrome, 'drug abuse' (DSM) or 'harmful use' (ICD), allows for a diagnosis of drug-related problems that do not satisfy dependence criteria. This diagnosis is made if at least one of 4 (DSM) or 1 (ICD) criteria of repeated consumption resulted in recurrent significant damage to the user's physical or mental health (ICD, DSM) and social functioning (DSM) within the past 12 months. Criteria for each diagnostic outcome are assumed to have equal weighting.[54,79,80]

While currently the most systematically constructed and evaluated nomenclatures of PSUDs internationally, these systems have evoked considerable debate in the field.[81-91] Several diagnostic issues raised pertain to assessment of CUD using the instruments in which the DSM/ICD criteria are operationalized: psychometric properties (reliability/validity), cross-system, and cross-cultural diagnostic agreement for CUD; the validity of the cannabis dependence-abuse distinction versus a spectrum of severity; validity of a cannabis withdrawal syndrome; applicability of the diagnostic formulations to adolescents; and the question of diagnostic cut-points, their sensitivity to, and appropriate disposition of, a sub-diagnostic group coined "diagnostic orphans".[92]

reliability/validity of diagnostic formulations across systems, cultures, and gender

While reliability, validity, and cross-system agreement for a cannabis dependence diagnosis has generally been good in many international studies,[18,33,83] poor cross-system concordance has consistently been found for harmful use/abuse across all demographic subgroups.[83] Caution is thus advised in assuming instruments assessing 'abuse' (DSM) and 'harmful use' (ICD) measure the same phenomenon.[81,84] The DSM social consequences (absent in ICD), and both cultural-specific and subcultural-specific mores with regard to cannabis use, will more heavily influence diagnosis of a cannabis use disorder in DSM than in ICD.[87] If poor reliability/comparability continues to be found for 'abuse', elimination of this category from the nomenclature should be considered.[81] An assumption of universality of PSUD underlies cross-cultural use of DSM-IV/ICD-10 taxonomies. However, in addition to poor cross-cultural reliability of

abuse/harmful use,[83,125] both conceptual difficulties and cross-cultural differences in the thresholds at which the criteria and diagnosis for cannabis dependence were applied have been found.[87,125] In short, the global applicability of DSM-IV/ICD-10 diagnoses for cannabis, featuring largely Western (USA, UK, Canadian) concepts and experience, remains unclear.[87]

More recently, gender differences in criteria endorsement for cannabis dependence and abuse have been observed, with abuse criteria exhibiting higher thresholds in women and dependence criteria in men.[93-95] Given gendered discrepancy in functioning of CUD indicators, Agrawal and Lynskey (2007) assert that "much more psychometric and taxonomic research is required to clarify the most scientifically valid and feasible diagnostic formulation of CUD" (p. 305).[93] Room (1998) also argues that the DSM assumption of equivalent phenomenology across substances ("there are no unique sets for cannabis dependence and abuse", DSM-IV-TR, p.235) obscures important differences *between* drugs and their harm liability.[87] DSM-IV criteria are vague for cannabis.[81] While this perspective is shared by others suggesting cannabis-specific criteria may be required for better assessment,[90, 95-97] a simultaneous call for standardization of dependence criteria across forthcoming DSM-V/ICD-11 has been made.[84] The cannabis withdrawal syndrome exemplifies this issue.

cannabis withdrawal syndrome

Despite sound evidence for its biological basis [100] and for reliable and valid tolerance and withdrawal symptoms in laboratory, controlled, clinical, naturalistic, and population-based adult and adolescent studies, [93, 96-99, 101-111] controversy persists over the existence of a clinically significant cannabis withdrawal syndrome (e.g., Smith, 2002; Soellner, 2005).[112,113] While ICD allows for a diagnosis of withdrawal without providing any descriptors, DSM-IV-TR (p. 235) continued omission of cannabis-specific withdrawal from its diagnostic formulations. However, Budney's significant seminal work has presented compelling evidence for a reliable and valid cannabis withdrawal syndrome, proposing criteria marked by anger or aggression, irritability, anxiety, restlessness and sleep difficulties as its most prominent symptoms.[104] The magnitude and time course of these effects appear comparable to tobacco.[103] Responding to Budney's call for the adoption of a diagnosis of a cannabis-specific withdrawal syndrome in the next revisions would eliminate (at least) one of the discrepancies between DSM/ICD nosologies.[83,97,103,114]

Not all cannabis users seeking treatment report withdrawal concerns.[18, 103] However, given the wide variations in the rapidity of development, duration, and severity of symptoms,[46,98-109] the continued omission of clearly-defined features of cannabis tolerance and withdrawal in DSM-IV/ICD-10 presents a diagnostic challenge for assessment and management of the large proportion of users who do report or evince abstinence symptoms. As yet, withdrawal and craving assessment tools, and pharmacotherapy research for cannabis dependence and withdrawal, are still in their early stages.[46,103] With antidepressant, anxiolytic, and (perhaps) cannabinoid agonists and antagonists[105] currently showing potential, controlled pharmacological trials are urgently needed to advance this important area in relapse prevention, given the likelihood of withdrawal to interfere with abstinence attempts.[103,105,115]

the dependence-abuse distinction: categorical vs. a spectrum of severity?

The conceptual and statistical independence of cannabis dependence from its consequences (abuse) is also controversial. Some argue for its retention in DSM-V and ICD-11.[84,117] Researchers directly assessing this issue among diverse adolescent and adult populations, however, found little evidence of distinct 'abuse' and 'dependence' factors.[93-95,118-127] Rather, findings indicated a unidimensional disorder with a gradient of severity, suggesting the DSM/ICD categorical distinction with mutually exclusive criterion sets would be more efficiently replaced by a quantitative model with a pooled set of dependence/abuse criteria used to determine gradations (none, low, mild, moderate, severe) along the problem severity continuum. In this dimensional view, sub-clinical or sub-threshold ratings may indicate an earlier, 'prodromal' stage in progression from consumption to drug-related problems, while lower dependence severity scores suggest an 'abuse' or 'mild dependence' diagnosis.[120-122,130,131]

Severity of cannabis dependence or problems is one of the most important dimensions in assessment, crucial for treatment need decisions in screening and efforts in treatment-matching.[129-130] From a public health perspective, the dimensional approach offers flexibility of cut-points to suit different populations and purposes. Distinguishing dependent from non-dependent individuals is a matter of degree, with no single arbitrary cut-point universally suitable.[129]

Both the dimensional and categorical models are necessary and complementary.[131-133] With their predetermined cut-points, categorical diagnostic techniques are essential to identify and classify individuals for treatment planning.[86,89,131-133] However, categorical systems tend to be procrustean, lose information, and result in many classificatory dilemmas when users do not meet the threshold number of criteria or meet criteria for two or more overlapping (e.g., dependence/abuse) categories. Denoting continuous dimensions as either 'present/absent' could lead to inappropriate diagnoses and treatment decisions. An inflexible cut-point that maximizes the hit rate within clinical settings does not provide the minimal threshold for defining when the person has the disorder among cannabis users in the community where people are likely to exhibit fewer symptoms and be on the diagnostic threshold. This at-risk group is the more appropriate target for early intervention to arrest progression to more serious problems. Moreover, although a DSM/ICD dependence diagnosis overrides an abuse (residual) diagnosis, many cannabis users qualify for both diagnoses.[54] Thus, cannabis use problems may be better measured along a single severity continuum.[92,124,131] This component could be built into the criteria themselves.[83,131] These unresolved issues are intimately related to the one that follows.

diagnostic orphans

According to current diagnostic systems, endorsement of three or more dependence criteria yields the dependence diagnosis. Use of such arbitrary cut-offs in alcohol research has produced a sub-diagnostic group called "diagnostic orphans"[92], defined as users who report one or two dependence symptoms and therefore do not meet full criteria for dependence while reporting no abuse symptoms.[92,141,142] Compared to other adolescent and adult diagnostic groups, diagnostic orphans were more similar to 'abuse' than 'dependence' diagnostic groups or those reporting no problems. This suggests diagnostic orphans and abuse groups have similar risks of substance-related problems. Diagnostic orphans and those assigned sub-clinical ratings on diagnostic criteria often characterize individuals in earlier, prodromal stages of problem development. Sub-threshold symptoms suggest a trajectory of escalating drug use and related problems.

This diagnostic phenomenon extends to cannabis-using adolescents and young adults.[28,92,119,138,142-144] Cannabis diagnostic orphans formed a separate group from dependent groups, evincing similar use patterns and problem profiles to the abuse groups, including other illicit drug use, regular tobacco and alcohol use, and mental health problems. The severity of diagnostic orphans' symptoms clearly indicated need for intervention.[28,119] Cannabis diagnostic orphans at age 20-21 years were more likely to be using, and to meet criteria for CUD, when assessed 4 years later.[145] Diagnostic criteria appear inadequate to capture all those having significant problems with their cannabis use.[28,64,145] Thus, as Bailey and colleagues (2000) caution, with incubating problems and likely to fall through the "diagnostic crack", cannabis diagnostic orphans and those reporting sub-threshold problem levels are an important area for assessment in early case identification efforts that "should alert practitioners to potentially serious problems" (p. 1801).[135] This at-risk group should be targeted by intervention efforts to arrest progression to a more advanced stage. Diagnostic issues with regard to adolescents flow directly from the two just discussed.

adolescents and DSM-IV/ICD-10 diagnosis

Adolescents (and increasingly, children) are a priority group for screening and assessment for cannabis use problems. Rather than simply younger versions of their adult counterparts, however, adolescent cannabis abusers have vastly heterogeneous characteristics, developmental stages, aetiological pathways, drug use patterns and problems, family and peer group issues, and treatment needs.[64,134-137,146,147] Adolescents generally have higher rates of binge and opportunistic cannabis use, shorter duration between first exposure and dependence, and shorter intervals between first and second drug diagnosis.[3,28,108] The diagnostic challenge is to incorporate other common elements in adolescents' complex problem spectrum, including psychiatric disorders (anxiety, depression, suicidal ideation and behaviour, posttraumatic stress disorder, bulimia nervosa, learning and behavioural disorders, schizophrenia), family conflict and dysfunction, family history of addiction, academic failure and dropping out, risky sexual behaviour and teenage pregnancy, delinquent participation and involvement with the criminal justice system.[28,134-137]

Being neither age nor developmentally specific, DSM-IV and ICD-10 diagnostic frameworks can be challenged with respect to adolescents. Dependence symptoms and medical problems, which may take years to develop, present differently in adolescents.[64,65,107,114,122,134-137] Since many adolescents intentionally initiate out-of-control drug

use to get "high" the 'impaired control' construct is also problematic. Nevertheless, teenagers can and do meet formal diagnostic criteria for cannabis dependence within a year of initial use.[64,108,118,138-140] A major limitation to accurate diagnosis is the categorical nature of DSM-IV and ICD-10 formulations.[95,119] Given their generally more pathological profile at treatment admission diagnostic thresholds are likely to be inadequate for adolescents, especially for dependence.[28,91,140] Behaviours that elicit legal and social consequences (apropos of an abuse diagnosis) for adolescents as minors may not create problems for adults.[91,134-137] Conversely, diagnostic criteria used may not include significant problems that adolescents experience from their drug use. Diagnostic thresholds for both dependence and abuse should thus be lower for adolescents. However, given the heterogeneity of adolescents reported symptoms, whether the dependence-abuse distinction among adolescents is diagnostically meaningful has also been questioned.[91,119] Support continues to grow for the dimensional approach to diagnostic classification based on a problem severity continuum (discussed above) as the most parsimonious model for the range of criterion profiles that characterize adolescent drug use disorders.

Debate continues on this unresolved issue. Since using adult measures can present psychometric problems, it cannot be assumed that adult models are directly transferable to adolescents.[63,64,135,136] Given adolescents' differential developmental stages, level of maturity, use patterns, issues, poor problem recognition and self-insight, some consider use of DSM-IV and ICD-10 criteria for adolescent drug disorders dubious.[28,64,146,148] Nevertheless, research generally supports the validity/utility of DSM-IV criteria for adolescent cannabis (and alcohol) use disorders.[91,135,137,140] Meanwhile, until validated developmentally-appropriate, adolescent-specific diagnostic criteria are established the cautious use of DSM/ICD diagnostic criteria among adolescents is recommended, keeping in mind the most frequent differences between adolescent and adult manifestations of cannabis use, problems, abuse and dependence.[64,134,136]

Clinical and ethical issues

Conducting assessment for cannabis problems raises several clinical and ethical issues. Community health and social services providers require education and training on the rationale, knowledge, methods and practical skills of cannabis A/I for proficiency in proactive detection of early-stage problem cannabis use and implementing age- and stage-appropriate interventions among their clients and consumers. The typically high rate of attrition in referral underscores the importance of such efforts at this first point of contact.[14,32,149-151] Raising their index of suspicion about cannabis problems among their consumers requires a shift in attitude for many health practitioners, by tradition symptom-focused and reactive. Those caring for adolescents require special skills for recognizing "red flags" of possible problem cannabis use, including all the above-listed risk factors and symptoms[134,136]

Ethical concerns arise during these clinical encounters. First, given public expectations that they provide health-related advice and help, health practitioners are ethically *obliged* to detect cannabis problems among their patients and intervene.[66] To ignore this potential health threat is "ethically unacceptable" (p. 46).[66] Another ethical requirement is for the user's *own* perception of cannabis' risks and their problems - and not that overtly imposed by the counsellor.[152] This has increased importance for adolescents who typically lack insight or ability to introspect. Prochaska (2000) describes the general dilemma of readiness to recognize and change health risk behaviours.[153] Users commonly do not recognize they have a problem with cannabis and are reluctant to discuss. Hence, cannabis use should be discussed in the language of health promotion rather than disease or 'disorder' detection, and assessment described as a marijuana or cannabis 'check-up'.[3,152]

Open, candid discussion about cannabis use, however, will occur *only* when trust and confidentiality is established and other important issues such as gender, culture, and sexual orientation, addressed. Building rapport and establishing a positive, non-judgmental supportive approach is vital for creating a respectful, safe, reflective and empowering therapeutic alliance that allows cannabis users to explore their experiences with cannabis, move beyond ambivalence, and find possible reasons to change.[152-154] This is especially critical for engaging adolescent users and their families to help avert or reduce resistance and generate motivation for change.[64,155-157]

Once at the point of considering change, a third ethical/legal issue may arise for individual counsellors in accepting a lesser goal than abstinence, such as controlled reduction. While consistent with the harm reduction philosophy, the (continued) use of an illicit drug by minors

has increased relevance for those working with adolescent users. This, in turn, raises ethical issues of confidentiality and its limits (i.e., not secrecy) with regard to parents/caregivers, family, other collaterals, and providers.[116] It is important to determine whether the adolescent is in need of protection and/or crisis intervention (e.g., self-harm, suicide attempts, or abuse) which require disclosure of the adolescent's condition.[116,158] The critical importance of engaging the adolescent's peer group network, and support of the whole family in family-based interventions for maximizing positive changes in all areas of functioning, is strongly emphasized.[26,77,155-161]

A further (and obvious) ethical mandate is a systematic and assertive follow-up plan for ongoing monitoring to ensure the user's continuity of care, safety, and support.[46,157,158]

screening and assessment tools for cannabis use disorder: psychometric and other characteristics

Assessment is a broad concept that subsumes the critical steps in detection and treatment of cannabis use disorders: screening, diagnosis, problem severity, and individualized in-depth evaluation.[33] User nondisclosure and evasive behaviour, lack of clinically-detectable signs and symptoms of early-stage cannabis problems, unreliability of clinical observation and unstructured non-standardised methods,[17,21-23,31,162] in conjunction with a low index of clinician suspicion underscore the importance of integrating instruments specifically designed to enhance the accuracy of assessment into this process.[22,31]

There are a number of ways of measuring the performance (utility) of such instruments across the assessment continuum. The most fundamental indices are *reliability* and *validity,* the tool's psychometric properties. Reliability (or reproducibility) broadly refers to an instruments' ability to measure a construct (e.g., cannabis use disorder) consistently, while validity refers to how accurately an instrument measures what it intends to measure.[60,163] Reliability is a necessary (but not sufficient) condition for validity. Reliability indexes how well an instrument's constituent items or subscales measure the same construct (*internal consistency*), and produce consistent scores over time (*test-retest reliability*) and observers (*inter-rater reliability*).

Validity is multifaceted and more complex. *Content validity* refers to the degree to which the instrument measures all aspects of the index disorder, while *construct validity* requires that the instrument measures only the characteristics of that disorder.[60,164] *Convergent* and *discriminant validity* pertain, respectively, to whether the instrument correlates strongly with measures designed to assess similar constructs, and the instrument's ability to distinguish persons with the disorder from those without it.[163] *Criterion validity* is based on how well respondents' scores on an instrument correlate with their scores on another known accurate measure of the construct, typically some external "gold standard" (e.g., DSM-IV/ICD-10) assessed either at the same time (*concurrent validity/diagnostic utility),* or in the future (*predictive validity/utility*).[60,164]

In a screening context, the most important validity indices are termed *sensitivity* (the instrument correctly identifies those with or at risk of the index disorder: *true positives*) and *specificity* (accurately identifies those free, or at low risk, of the disorder: *true negatives*). These indices assist in interpreting scores obtained on a particular measure and in identifying an optimal cut-point. Scores that maximize sensitivity and specificity (*cut-offs*) can be obtained using statistical procedures. *Positive predictive value* is calculated as the percentage of identified persons who are cases. Related to all the above indices, the *generalizability* of optimal cut-offs identified on a particular measure both to and across other populations, cultures, places, and time is a critical aspect of the utility of a screening tool.[165-166]

The highest value possible is desired for all the foregoing indices. Where available, information on these various performance indicators will be included in the review of cannabis instruments that follows.

Level 1. screening

Screening is distinguished from further, more detailed diagnostic and in-depth assessment. Screening is a *preliminary* assessment that attempts to detect individuals with harmful and potentially harmful cannabis use among a broad population, such as generalist health (GPs, hospital wards and emergency rooms, nursing practices), counselling (mental health outpatient, schools, employment, youth and children), and other social services, welfare and justice clients. Screening does *not* enable a clinical diagnosis to be made or determine the complete profile of psychosocial functioning and needs, but identifies those who *may* have a problem that warrants further assessment.[19,60]

Screening tools can confirm the presence of a suspected drug use disorder when medical or psychosocial indicators are apparent or, conversely, raise the health professional's index of suspicion in (apparently) asymptomatic individuals. Screening instruments should be acceptable to heterogeneous users, brief, simple (given the cognitive/neurological deficits likely in this relatively young population), efficient, readily available, low or no cost, be capable of detecting cases *and* those at risk, and easily administered by non-specialist clinicians and laypersons with limited clinical experience.[17,60,167] Since the public health approach entails casting a wide net initially for maximum detection and then ruling out false-positives through diagnostic assessment, screening must be *over*sensitive to possible cannabis use problems.[17,167] Higher sensitivity is preferable to higher specificity to minimize the possibility of overlooking an individual who may benefit from intervention. Erring on the side of caution at the outset is essential to increase the likelihood that high-risk cases are discovered.

Two different screening procedures are typically used for cannabis misuse: (1) self-report questionnaires and biochemical laboratory tests.

Biochemical tests

Biochemical indicators of cannabis use/misuse include urine, blood/plasma, scalp hair, saliva, breath, tears, sweat, breast milk and meconium.[30,168-170] While less susceptible to biases in self-reports, biological markers of cannabis use have their own limitations. THC metabolites disappear rapidly from the bloodstream and are non-detectable after about 20 minutes. The least costly and most widely-used screen is the Enzyme Multiplied Immunoassay Technique (EMIT) urine test, a comparatively accurate screen for cannabis.[171,172] Sensitivities varying between 88-90% and specificities between 95-100% have been reported.[173] Nonetheless, laboratory errors, accidental (or intentional) donor dilution or adulteration, passive cannabis exposure, or concurrent use of other drugs and some medications (e.g., codeine) can affect accuracy of EMIT tests.[30,174] The most precise detection method is gas chromatography/mass spectrometry (GC/MS), typically used to verify positive screens.[170] The prohibitive costs (either confirmatory or one-step) and expertise required for interpretation of on-site cannabis testing, however, rules out this method for routine screening in community settings.[175]

Most importantly for screening, the biological half-life of lipophilic THC and interindividual differences in excretion renders urinalysis unable to determine dosage, time or route of administration, extent of effects in the user, or distinguish chronic use from a single dose.[30,60] Complete elimination of a single dose from urinary fluids can take more than 30 days.[55] A positive result could occur in a chronic user who quit several weeks ago or a non-user with recent passive exposure to cannabis smoke.[30,174] The mere presence of urinary or plasma cannabinoids does *not* necessarily indicate a pattern of dependent, harmful, or risky use. This reduced sensitivity/specificity precludes using these biological assays as definitive indicators of either recent or problem cannabis use.[174,175]

Alternative matrices (hair, saliva, sweat, breath) reflect varying temporal windows, and their full potential for cannabis screening remains unknown.[168,175-178] Saliva testing avoids most adulterants, currently appearing less likely to reflect false positives from passive exposure.[179] Meconium analysis is recommended for detection of at-risk neonates with *in utero* cannabis exposure to enable medical follow-up.[180] Currently, urine remains the preferred and most reliable test for cannabis metabolites.[175] Its advantages include ease of collection, acceptability, little preparation requirement, ability to be monitored for adulteration, comparative non-invasiveness, and corroborative utility for self-reports.[30] However, since supplementary contextual information is required for accurate interpretation of laboratory test results, urine toxicology is more appropriately used as an adjunct to self-report methods rather than a sole approach to screening.[30,175]

Self-report questionnaires

Most of the self-report screens previously used to detect cannabis use problems have been adaptations of existing alcohol or other drug screening tools.[18] Well-known examples include adult and adolescent versions of the 149-item Drug Use Screening Inventory (DUSI; DUSI-R-A),[181,182] the 139-item Problem Oriented Screening Instrument for teenagers (POSIT),[183] the 40-item Personal Experience Screening Questionnaire (PESQ)[184] and the Drug Abuse Screening Test (DAST-28, DAST-20; DAST-10).[185-187] Briefer models include 'conjoint' (alcohol and drugs) screens (e.g., 4-item CAGE-AID; 13-item SMAST-AID),[188] the adolescent 6-item CRAFFT,[189] the adult 11-item ASSIST[190] and the 10-item DUDIT.[191]

Many of these (and other similar) drug screening tools are too lengthy, complex and unwieldy, or otherwise unsuitable for time- and cost-efficient administration in busy community settings by generalist health and laypersons without formal training.[34,35] Others vary widely in length, focus, content, group/s targeted, and score utility. To varying extents, with their generic focus on use of "drugs" and reliance on only one or two cannabis items, primary focus on clinically-important disorder and insensitivity to low-level misuse, global severity scores, limited evidence of predictive validity or utility for use among both general adult and adolescent populations, and the various ethnic/cultural subgroups in these populations both within and outside their original countries, these tools are insufficient as quick and accurate screens *specifically for* cannabis use problems.[27,35,138] Fortunately, the recent development of a small range of cannabis-specific screens in disparate geographic locations has begun to redress this gap in instrumentation.

In New Zealand in 1990, a pioneering attempt was made to conceptualize a specific measure for detecting cannabis use problems, the *Cannabis Abuse Syndrome Screening Test* (*CASST*).[192] With a binary 'yes/no' response format the 11-item screen covers problems associated with cannabis use, focusing heavily on cognitive problems. Designed for clinical administration and embedded in assessment of the user's cannabis consumption history (thus requiring training for its administration), the tool requires 15-45 minutes to complete. An affirmative answer to three or more questions suggests a diagnosis. When piloted among polydrug users, reliability and validity measures failed to reach adequate standards. No further validation or developmental work on the CASST has been reported. New Zealand primary care guidelines for recognition, assessment and treatment of cannabis abuse recommend the CASST questions as potentially useful in discussion with appropriate patients.[193]

From the 1990s, promulgation of the public health approach emphasizing *earlie*r detection of a broader clinical spectrum of substance-related disorders, problems and disabilities, and publication of the international alcohol AUDIT[194] screen for hazardous use was the impetus for development of a new generation of cannabis-specific screening tools modeled on this template.

In New Zealand, the *Cannabis Use Disorders Identification Test* (*CUDIT*)[195] was developed to mirror the AUDIT by simple substitution of AUDIT item wording ("cannabis" for "alcohol") and other minor modifications. The 'prototypical' CUDIT thus covers ICD-10 criteria for substance use disorders from four conceptual domains: cannabis consumption, using behaviour, adverse psychological reactions, and problems. With an AUDIT-type dimensional response format, the 10-item CUDIT has a possible score of 40. The CUDIT can be administered by an interviewer or self-completed using printed or computerized versions. Among alcohol-dependent outpatients (n=53) internal consistency reliability was 0.84.[195] As per the AUDIT, the optimal CUDIT score cutoff for identifying current cannabis use disorder was 8 or more, with a sensitivity of 73.3% (11 of 15 individuals with a current cannabis use disorder scored 8 or more) and positive predictive value was 84.6% (11 of the 13 individuals scoring at this level were diagnosed with a cannabis use disorder). Performing better than a single use frequency measure, the authors suggest the CUDIT to be a viable screen for CUD in high-risk populations.[195]

Several possible conceptual, measurement, and validation (generalizability) limitations of the CUDIT can be identified. These include the simple 'cannabis/alcohol' terminology conversion (given the previously-discussed controversy about cannabis-specific criteria and alcohol's different harm liability), non-representation of specific dependence criteria demonstrating utility for discriminating dependent from non-dependent users,[196,197] non-representation of abuse or 'problem' items (social, interpersonal, legal, financial) common among youth cannabis users, the small and typically older clinical index sample, and the "poor performance"[195] of individual CUDIT items. When a German version of the CUDIT was tested among adolescents and young adults the optimal cutoff identified was between 3 and 5.[198] The researcher concluded that while it has potential as a viable screening tool, the CUDIT needs revision. A current CUDIT drawback for cannabis A/I is lack of attention accorded sub-threshold problems (diagnostic orphans) and risky use, primary targets of the screening/early intervention approach.[96,138] The CUDIT's performance among diverse adult and adolescent users from the general population, including those with pre-clinical symptoms and risky use patterns, test-retest reliability, and longitudinal (predictive) performance, are yet to be reported.

In the USA, development of the 31-item *Marijuana Screening Inventory* (*MSI-X*) was designed to assist clinicians recognize problem marijuana use.[199-202] This paper-and-pencil screen features 'yes/no'

responses to questions reflecting DSM abuse criteria, simple additive scoring, with cutoffs of 6 to denote 'high risk', 3-5 'moderate risk', 1-2 'low risk' and 0, 'no problem' use. When tested on archival data (n=408, mean age 29) and an adult clinical sample (n=107, mean age 33), internal reliability estimates of 0.89 and 0.90, and a cutoff score of 6 achieving maximum sensitivity (.83 and .73) and specificity (.89 and .96), respectively, were obtained. Based on the clinical sample data (only) the MSI-X demonstrated overall moderate to good concurrent, convergent, and discriminant validity with several generic drug (e.g., ASI, DAST-20) measures and the 'DSM IV-TR Guided Marijuana Inventory (DSM-G-MI)', a 30-item questionnaire specifically constructed as a proxy diagnostic criterion standard.[201] A number of data inconsistencies and MSI-X limitations, including the relatively small, adult-only sample, and uncorroborated self-report data, were acknowledged.[202] An important limitation was (and remains) lack of an empirically-verified standardized diagnostic interview as the criterion or 'gold standard'.[202] As yet, performance of the MSI-X among adolescents and/or other adults in the general population, its validation using a widely-accepted and standardized 'gold standard' criterion, and its longitudinal predictive performance, have not been published. Even with faultless characteristics, the 31 items may reduce the MSI-X's feasibility in some community settings.

In Europe, as part of ongoing EMCDDA efforts to define and extend 'problematic' drug use to cannabis, two cannabis-specific screens have recently been developed, the 6-item Cannabis Abuse Screening Test (CAST) in France[203] and the 8-item Problematic Marijuana Use (PUM) test, in Poland.[204] Items were derived from existing screens (CRAFFT, CUDIT, POSIT) and tested among community-based adolescents and youth, aged from 13 (PUM) through to 22 years (CAST). Using their criterion referents (POSIT or clinical interviews) and ROC analyses, the authors reported sensitivity and specificity, respectively, of 0.80 and 0.88 (PUM) and 0.93 and 0.81 (CAST) at specified cutoffs.[203,204] These screens share several conceptual and methodological drawbacks, the most important being lack of an objective standardized criterion 'gold standard'. With relatively weak methodologies, including non-standardized clinical interviews by multiple (80) diverse clinicians and non-blind data collection (PUM), or use of the POSIT for criterion standard (CAST), use of a lifetime window ("have you ever…"), and cross-sectional data without test-retest or external corroboration of self-reports, these screens require further validation research before universal widespread use of these screens among other populations and across multiple community settings can be recommended.[203,204]

As earlier noted, an important population for cannabis screening are those with, or vulnerable to, mental illness. The high rates of comorbid cannabis use and psychiatric disorder, and failure of 'traditional' screening instruments to detect cannabis (and alcohol, cocaine) use disorders among acutely-ill psychiatric patients, prompted development of the 18-item Dartmouth Assessment of Lifestyle Instrument (DALI) in the USA.[205] Using clinical rating scales and a standardized structured DSM (SCID) interview as the criterion 'gold standard', multiple drug screening instruments, and several structured interviews for substance use and psychiatric disorders, analytical techniques were employed to identify the optimal (8-item) subset for accurate detection of CUD (and alcohol, cocaine) among dually-diagnosed persons in an acute-care psychiatric facility. Demonstrating strong psychometric properties among the index sample,[205] requiring minimal administration time, with interviewer and self-administered versions (for less impaired individuals) and simple, additive scoring, the 18-item DALI has potential for use among this important target population of cannabis problems screening. Additional work is needed to evaluate its performance in other psychiatric settings and populations.

Indigenous persons in Australia are another important at-risk population for cannabis-related harms.[206-208] The present review found no cannabis-specific screening tools developed specifically for this population. Given the high rates of polydrug use and coexisting mental health problems among this population, the 13-item Indigenous Risk Impact Screen[209] was recently developed to reflect the combined severity of these interacting problems within the one instrument. Two subscales (alcohol/drug; mental health) demonstrated good psychometric properties (test-retest and internal consistency reliability, convergent validity with other well-validated drug screens) with 83% sensitivity and 84% specificity at the optimal combined cutoff (11).[209] Currently, the lack of a 'gold standard' referent for cannabis and overrepresentation of alcohol users in the index developmental sample restricts generalization of these results to other indigenous persons and communities. Meanwhile, the authors recommend the IRIS form a routine part of clinical practice for indigenous persons to ensure appropriate identification, intervention, and referral.[209]

In concluding their 2005 review of existing cannabis assessment tools, Stephens and Roffman emphasized the need for more psychometric studies, "...some of which might profitably start with an original item pool generated by experts in cannabis use problems" (and)..."conducted with a wider range of users in order to develop measures that identify and predict hazardous levels of use" (p. 265).[18] A cannabis screen incorporating both objectives was recently developed in New Zealand.

The 16-item Cannabis Use Problems Identification Test (CUPIT)[138] was constructed via an international addictions/cannabis experts panel methodology and tested among a community-based sample of heterogeneous at risk adolescent (n=138) and adult (n=74) cannabis users aged 13-62 years from multiple diverse community settings. The CUPIT demonstrated good test-retest (0.88 to 0.99) and internal consistency reliabilities for the two derived subscales, 'dependence' (0.92, whole sample) and 'problems' (0.90 adults, 0.79 adolescents). Highly concordant with criterion measures (CIDI-derived DSM-IV/ICD-10 diagnoses, dependence severity, total symptoms) and other validated measures (CPQ/CPQ-A, BSI) of cannabis-related problems (convergent validity), the CUPIT reliably discriminated diagnostic subgroups (no diagnosis, abuse/harmful use, dependence) along the problem severity continuum (diagnostic utility). CUPIT scores had significant longitudinal predictive utility for diagnostic group membership, cannabis consumption, and problem severity 12 months later. A CUPIT score of 12 was optimally efficient for capturing both currently diagnosable CUD and those at risk (e.g., diagnostic orphans) in the screening net with 98% sensitivity, 95% positive predictive power, and reduced (35%) specificity.[138] Given the highly disordered at-risk index sample, alternative cut-offs may be more applicable for screening in other cannabis-using populations and settings. Feedback from respondents indicated the CUPIT was highly acceptable. With these favourable characteristics among heterogeneous users from the general population, the CUPIT appears promising for use across multiple community settings. Given its preliminary developmental stage, further validation is required among other diverse cannabis-using populations of adolescents and adults. The performance characteristics of the CUPIT are currently being examined in another Western culture.

In sum, a small but expanding assortment of brief cannabis-specific tools now exists for screening for cannabis use problems. While those reviewed require more extensive validation (and perhaps developmental work) in other adolescent and adult clinical and non-clinical populations of cannabis users, and in different cultures, several currently show some promise as time-efficient screening tools for use in diverse community health and other settings.

The course of action taken with those who screen positive will vary depending on how entrenched use patterns and associated problems have become, and on the compliance and motivation of the individual concerned.[18,46] For those evidencing a relatively mild problem level or nondependent but risky use patterns, immediate implementation of an opportunistic brief intervention may be the appropriate level of care. An important step in A/I for those who screen positive at the more severe end of the problem spectrum is referral for more extensive assessment, and possibly specialist treatment.

Level 2. cannabis problem assessment

In contrast to one-off screening in broader populations to identify 'at risk' cannabis users, assessment is a more systematic evaluation of those identified by self-referral, professional referral, or through more formal screening procedures, as requiring further assessment. Assessment is an extensive, longitudinal clinical process conducted by qualified and accredited professionals to establish a diagnosis, determine diagnostic severity, and develop an individualized treatment plan tailored to the client's presenting needs.[60,167] This includes monitoring and reassessment as the individual progresses through treatment and treatment needs change, and evaluating treatment outcome. The multi-dimensional nature of cannabis use and user problems requires multidimensional assessment in bio-psycho-social domains.[18] Assessment tools include interviews, laboratory tests, medical records, questionnaires, collateral reports, and various other data bases and records, as available. The selection of tools is highly dependent on the setting, patient or consumer population, assessment purpose and goals, and the administrator's training and clinical experience.

As outlined earlier, the DSM and ICD diagnostic criteria distinguish cannabis dependence from cannabis use-related problems and disabilities (abuse).[79,80,129] Whereas the diagnosis of dependence is predicated on loss of control, compulsive use, increased salience of use, and associated tolerance and withdrawal, negative consequences may befall cannabis users who do not show these signs of dependence. Persons identifying recurrent

interpersonal, school/educational, employment, hazardous use, financial and legal problems associated with their cannabis use meet criteria for abuse. Dependent users are more likely to need intervention, and perhaps more intensive intervention, in order to make changes.[18] Among those with nondependent but problematic use, assessing and discussing the specific types of negative consequences, their number, frequency, and severity, and their negative impact on the user's life may precipitate motivation to make lifestyle changes.[18,46] Comprehensive, multidimensional assessment will assist with clinical exploration of treatment options appropriate for such non-dependent but at-risk users.

Diagnostic assessment

A reliable and accurate diagnosis is crucial for a timely and appropriate response to cannabis use problems. Diagnosis typically involves a systematic evaluation of signs, symptoms, and laboratory data as a basis for treatment planning and estimating prognosis.[33] Diagnosis is also required to confirm cases and exclude false screen-positives from further assessment. As Babor has noted, there is a tremendous array of strategies and well-validated standardized instruments for assessing current cannabis use and establishing a formal diagnosis of dependence or abuse/harmful use according to DSM and ICD criteria.[33] The most comprehensive are fully or semi-structured clinical or research interview protocols.

One highly reliable and valid fully-structured interview with specified questions and responses designed for respondents aged from 15 years and extensively used by clinicians and trained laypersons worldwide is the WHO's Composite Diagnostic Interview Schedule (CIDI),[210] and its variants, the University of Michigan (UM-CIDI)[211] and Munich (M-CIDI)[212] versions, providing both DSM-IV and ICD-10 diagnoses.[33] Questions also cover history of cannabis use, age of onset, and recency of symptoms. The CIDI is relatively simple to administer.[22] The substance use module (CIDI-SAM) can be used independently. Requiring about 60 minutes to administer for all drug diagnoses, and 20-30 minutes for cannabis questions only, the CIDI-SAM is reliable in a variety of populations.[81,133,213-216] Also available at low cost for use by clinicians and trained laypersons is a computer-assisted version (CIDI-Auto version 2.1)[217,218] with reliability and validity reported for both clinical and general populations in diverse cultures.[127,219-222] While all of these tools can appropriately be used among younger cannabis users, a well-known alternative with sound psychometric characteristics is the Adolescent Diagnostic Interview (ADI).[223]

Semi-structured interviews more closely approximate the flexible conditions typically found in community-based clinics.[33] These protocols do not require strict adherence to written questions, but do rely heavily on the interviewer's clinical experience and knowledge of psychiatric syndromes.[33] Examples include the DSM-IV Structured Clinical Interview (SCID)[224,225] for adults and adolescents, and the ICD-10 Schedules for Clinical Assessment in Neuropsychiatry (SCAN).[226] Both have been found to be reliable across a variety of age and cultural groups.[119,227-230] Specifically developed to overcome some of the diagnostic drawbacks of the SCID (i.e., differentiating withdrawal symptoms from those of psychiatric disorders, and independent psychiatric disorders from substance use), the DSM-IV Psychiatric Research Interview for Substance and Mental Disorders (PRISM)[231] has also shown to be highly reliable.[232] Another instrument designed for use by well-trained lay persons and providing both DSM-IV and ICD-10 diagnoses, the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA),[233] is highly reliable and valid for both alcohol and drug dependence.[233-235] Two adolescent protocols based on the DSM-IV and with good psychometrics and computerized versions available are the Diagnostic Interview Schedule for Children and Adolescents (DISC-IV)[236] and the widely-used Global Appraisal of Individual Needs for adolescents and adults (GAIN).[237]

Mapping directly onto DSM and ICD diagnostic criteria, the above criterion/diagnostic protocols are considered the 'gold standard' for cannabis use (and other substance use and psychiatric) disorder. Although requiring a lengthier assessment and training, they offer more detailed information about the nature and consequences of cannabis and other drug use.[18] Many are modular, and can be shortened by using only the Psychoactive Substances Use Disorders section/s and to focus on cannabis. Several have computer-assisted versions and algorithmic scoring. Equally if not more importantly, these instruments provide not only a lifetime and 30-day cannabis (and other drug) diagnosis but also offer a full range of other ICD and DSM Axis I and Axis II diagnoses. This is of major importance, given the high rate of comorbidity of cannabis and other drug and psychiatric disorders.

Severity of dependence

While a diagnosis indicates the presence/absence of a disorder, cannabis dependence varies across a continuum of severity from relatively mild to severe, life-disabling disorder.[54] Severity of dependence is one of the most important dimensions in assessment, crucial for intervention decisions in screening, treatment-matching, and in goals selection.[22,128-130] The presence of tolerance and withdrawal, for example, is generally indicative of greater severity that may require monitoring or detoxification treatment.[98-105,238] However, despite conceptualization of the dependence syndrome as dimensional,[129] severity specifiers were not included in the DSM/ICD diagnostic systems.

Several strategies are used for assessing dependence severity.[22] While many interview protocols, including the 'gold standards' reviewed above and various others, e.g., the Addiction Severity Index (ASI),[239] provide severity indicators, these often require trained interviewers and considerable administration time. Simple counts (or 'severity scales') of DSM-IV or ICD-10 dependence criteria met (e.g., 0-2=no dependence, 3-4=mild dependence, 5-6=moderate dependence, 7-9=severe dependence) have been found to perform adequately well.[240-244] A semi-structured clinician-rated interview, the Substance Dependence Severity Scale[245,246] operationalizes every DSM-IV/ICD-10 criteria for all drugs including cannabis, and is shown to have good psychometric properties and to predict outcomes. This tool also requires specialized training and up to 40 minutes to administer, however. This review failed to find further validation data specifically for cannabis users in treatment.

Apart from the new cannabis screening tools reviewed earlier, there are few brief validated measures of dependence severity.[18] In Australia, the optimal cutoffs for detecting cannabis dependence among long-term users were examined by comparing CIDI-SAM diagnoses with three short self-report ICD/DSM measures.[133] All three measures showed good sensitivity (64-76%) and specificity (79-85%) in detecting 'at least moderate' cannabis dependence. While the optimal diagnostic cutoffs remained unchanged in two of the scales, a more liberal cutoff (from 5 down to 3) was optimal for the 5-item Severity of Dependence Scale (SDS).[247] In addition to these adult long-term users, the SDS has shown good psychometrics among Australian adolescents[248] and New Zealand adults and adolescents.[138] A cutoff of three (adults) and four (adolescents) was optimal for detecting at least 'moderate' levels of cannabis dependence. The SDS also demonstrated sound psychometric properties among Australian acute-care psychiatric patients, with a cutoff of two optimal for detecting cannabis dependence.[249] The SDS was the strongest predictor of cannabis dependence among this patient group.[249] The SDS is also sensitive to the effects of treatment.[250]

Thus, with its severity continuum and diagnostic utility at identified cutoffs among different populations, the 5-item SDS has clear potential as a brief clinical cannabis dependence severity screen and as a treatment outcome predictor in settings where time and cost are important considerations. Optimal cutoffs for *degree* of cannabis dependence (mild, moderate, severe), however, have yet to be determined.[18,133, 251]

Withdrawal and craving

A clinically important withdrawal syndrome characterized by a time-dependent constellation of emotional, behavioural and physical symptoms that include anger/aggression, decreased appetite, irritability, nervousness/anxiety, restlessness, sleep disturbances and strange dreams (and less commonly), chills, depressed mood, shakiness and sweating, follows abrupt cannabis cessation in the majority of heavy users.[97-106] Onset of withdrawal symptoms commonly occurs between 24-72 hours of cessation.[103] Although symptoms commonly abate within 7-14 days of abstinence[103] their potential to interfere with sustained abstinence suggests the need for targeted intervention.[18,97-109] The non-universal reporting of withdrawal phenomena among treatment presentations presents the opportunity for incorporating withdrawal assessment into clinical practice when such symptoms manifest or are suspected.

While withdrawal checklists are often embedded in the 'gold standard' interviews (e.g. the CIDI), several standardized withdrawal instruments have been developed to assist with severity assessment. These include a 14-item diary for abstainers to rate past 24-hour symptoms each day of the 28-day withdrawal period, which generates scores on a 10-point scale of severity.[106] With a similar timeframe, the Marijuana Withdrawal Checklist (MWC)[103] presents 27 symptoms for which respondents indicate severity during the prior 24 hours on a 4-point scale. A withdrawal discomfort scale (WDS) is computed by summing the 10 MWC items most frequently reported.[103] Such daily ratings allow for identification of the temporal profile of the user's withdrawal symptoms, severity, and the appropriate timeframe for increased efforts to support abstinence goals.

Although controversial in the addictions, a related concept is cannabis *craving,* typically understood as a strong and sometimes irresistible desire or urge to use a substance associated with both positive expectancies for drug effects and expected relief from withdrawal symptoms.[18] Thought to promote continued drug use or trigger relapse after periods of abstinence[54], craving has been reported in both adolescents and adults.[252-258] While not universally accepted, highly complex, and confounded with other symptoms such as depression, withdrawal, and other drug use[259] some researchers have made efforts to assess cannabis craving, given the relapse potential.

Directly adapted from a 10-item tobacco craving questionnaire, with 2 subscales corresponding to anticipated positive effects and anticipated relief from negative affect or withdrawal, the Marijuana Craving Questionnaire (MCQ) yields an overall score of craving severity.[102,103] This tool is provided within the NSW clinical guidelines.[238] Another Marijuana Craving Questionnaire (MCQ)[255,256] with 47 original items reflecting the multidimensional nature of craving has four subscales (compulsivity, emotionality, expectancy and purposefulness) defined by a 17-item subset. These scales demonstrated good psychometric characteristics among users not seeking treatment. Either version can be used, and in a written or computerized format. The authors recommend the MCQ administration at intake, during, and treatment completion.[260]

Given the ongoing controversy with regard to craving *per se,* the early stage of this concept in cannabis research, and the growth in research on the use of non-aversive pharmacological aids aimed at reducing cannabis craving as an adjunct to cognitive-behavioural treatments, more studies are required in adolescent and adult populations to advance knowledge in this potentially important domain of assessment in relapse prevention.

Cannabis consumption

Diagnosis of a cannabis-related disorder should be routinely accompanied by a detailed retrospective history of cannabis (and other drug) consumption.[18,33,46] This should include a history of use frequency and duration, the type (heads/buds, leaf), source (plantation, hydroponic) variant (herbal cannabis/marijuana, resin/hashish, oil) and amount of cannabis used, route of administration, the number of hours per day spent intoxicated from cannabis, and the amount spent on cannabis per week/day.[46,238]

As earlier outlined, the difficulties in cannabis (THC) quantification involve a complex confluence of pharmacological, biological, psychological and behavioural factors. This results in a wide spectrum of use patterns in users concerned about their use, ranging from those who have experienced very aversive acute effects from seemingly low-level use, to longer-term users who (typically) consume more potent cannabis preparations and present with concerns about loss of self-control rather than negative effects on their health or social functioning.[18] Given the number of variables involved, the wide variation in users' retrospective use estimates and their lack of meaningful co-variation with dependence and problems, and only gross agreement overall with self-reported frequency measures, assessment of cannabis consumption has typically focused on *frequency* and *pattern* or *intensity* of use for more clinically meaningful information.[18]

frequency of use

Frequency of use in a specified period can be assessed with simple summary questions (e.g., "During the past week [month, 90 days, six months] on how many days did you use cannabis?"), prospective diaries[18], or time-line followback (TLFB) techniques.[261,262] While such summary questions are often embedded in more comprehensive drug assessments (such as the ASI), self-monitoring and TLFB procedures provide more detailed information on use patterns and any important changes over the assessment period. The TLFB is a semi-structured interview employing a calendar with memory triggers to prompt recall of substance use, and window selected (past month, 90 days) appropriate to assessment goals. Starting with the most recent month and then backwards, days on which cannabis was used, and the quantity consumed (cones, joints) on each use day, are systematically recorded for the specific period. Shown to be clearly superior to other approaches, and now the most widely-used consumption measure in cannabis treatment research, the various versions of the TLFB interview have shown excellent psychometric properties and ability to yield a relatively accurate retrospective portrayal of cannabis use among males and females aged from 14 years in both general population and clinical samples.[70,138,175,195,242,262-264] Requiring minimum training, the TLFB can be interviewer-, self-, or computer-administered, and typically takes only 20 minutes to evaluate a 90-day period and 30 minutes for 12 months.[265] A longer history of use can be gathered by asking users how the assessed pattern compares to use at more distal time points.[18]

quantity or intensity of use

Quantity assessments have employed measures such as the number of ounces/grammes per week or day, or the number of "bongs" ("joints", "spots") typically consumed in a day and used conversion formulae to obtain "standard" measurement units.[70,138,242,250,251,266] These highly prevalent methods of cannabis consumption are readily understood by adult and adolescent users. Given the crudity of such estimates, however, focusing on the pattern or intensity of use may provide more clinically useful information.[18] Again, single-item questions ("On a typical day, how many times do you smoke (or) how many hours do you spend or feel high/stoned?") may be adequate. Stephens and colleagues modified the TLFB interview to collect information about cannabis use during specific quarters of each day (morning, afternoon, evening, night) and found this performed well in differentiating use levels, and in its sensitivity to treatment effects.[107, 242,243] Formal psychometric evaluation of this method has not yet been conducted.[18]

biochemical measures

Reviewed earlier with regard to screening, a range of biological markers with varying temporal windows can detect cannabis use. Urine toxicology is most commonly employed in treatment contexts. The limitations of urinalysis as an indictor of use recency, problem use, and severity of the underlying syndrome, were earlier identified. Within a given individual, however, comparison of quantitative laboratory values from successive urine samples over treatment duration (intake, during, exit) can be used to monitor the fluctuations of urinary THC concentration (and other substances) over time, detect new smoking, and to corroborate users' self-reports.[30]

Cannabis-related problems

An adequate assessment of cannabis problems must extend beyond determination of a diagnosis and severity of dependence to ascertain the impact of problematic cannabis use on the full range of the individual's life functioning and activities.[18,22] Necessary for evaluating treatment-related change and outcome, gathering and discussing such information is also a vital part of motivational interventions to raise users' awareness of the connection between their cannabis use and the consequences experienced.[18] Although cannabis problems assessment is included in the same 'gold standard' diagnostic interviews, several alternatives are available specifically for this purpose.

The ASI,[239] a standardized semi-structured interview with well-established reliability and validity in a number of formats and settings, assesses the nature and severity of lifetime and recent (past 30 days) problems in seven areas: history, frequency, and consequences of alcohol and drug use, and medical, legal, employment, family/social relationships, and psychiatric functioning. An adolescent version, the CASI-A[267] similarly covers seven broad areas. Higher scores indicate greater problem severity, thus significant elevation in any specific ASI domain score should, at a minimum, indicate need for treatment or referral for such services.[22] Cost free, available in more than nine languages, requiring approximately an hour (or less) for administration, and with computerized versions and scoring, the ASI is among the most widely-used intake and outcome assessment devices in drug treatment contexts.[22] While having the advantage of objectively assessing psychosocial functioning (without requiring the user making cannabis use/functioning connections), the ASI does have limitations. Reliability and validity require standardized implementation and training.[22] Cannabis treatment outcome studies in which it was used suggest the ASI may lack sensitivity to changes in use and more subtle forms of dysfunction.[18,373] It may not perform well among persons with severe mental illness.[268] Moreover, a number of domains of major importance in cannabis problems assessment, such as comorbid psychopathology, are not covered by the ASI. Thus, although more time-consuming, the 'gold standard' interviews are generally seen as more comprehensive and inclusive, reliable, and valid.[22]

Several shorter self-report questionnaires have been developed for cannabis problems assessment. Stephens and colleagues developed the 19-item Marijuana Problem Scale (MPS) for use in treatment outcome evaluation.[243] With a dimensional three-response option format (no problem, minor problem, major problem) the MPS yields an overall index of cannabis-related psychological, medical, cognitive, interpersonal, school/employment, legal and financial problems experienced over the past 90 days.[107,269] A small number of MPS items relate directly to DSM-IV cannabis use disorder (e.g., withdrawal). Assigning higher values to problems rated as "major" provides a weighted total score.[18] Across a variety of treatment outcome studies the MPS has performed well, achieving internal consistency reliability estimates within the range of 0.83 and 0.89, and showing sensitivity to change.[242,243,269]

Copeland and her colleagues[270]developed the multidimensional Cannabis Problems Questionnaire (CPQ), a 53-item global measure of cannabis-related problems, including hazardous use, interpersonal problems, psychological and motivational concerns, physical health, finances, and neglect of other activities. The scale has a dichotomous 'yes/no' response format. Among an adult clinical sample at baseline and six month follow-up assessment the CPQ demonstrated good reliability (mean internal consistency of 0.93) and sensitivity to change.[250] Among a convenience sample of adult users (n=100) stratified by age, gender, and past 90-day cannabis use, three scales (acute/physical, psychological, and social consequences) were derived from a 22-item subset.[271] Demonstrating high one-week test-retest (0.92-1.00) and inter-rater (0.74-1.00) reliability, significantly inter-correlated and internally consistent factor scales (0.78, 0.71, 0.55, respectively) and diagnostic accuracy (total score classified DSM-IV dependence with 84% sensitivity and specificity), the 22-item CPQ appears to be a valid, reliable, and sensitive measure of cannabis-related problems.[271] Among at-risk adult users in New Zealand, the original 'core' 29 items demonstrated internal consistency of 0.81, and longitudinal (12-month) sensitivity to change consistent with increased cannabis use and diagnostic severity.[138]

A 58-item adolescent version (CPQ-A) comprising 30 'core' items and 28 additional items (parental, relationship, school performance, and employment issues) was adapted from the CPQ.[144] Using identical methodology to the parent CPQ, the psychometric properties of the CPQ-A were tested among a stratified convenience sample of 100 adolescents aged 14-18 years.[144] As did the adult version, the CPQ-A yielded three, significantly inter-correlated factors (financial/psychosocial, physical, acute negative consequences) from a 27-item subset. Producing excellent one week item test-retest (average 0.92) reliability coefficients, internally consistent factor scales (0.88, 0.72, 0.73, respectively), diagnostic accuracy (total score classified DSM-IV cannabis dependence with 90% specificity and 78% sensitivity), and a significant convergent correlation (0.74) with the SDS score, the 'core' CPQ-A also appears to be a reliable and valid measure of cannabis related problems among this adolescent population.[144] Among at-risk adolescent users in New Zealand, the original 30 CPQ-A 'core' items were internally consistent (0.81) and sensitive to longitudinal (12-month) change consistent with increased cannabis consumption and diagnostic severity.[138]

In sum, as valid, reliable, and sensitive measures of change in cannabis-related problems among adult and adolescent users in the community and a range of treatment settings, the MPS and the adult and adolescent CPQ are relatively time-efficient brief, acceptable, and easily-administered instruments suitable for use in multiple community settings. These tools may also be clinically useful for encouraging problem recognition and providing feedback in discussion about the impact of cannabis on the user's life. The original full versions of these tools might more profitably be used for this purpose.[144,271]

Level 3. personal assessment

A comprehensive assessment must include an array of factors associated with the initiation and maintenance of cannabis problems, the likelihood of relapse, and achievement of long-term treatment goals such as abstinence or controlled/reduced consumption. Consistent with the biopsychosocial model of addiction, each individual's life experiences, comorbid psychopathology, and psychosocial functioning should also be assessed to broaden the context in which the individual's cannabis use problems are perceived.

Comorbid psychiatric disorders

In addition to increasing the overall symptom burden, the dynamic interaction between cannabis and other drug use, psychiatric symptoms, and individual personality factors adds considerable clinical complexity to assessment and treatment decisions.

comorbid drug use and disorders

The use of cannabis in isolation from other drugs is rare.[54] Cannabis and other substance use, particularly alcohol and tobacco, and comorbid cannabis and all other drug use and disorders are highly prevalent in both clinical and general adult and adolescent populations.[63,126,250,272] Adolescent cannabis users commonly binge drink, a combination with a synergistic increase in intoxication that has potential to cause even greater harm than either alone.[28,63] Thus, given the extremely high prevalence of other substance use problems among cannabis users in the general population (82% of those meeting criteria for dependence and 72% of those meeting criteria for abuse also met criteria for another drug use disorder)[272] other drug use should be assessed when people request treatment for cannabis use problems.[272,274]

A full drug use history, exploring age of onset of various substances, lifetime and recent drug use, periods, duration, and patterns of consumption, problems experienced from use of the different dugs and any previous treatment, should routinely be taken. This information is systematically gathered and evaluated through the 'gold standard' and various other interviews (e.g., ASI).[239] An alternative instrument specifically developed for this purpose is the one-page Drug Use History Questionnaire (DHQ)[279] that collects data for nine different drug class: alcohol, cannabis, hallucinogens, depressants, inhalants, narcotics, stimulants, tranquillizers, and other psychoactive drugs. Requiring between 5-10 minutes to administer, and expandable to include other drugs (e.g. tobacco) as required, the DHQ has demonstrated good reliability/validity among drug users (including cannabis users) assured of confidentiality.[279] Although extensive validation of this tool specifically among samples of primary cannabis users has not yet been reported, the DHQ appears to offer a no cost, time-efficient, structured and standardized tool for use by busy clinicians when time and cost are deciding factors.

comorbid psychopathology

Cannabis use and other psychiatric syndromes, including amotivation, anxiety, depression (more frequently females), cannabis-induced psychosis and schizophrenia commonly co-occur in both clinical and general adult and adolescent populations.[270,272-275,280-296] The directionality, causality, and specificity of the relationships between cannabis use and these syndromes remains controversial. While a common vulnerability with varying order of onset or a bi-directional causal relationship are possible, controlled longitudinal cohort studies[297-301] and recent comprehensive reviews[302-306] conclude that there is more evidence for a causal role of cannabis in these psychiatric syndromes than for the reverse association. Cannabis use is also linked with antisocial personality disorder conduct and attention deficit hyperactivity disorder among young people.[108,305-309] Comorbid trauma exposure (e.g., sexual abuse) and PTSD with cannabis use is also common.[310-313]

Additional psychiatric disorders can alter the clinical course of CUD by negatively affecting the time of detection, diagnosis, prognosis, therapeutic selection, treatment adherence and outcome. Conversely, left untreated, comorbid cannabis use disorder can lead to a more continuous course of psychiatric disorder, poor response to treatment, poor medication compliance, increased relapses, risk for violence, service utilization and hospitalizations, and significant disability.[287,314-317] Thus, paying special attention to high-risk individuals, it is imperative that other psychiatric disorders are detected by time-sensitive screening, comprehensively assessed, and dually-diagnosed individuals receive treatment for *both* disorders simultaneously and consistently in a comprehensive treatment package.[315-317]

As noted earlier, a major concern is accurate diagnosis and differentiation between drug-induced states and primary psychiatric syndromes. Given their close resemblance, care must be taken to allow for an adequate period of detoxification and abstinence (at least 28 days to allow for cannabis' half-life) to differentiate withdrawal symptoms from those of independent psychiatric disorders.[238,259,232] The 'gold standard' interview protocols (e.g., CIDI, SCID, PRISM) were specifically designed for diagnosing comorbid psychiatric syndromes, and widely considered the best diagnostic instruments available for comorbid psychiatric and drug disorders. Diagnosing Axis II personality disorders in drug abusers, for example, is challenging.[318] Given their high prevalence in drug abusers, greater dependence severity, poorer treatment response and prognosis, accurate identification of personality disorders is critical in treatment planning.[319] While various self-report measures may be useful for screening cannabis dependants for personality disorders, clinician interviews such as the SCID are considered more reliable and accurate.[22] Nevertheless, with their accredited training and lengthy time requirements, these may not be viable for all situations. While also requiring a well-trained user, one abbreviated structured diagnostic interview, the MINI (or MINI Plus)[320] employs a decision tree logic to assess the major adult Axis 1 disorders in DSM-IV and ICD-10. However, shorter validated screening instruments would provide a useful alternative for rapid clinical identification of psychiatric disorders in affected individuals.

Several shorter measures are employed in cannabis treatment outcome research. Most often used are the well-validated 21-item self-report Beck Depression Inventory BDI[321] for assessing the presence and severity of depressive symptoms, and the State-Trait Anxiety Inventory (STAI).[322] Also used is the Symptom Checklist 90-R (SCL-90-R)[323] and its truncated forms, the 53- and 18-item Brief Symptom Inventory (BSI)[324,325] The latter tools provide anxiety, depression, and somatization subscales as well as an overall index of psychological distress. With

well-established internal consistency and test-retest reliability, construct and predictive validity, the BSI is validated and widely used in adolescent community and drug treatment samples aged from 13 years.[324]

Various other measures with adult, adolescent, and child versions available for use by physicians are the 18-item Brief Psychiatric Rating Scale (BPRS)[326] and the 42-item Depression Anxiety Stress Scale 42 (DASS 42),[327] with high internal consistency and the ability to yield meaningful discriminations in a variety of settings. A shorter 21-item DASS is also available.[328] The Positive and Negative Syndrome Scale (PANSS)[329] is a 30-item, 7-point rating scale for physicians to assess the presence/absence and severity of symptoms of schizophrenia over the past week. A widely-used tool with well-established psychometric properties, the PANSS does require formal training and requires a relatively long administration time (30-40 minutes), which may not be viable in some community practices. Other well-validated tools include the 21-item Beck Anxiety Inventory (BAI),[330] specifically developed to reliably discriminate anxiety from depression in a variety of clinical populations, the K10[331], a 10-item measure of non-specific psychological distress over the past four weeks, and the Short-Form 12-item Health Survey (SF12),[332] a subset of the SF-36 measure of physical and mental health, and available in standard (4-week recall) and acute (1-week recall) formats.

One very brief measure that may have screening utility among cannabis users is a 4-item screen for DSM-IV Post-Traumatic Stress Disorder that is widely used in primary care settings, (PC-PTSD).[333] This was recently tested among 97 drug-disordered patients, including cannabis users, at a medical centre.[333] Given that comorbid PTSD and drug-disordered individuals present with greater problem severity, greater trauma and cue-elicited drug craving, and have poorer outcomes, the PC-PTSD's extreme brevity and preliminary psychometric properties reported suggest the tool's potential for use in clinical contexts to increase the detection of previously unrecognized PTSD among cannabis (and other drug) disordered individuals.[333]

As yet, no brief screening tool is recognized as the 'gold standard' for identifying serious mental illness (major depression, bipolar disorder, and schizophrenia) among drug-disordered individuals who should be further assessed. In Australia, a (rare) attempt to develop a screener for the presence of psychosis among general population samples was the 7-item Psychosis Screener (PS).[334] The PS demonstrated a "moderate" ability to discriminate those who meet diagnostic criteria for psychotic disorders from those who do not,[334] but requires validation among cannabis-using populations. Another candidate, the K6 screening scale, was developed from survey data from non-institutionalized adult drug-disordered individuals, including cannabis.[335] The K6 measures the likely presence of eight specific psychiatric syndromes (psychotic, bipolar, major depression, generalized anxiety, post-traumatic, agoraphobia, social phobia, and panic disorders) and one general summary diagnosis. When validated against the CIDI short form, with its dimensional (0-4) scoring and a cutoff score of 13, the 6-item screener performed well in identifying serious mental illness among drug-dependent individuals.[335] This promising performance, its brevity, and ease of administration suggest the K6 may have potential for use as a first-stage clinical screen for serious mental illness among cannabis-dependent individuals. However, further and extensive validation among cannabis users in community-based drug treatment contexts is clearly needed, given the widespread use and the serious ramifications of cannabis consumption in these vulnerable populations.

neuropsychological deficits

The neurological impact of cannabis use is a major clinical issue, with memory and concentration loss among the most commonly-reported concerns of cannabis research participants and treatment seekers. Much evidence now exists for the neurotoxic effects of cannabis use on adult and adolescent attentional, working memory, and executive cognitive functioning.[336-344] These deficits are likely to be greater among comorbid substance-dependent users.[341] While currently appearing attributable to prolonged cannabis use, and to endure beyond the period of acute intoxication and worsen with increasing years of use, the recoverability of cognitive functioning post-abstinence remains under investigation.[41] Of major concern is emerging evidence of greater adverse cognitive consequences of early cannabis onset (before age 16) with post-abstinence residual effects among adolescents,[338,342-348] and cognitive deficits that persist through adolescence in children prenatally exposed to cannabis.[349,350]

The implications for assessment are clear. Given potential cannabis-induced cognitive deficits and perhaps marginal reading, learning and/or comprehension skills among cannabis users generally, and younger users in particular, using

conceptually simple, concrete, non-ambiguous terminology and phraseology is essential. Assessment instruments and interviews need to be simple, brief as possible, and carefully matched to the individual's developmental stage and abilities. Assessment of neuropsychological deficits in cannabis users can provide useful information regarding their cognitive capacity for treatment and domains of functioning that may affect their likelihood of relapse. While other commonly-used brief tests of neuropsychological functioning with reasonable psychometric support among drug-using populations such as the Mini-Mental Status Examination[351] may be used, the subtle nature of cannabis-induced deficits appears to require sensitive neuropsychological assessment.[18] Generally, tests specifically designed to test memory and learning, such as the Rey Auditory Verbal Learning Test (RAVLT),[352] Buschke Selective Reminding Test (BSRT),[353] and frontal lobe function, such as the Stroop test,[354] the Wisconsin Card Sorting Test (WCST)[355] have been shown to be most sensitive to cannabis.[18,340] Similarly, adolescent users have shown deficits on the RAVLT and various tests on the Cambridge Neuropsychological Test Automated Battery (CANTAB).[356] Solowij and Michie's comprehensive review[340] provides an excellent reference source for specific test selection.

Cognitive and behavioural dimensions

Cognitive-behavioural (CBT) and Motivational Enhancement (MET) treatments, and Contingency-Management interventions (CMI) are the most researched and most strongly empirically-supported approaches to the treatment of cannabis dependence.[391] These approaches make extensive use of formal assessment, and require integration of specific psychological and behavioural assessments for treatment planning and evaluating outcomes.[22] Assessment domains include: readiness to change, high-risk situations, self-efficacy, coping skills, and outcome expectations.

readiness to change

As reiterated throughout this paper, individuals vary in their motivation or readiness to make behavioural changes, even when they purportedly agree with their diagnoses and their need for treatment.[358] Prochaska and DiClemete[358,359] provided a conceptual framework within which motivation to change substance use disorders may be placed. The transtheoretical Stages of Change (SOC) model proposes that individuals progress through a series of stages (pre-contemplation, contemplation, determination, action, maintenance, and relapse) that characterize the dynamic, recyclical state of readiness to change behaviour that individuals experience. As one moves through the stages, commitment to change is increased and ambivalence resolved.

The SOC model has been applied to a number of health behaviours, including cigarette, alcohol, and drug use. Instruments developed to measure motivation and stages of change-readiness include self-administered questionnaires, algorithms, rating scales, and visual analogs. Those most frequently reported in treatment outcome studies (including cannabis) are the University of Rhode Island Change Assessment (URICA),[360] the Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES),[361] the Contemplation Ladder,[362] and versions of the Readiness to Change Questionnaire.[363]

The stages metaphor has its critics.[364-372] Rather than a continuous stage process, an individual's motivation to change may reflect a fluid *state* of readiness with attitudinal and behavioural components.[371, 372] The view of motivation as a malleable state (rather than trait) has clear implications for treatment-matching and motivational enhancement strategies. A comprehensive critical review of the psychometric properties of the above-listed (and other) instruments used to assess readiness to change drug abuse found mixed support for these measures, particularly with regard to predictive utility.[372] Cannabis treatment outcome studies reflect similar findings. Budney and colleagues reported an overall *decrease* in motivation during treatment as measured by URICA scores of three adult groups voluntarily treated.[373] Among incarcerated adolescents, scores on the Marijuana Ladder had significant concurrent and predictive utility for marijuana use and treatment engagement.[374] (A visual analog of a ladder with 11 rungs and five anchor statements loosely reflecting the stages of change has intuitive appeal for younger problem users). However, the different incentive contingencies operating in these samples precludes meaningful comment.

Hence, with overall scant evidence of their psychometric properties for cannabis users, the utility of these tools among treatment-seeking individuals remains uncertain. Meanwhile, given that no single measure can currently be recommended for use in clinical settings, careful consideration must be given to the population characteristics, measurement goals, and assessment procedures when selecting among these instruments to determine which has most clinical utility in a specific setting.[372] Given

the current uncertainty, West[371] suggests health practitioners at least enquire about users' desire to change ("Do you plan/want to change...?") and "firmly" encourage change in, and offer support and assistance to, *all* help-seeking individuals.

An alternative approach to assessing readiness to change has explored intrinsic and extrinsic dimensions of motivation for changing drug use. Using a modified 20-item tobacco Reasons for Quitting (RFQ) Scale, researchers found similar concerns (self-control, health concerns, social influence, legal issues) motivated cocaine and marijuana treatment-seekers.[375] Desire for self-control was a more powerful intrinsic motivator than health concerns, and social concern a salient extrinsic motivator, for marijuana change.[375] These motivators replicated among severely-impaired treatment-seekers (including primary marijuana users) with loss of self-esteem emerging as an even stronger motivator for abstinence.[376] In both studies successful abstinence was associated with high intrinsic, and low extrinsic, motivation.[374,376]

Using the RFQ supplemented by 12 additional 'legal' motivation questions among adolescent criminal justice clients mandated to treatment, Dennis and his colleagues[263] developed the Adolescent Motivation for Marijuana Treatment Scale (AMMTS), a 29-item measure with three internally consistent subscales (0.93; personal reasons, 0.74; interpersonal reasons, 0.80 legal reasons). Scores on the AMMTS predicted subsequent retention in treatment, drug use and related problems, at follow-up. Reorganized into 2 scales (personal and interpersonal reasons) and with several new items, the 33-item RFQ is a component of the GAIN intake interview[237] routinely used for generating treatment clients' personal feedback reports as a basis for motivational discussion. (M. Dennis, personal email communication, February 2008).

The authors of these studies suggest the RFQ versions have the ability to provide clinicians with valuable anticipatory information on which areas to target motivational enhancement strategies in order to increase problem users' retention in treatment and commitment to change. However, further evaluation of the RFQ is clearly required among adolescent and adult cannabis users, and particularly less-severely impaired individuals.

high risk situations and self-efficacy

The revised cognitive-behavioural model of relapse to drug use after a period of abstinence focuses on a dynamic interaction between multiple risk factors and situational determinants.[377] Treatment models such as CBT place strong emphasis on the concepts of high-risk situations, self-efficacy, and coping skills.[378,379] CBT emphasizes that the risk for drug use is greatest in user-specific situations ('high-risk' situations, or 'triggers'), and that failure to have adequate or alternative coping responses to these situations increases the probability of drug use by decreasing the individual's self-efficacy or confidence in being able to avoid using.[364-366] Bandura (1995)[380] defined perceived self-efficacy as "beliefs in one's capabilities to organize and execute courses of action required to manage prospective situations" (p.2). While high-risk situations for individual cannabis users may be idiosyncratic, precipitants of relapse common to many addictive behaviours (negative emotional states, interpersonal conflict, social pressure to use) are also among relapse vulnerability factors for cannabis.[18] Assessing all these mediating processes is therefore critical for identification of areas of low self-efficacy to target preemptively with individualized coping skills training to prevent relapse.[18,381]

As yet, no self-report assessment tool specifically for cannabis high-risk situations and few tools for assessing perceived self-efficacy in such high-risk situations, have been developed.[18] Stephens and his colleagues developed a 7-point Self-Efficacy Scale from a 19-item inventory of high-risk situations adapted from prior research with other drug users.[382,383] Ratings were averaged across situations to provide an index of self-efficacy with a range of one to seven. Alpha reliabilities were .89 and .94 at pre- and post-treatment assessments, respectively. After CBT treatment, increased self-efficacy judgments were found to be a moderately strong predictor of cannabis use.[382,384] This outcome was subsequently replicated.[385] Budney and colleagues[373] adapted a 39-item measure of individuals' confidence in resisting use of alcohol across an inventory of alcohol high-risk-for-drinking situations or mood states to marijuana, the Situational Confidence Questionnaire (SCQ).[386] Again, significant pre- to post-treatment improvement on situational confidence in users receiving behavioural coping-skills therapy for marijuana-smoking situations was reported.[373] Similarly, Copeland and colleagues adapted this tool for cannabis in a treatment study among adult cannabis users.[250] However, the SCQ length presents an obstacle to rapid administration and scoring in clinical (and research) contexts, and no further developmental work on this tool has been done (J. Copeland, personal communication, February 2008).

A generic drug tool developed by the original research group, the 50-item Drug-Taking Confidence Questionnaire (DTCQ)[387,388] assesses anticipatory coping self-efficacy with eight subscales (unpleasant emotions, physical discomfort, pleasant emotions, personal control, urges and temptations to use, conflict with others, social pressure to use, pleasant times with others). When validated among treatment-seeking adult drug users (including primary cannabis problems) at intake, the DTCQ subscales demonstrated reliability (0.79 to 0.95), and conceptually consistent convergent/discriminant validity with other measures (e.g., BSI, SOCRATES, SCL-90-R, Hopelessness Scale). The authors consider the DTCQ to be a promising situation-specific coping self-efficacy measure across a wide range of drugs for use in clinical settings.[388] An 8-item version of the DTCQ (DTCQ-8)[389] was simultaneously validated among this sample as a global measure of coping self-efficacy across high-risk situations. Also evidencing good psychometric properties, the DTCQ-8 offers a promising and considerably briefer tool for identifying areas to focus strategies for fortifying users' confidence in their ability to make changes. The predictive validity of both DTCQ versions is yet to be evaluated.[389]

Another generic drug tool specifically developed to measure self-efficacy for avoiding drug use by multiple drug users is the 16-item Drug Avoidance Self-Efficacy Scale (DASES).[390] When tested among voluntary treatment-seekers aged 16-30 years (n=363), of whom more than 75% had cannabis in their multiple drug repertoire, the DASES demonstrated internal consistency reliability (0.91), and correlated consistently with pre-treatment drug use severity measures, and with expected differential changes in post-treatment measures (significantly greater in the more intensive treatment).[390] Given that most drug users are polydrug users, the authors report the DASES to be a reliable and valid tool required to fill the void in measures of self-efficacy in avoiding *any* drug use across a range of high-risk situations.[390]

The majority of the tools just reviewed, and particularly the shorter cannabis self-efficacy scale, have potential for use in busy community-based settings for treatment planning and outcome assessment. More extensive validation among diverse groups of adult and adolescent primary cannabis users is required. In addition, the maximal brevity of the 8-item DASES may also render this tool a viable generic measure for rapid assessment of self-efficacy in busy community settings before a brief intervention or referral for comprehensive assessment. However, further validation of this tool is also needed.

coping skills

The core of CBT is the development of coping skills to deal with high-risk situations for drug use.[18,391] Successful coping in high-risk situations is thought to lead to an increased sense of self-efficacy, but failure to cope initiates a chain of events in which diminished self-efficacy may lead to a slip and perhaps to a full-blown relapse. Assessment of coping skills is often conducted through role-playing, modeling, clinical instruction and judgment to assist the client in practicing and ultimately mastering techniques for avoiding or coping with high-risk situations for drug use.[22,391] Generic coping skills measures such as the original and brief forms of the COPE[392,393] are widely used for this purpose in health settings, including drug treatment. Internal consistency reliabilities range from 0.50 to 0.90 for COPE scales assessing effective and ineffective methods of coping (e.g., Denial, Active Coping and Behavioral Disengagement).[392] The more immediate goal of coping skills training, however, is to help the user learn addiction-specific skills related *directly* to avoiding or reducing cannabis use.[18,402]

To date, assessment of specific coping skills among cannabis users has been minimal.[18] A brief anticipatory coping strategies measure used in one earlier adult treatment study showed theoretically consistent correlations with self-efficacy for avoiding cannabis use, and negative relationships with actual cannabis use post-treatment, but the measure was not validated with regard to *actual* coping skills.[383] More recently, the 48-item Coping Strategies Scale (CSS), a tobacco measure based on the change processes articulated in the SOC model, was adapted for marijuana and tested in a large treatment sample.[394] Subscales based on two theoretically distinct dimensions produced good internal consistency reliability estimates (0.89 active vs. 0.91 avoidant strategies). However, while marijuana use outcomes were predicted by treatment type and by use of coping skills, the hypothesized systematic variation with CBT treatment (i.e. the coping skills oriented MET-CB training model) was no more successful than the MET condition. Rather, increased self-efficacy appeared to mediate outcomes.[394]

Hence, as yet there is no validated measure of coping skills or strategies actually used in cannabis avoidance. Given the apparent failure to support the CB relapse prevention model, the researchers

concluded that more research is needed to clarify just which factors are at work in CBT for cannabis avoidance.[394]

One recent study explored quit strategies used by 65 non-treatment-seeking adult primary marijuana smokers with no other current substance abuse or dependence. A 13-item 'Marijuana Quit Questionnaire' (MQQ)[395] was used to rate the use and effectiveness of each listed strategy. Respondents reported using an average of 3.2 strategies. Strategies clustered under 'changed environment', 'seek organized/ professional help', and 'social support' constructs. Changing one's environment was rated most helpful, and seeking help from professionals least helpful. Given the similarity of these strategies to those employed in natural recovery from alcohol and other drug use, these researchers urge primary care clinicians to be *pro*active in offering assistance and incorporate the coping strategies in the MQQ into treatment plans for their marijuana-using patients.[395]

Given the (earlier reviewed) issue of adult/ adolescent differences, adult models of relapse and relapse avoidance may not generalize to adolescents. For assessing teen coping responses in hypothetical high-risk-for-relapse situations, the 33-item Adolescent Relapse Coping Questionnaire (ARCQ)[396] was developed and tested among 136 drug-abusing adolescents (39% primary marijuana) at 12 months post-treatment. Three coping factor scales (cognitive and behavioural problem solving, self-critical cognitions, and abstinence-focused coping strategies) evidenced good psychometric characteristics, correlating in conceptually consistent patterns with study variables (self-efficacy, perceived difficulty of coping, importance of not using, actual drug use).[396] Self-criticizing had a significant inverse relationship with self-efficacy, and a positive correlation with difficulty of coping and concurrent drug and alcohol use. Use of abstinence-oriented strategies (e.g., leave or avoid the situation, contact a support person) predicted alcohol and drug use during the following year. Differing substantially from previous adult-based factors, this suggests differences between adult and adolescent coping strategies in drug relapse.[396] The hypothetical testing situation, the limited range of potential coping strategies tested, and for only a single situation, limits the generalizability of findings to other situations and to actual coping behaviour.[396] This tool was recently prospectively incorporated in a large-scale cannabis youth treatment outcome study in the USA.[263]

As with adult users, however, extensive validation of *actual* coping in real life relapse-risk situations is needed to elucidate the role of coping in adolescent cannabis relapse. More prospective research (with multiple follow-ups) is required to elucidate these processes at work among cannabis users, both between individuals and *within* a particular individual, over time, and across specific high-risk situations.

effect expectancies

Cognitive cannabis expectancies are also important in the mediation and prediction of its use. Cannabis expectancies have been assessed with the Marijuana Expectancy Effects Questionnaire (MEEQ)[397] a 48-item (short form of original 78) covering six domains (Cognitive and Behavioural Impairment, Relaxation and Tension Reduction, Social and Sexual Facilitation, Perceptual and Cognitive Enhancement, Global Negative Effects, and Craving and Physical Effects). Scores on these factor-based scales discriminated between patterns of nonuse (generally negative effects expected) and varying degrees of use (generally positive effects expected) among young adults.[397] The MEEQ also discriminated between male users and nonusers in a treatment setting.[398] Scores on the MEEQ and an alcohol expectancies scale scores from volunteer survey respondents (n=2600) aged 13-86 years predicted simultaneous use over and above expectancies for each drug individually.[399] Among both clinical and community samples of adolescents the MEEQ predicted drug use preference, initiation, and desistance of cannabis use over a two-year period.[400] In another study, high negative expectancies for marijuana among adolescents partially mediated the relationship between impulsivity and marijuana use.[401] Negative expectancies may have a protective role with respect to initiation and level of marijuana use.[401]

Hence, assessment of cannabis expectancies could be useful in identifying those at risk for initiation and/or escalation of cannabis use, and efforts made in strengthening negative expectancies among vulnerable and more impulsive individuals.[18,401] With favourable psychometric characteristics evident among these diverse populations, the MEEQ has potential for this purpose. In its current form, however, the MEEQ's length may be an obstacle to its ready uptake in community settings. A further consideration is the generalizability of these findings to populations and population subgroups outside the USA with its more stringent prohibitionist policies and strategies. This remains an open question.

In summary, instruments currently available for measuring cannabis use problems include a variety of standardized diagnostic tools, comprehensive measures for assessing multiple dimensions of drug/cannabis use disorder, and others that focus on a specific aspect of cannabis disorder or problems. As shown above, the vast majority of these tools have been adapted from the alcohol or other drug assessments for use in cannabis treatment-outcome research projects, typically among more severely-impaired users. While representing a 'starting point'[18] in cannabis assessment instrumentation, there is as yet a relatively small body of evidence of these tools' performance characteristics for cannabis, particularly among less-impaired users, and almost no evidence of their performance among clinical populations in naturalistic community settings. Given the current state of the science, a number of recommendations for clinical practice and future research to advance cannabis instrumentation can be made.

recommendations

clinical recommendations

1. Routine opportunistic screening for cannabis use problems among all adolescent, adult, and at-risk preadolescent attendees in primary health care.

As first point of contact along the healthcare continuum, health practitioners are in an ideal position to detect, diagnose, assess, influence and treat all people with cannabis use problems. Along with alcohol and tobacco use, opportunistic screening for cannabis use among adolescents and young adults presenting with respiratory and/or psychiatric symptoms is encouraged. Cannabis questions are likely to meet with less resistance when embedded in a routine 'health check-up' interview. Alternatively, integration of assessment techniques into standard clinical practice can be implemented by computerized reminder systems for conducting cannabis screening, and self-administered questionnaires completed in reception or triage. A high level of suspicion and cannabis toxicology screening is recommended when young people present to emergency room or other care following accidents, trauma, or evincing intoxication, disorientation, or psychiatric symptoms. Appropriately conducted, screening will expedite referral to appropriate specialist services for diagnostic and comprehensive assessment.

2. A sound and thorough pre-intervention assessment is essential for appropriate clinical management of cannabis use problems

DSM/ICD diagnostic procedures are accompanied by in-depth multidimensional assessment using standardized instruments to enhance the accuracy of information elicited. This information will determine the severity of cannabis' impact on the user's physical and psychosocial functioning, and assist in formulation of an individualized treatment plan. Withdrawal management is a valid and important goal of treatment. Practitioners require education about the expected severity, duration, and implications of cannabis withdrawal. Alcohol and other drug use require simultaneous assessment and therapeutic attention.

3. Individuals identified with pre-clinical cannabis problems or risky use patterns are a primary target group for an early/brief intervention.

Data from the clinical interview and cannabis problems measures can assist identification of those on the diagnostic threshold (diagnostic orphans) and at-risk users for a brief intervention targeted at arresting escalation to dependence and increased problem severity.

4. Comorbid drug and psychiatric disorders are a critical component in cannabis assessment.

Screening for co-occurring mental health disorders, and using the DSM-IV/ICD-10 systems to categorize comorbid drug, mood, anxiety, and other psychiatric syndromes likely to be present in cannabis-using patients is strongly recommended, given the high prevalence of neurological impairment and potentially serious prognostic implications of comorbid psychiatric syndromes. Appropriate training/experience in psychopathology, assisted by use of well-validated structured interviews, is essential. While requiring increased administration time, these standardized tools are intuitive, easy to use, more reliably establish the presence of a psychiatric syndrome, and help clarify whether the disorder is primary, substance-induced, or merely expected effects of cannabis or other substances. Dually-diagnosed individuals must receive simultaneous treatment for both disorders in an integrated, coordinated, and comprehensive manner.

5. The therapeutic alliance has a key role in cannabis treatment outcomes.

Providing assurance of confidentiality, and an accepting, empathic, caring and respectful clinical posture will elicit the most useful information and yield the most meaningful diagnoses and assessment possible. Building rapport, and maintaining a non-

judgmental, safe, empowering therapist-client relationship with the ability to generate hope and confidence, is at the core of the change process.

recommendations for future research

Testifying to the rapid progress in development and validation of screening, diagnostic and assessment tools for cannabis use disorder and problems in recent years, this review has also identified where important gaps in instrumentation remain. Research in these areas is required to help bridge or reduce the current hiatus between research and clinical practice. Future research focusing on at least the following important areas is recommended:

(a) The practical utility of several of the tools reviewed.

Several of the cannabis manual-guided protocols and tools reviewed require skilled interviewers with considerable clinical experience, formal qualifications and training, and intensive supervision. While use of these tools satisfies conditions for sound epidemiological and treatment outcome research, they may have limited viability in the different circumstances of community-based clinical practice. Given the early stage of controlled trials of different treatment approaches to cannabis problems, the logistics, considerable time and costs involved in extensive formal assessment batteries required by those promising (behavioural) approaches, the practical value for community clinical practice has yet to be demonstrated. Validation studies conducted in community clinics are urgently needed.

(b) The need for extensive validation of instruments reviewed.

Given the youthful stage of cannabis instrumentation, relatively few cannabis tools have been subjected to extensive validation among cannabis users. Many that do show promise are supported by studies with a relatively weak level of evidence, most pronounced in the new screening tools. While comparatively abundant psychometric data are available for temporal and internal consistency reliability, content and criterion validity, evidence of the screens' validity among subpopulations defined by gender, diverse age, ethnic/cultural groups, and settings, and data with respect to their discriminant and predictive validity, are almost nonexistent. Replication and independent validation studies are clearly needed.

Several cannabis assessment tools have not been extensively evaluated for their ability to measure treatment outcomes or change. A further research issue is that most current cannabis (and generic) assessment tools do not readily translate into the appropriate type of intervention for primary and secondary cannabis problems, nor guide the matching of different populations of users (such as adolescents) with different treatment goals (abstinent, use moderation) to different types of treatment, modalities, or dose. Development and evaluation of such measures for use both within and across diverse groups of cannabis users will enhance understanding of the relative effectiveness of different therapeutic approaches, and further elucidate the processes, mechanisms, and mediators of change.

(c) The appropriateness of cannabis screening and assessment tools for special high-risk populations

There has been little – if any - investigation into the appropriateness and performance of the newer cannabis tools for cannabis misuse in psychiatric and indigenous populations. Widespread use of cannabis screening and problems measures cannot be recommended without having tested their psychometric properties and ethnocultural appropriateness among these important target groups. Pilot testing may suggest population-specific cannabis screens and assessment instruments need to be developed and validated for use among these groups. Such research warrants high priority, given the high cannabis use rates in these relatively large and vulnerable population segments. Timely detection of cannabis use problems by clinical screening in both primary care and psychiatric settings, and of psychiatric disorder among cannabis users in drug treatment settings, can help prevent more serious cannabis-precipitated pathology.

(d) The impact of screening and assessment measures in treatment

Given the current barriers to universal screening for cannabis and other drugs and psychiatric disorders by medical practitioners, mental health, and drug treatment professionals, research will be required to determine whether the development, availability, and dissemination of cannabis assessment tools to the field does lead to better detection and problem management.

summary

Routine medical and social services consultations present a unique opportunity to reduce the burden of harm associated with cannabis use. Screening and early intervention may prevent transition to

dependent use and more severe problems. It also provides an opportunity for primary prevention or improved treatment for comorbid psychiatric disorders to improve overall outcomes. A thorough, accurate cannabis assessment provides a foundation for developing an alliance with patients, a blueprint for treatment planning, and a reference point for treatment monitoring and aftercare. It is thus imperative that practitioners are aware of the strengths and limitations of available tools when selecting instruments most appropriate to the purpose to hand, target population, and setting. This review has identified and described the more established clinical protocols as well as promising instruments available to assist the practitioner in cannabis assessment. These measures are summarized in Appendix 1 and 2. The review has also identified areas where further empirical development of assessment tools and further psychometric validation of current measures is sorely needed in order for the field to progress and continue to make significant theoretical and practical contributions to public health initiatives to prevent and reduce cannabis-related harms in the community. Clearly this should be a high priority for this youthful field for, despite the dramatic growth in cannabis treatment-outcome research and empirically-developed instruments in recent years, Stephens and Roffman's observation is a sobering reminder that "there is much work to be done".

references

1. **United Nations Office on Drugs and Crime.** (2006). *World Drug Report 2006*. Oxford: Oxford University Press.

2. **Fergusson, D.M. & Horwood, L.J.** (2000). *Cannabis use and dependence in a New Zealand birth cohort*. New Zealand Medical Journal *113*, 156-158.

3. **Berghuis, J.P., Swift, W., Roffman, R.A., Stephens, R.S., & Copeland, J.** (2006). The Teen Cannabis Check-up: Exploring strategies for reaching young cannabis users. **In R.A. Roffman & R.S. Stephens (eds.)**. *Cannabis dependence: Its nature, consequences, and treatment* (pp.275-296). Cambridge: Cambridge University Press.

4. **Australian Institute of Health and Welfare.** (2007). *Alcohol and other drug treatment services in Australia 2005-2006: Report on the National Minimum Data Set.* (Drug Treatment Services Series Number 7). Canberra: Australian Institute of Health and Welfare (AIHW cat. No. HSE.).

5. **European Monitoring Center of Drugs and Drug Addiction (EMCDDA) Annual Report 2006:** The State of the Drugs Problem in Europe. Lisbon: EMCDDA.

6. **Substance Abuse and Mental Health Services Administration.** (2006). *The National Survey on Drug Use and Health 2003.* Rockville, MD: US Department of Health and Human Services.

7. **Mental Health Council of Australia.** (2006). *Where there's smoke…Cannabis and mental health.* Report of the Mental Health Council of Australia Working Group. Mental Health Council of Australia.

8. **World Health Organization.** (2002). *The World Health Report 2002: Reducing risks, promoting healthy life.* Geneva, Switzerland: WHO

9. **World Health Organization.** (2004). *The neuroscience of psychoactive substance use and dependence.* Geneva, Switzerland: WHO.

10. **Institute of Medicine.** (1990). *Broadening the base of treatment for alcohol problems.* Washington, DC: National Academy Press.

11. **Institute of Medicine.** (1990b). *Treating drug problems,* Volume 1. Washington, DC: National Academy Press.

12. **Hall, W. & Swift, W.** (2006). Policy implications of cannabis dependence. **In R.A. Roffman & R.S. Stephens (eds.).** *Cannabis dependence: Its nature, consequences, and treatment* (pp.315-319). Cambridge: Cambridge University Press.

13. **Penrose-Wall, J., Copeland, J. & Harris, M.** (2000). *Shared care of illicit drug problems by general practitioners and primary health care providers: A literature review.* Sydney: Centre for General Practice Integration Studies, University of New South Wales.

14. **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.

15. **World Health Organization.** (1998). *Alcohol, drugs and tobacco programme.* World Health Organization Phase III Collaborative Study on implementing and supporting early intervention strategies in primary health care. Report on Strand I: General practitioner current practices and perceptions of preventive medicine and early intervention for hazardous alcohol use. A 16-country study. Copenhagen, Denmark: WHO.

16. **Anthony, J.C.** (2000). Putting epidemiology and public health in needs assessment: Drug dependence and beyond. **In G. Andrews & S. Henderson** (eds.). *Unmet need in psychiatry: Problems, resources, responses* (pp. 302-308). Cambridge: Cambridge University Press.

17. **Fleming, M.** (2002). Screening, assessment, and intervention for substance use disorders in general health care settings. *Substance Abuse 23,* 47-66.

18. **Stephens, R.S. & Roffman, R.A.** (2005). Assessment of cannabis use disorders. **In D.M. Donovan & G.A. Marlatt (eds.).** *Assessment of addictive behaviors,* 2nd edition, (pp.248-273). New York: The Guilford Press.

19. **Babor, T.F., Sciamanna, C.N. & Pronk, N.P.** (2004). Assessing multiple risk behaviors in primary care: Screening issues and related concepts. *American Journal of Preventive Medicine 27,* 42-53.

20. **Leccese, M. & Waldron, H.B.** (1994). Assessing adolescent substance use: A critique of current measurement instruments. *Journal of Substance Abuse Treatment 11,* 553-563.

21. **Center on Addiction and Substance Abuse.** (2000). *Missed opportunity: National survey of primary care physicians and patients on substance abuse.* New York: Author.

22. **Carroll, K.M. & Rounsaville, B.J.** (2002). On beyond urine: Clinically useful assessment instruments in the treatment of drug dependence. *Behavior Research and Therapy 40,* 1329-1344.

23. **Copeland, J., Rees, V. & Swift, W.** (1999). Health concerns and help-seeking among a sample entering treatment for cannabis dependence. Letter to the Editor. *Australian Family Physician 28,* 540-541.

24. **Gerada, C.** (2003). Drug misuse and primary care in the NHS. *Drugs: Education, Prevention, and Policy 7,* 213-221.

25. **McArdle, P.** (2004). Substance abuse by children and young people: A contemporary disease. *Archives of Disease in Childhood 89,* 701-704.

26. **Swadi, H.** (2000). Substance misuse in adolescents. *Advances in Psychiatric Treatment 6,* 201-210.

27. **Alexander, D.** (2003). A review of marijuana assessment dilemmas: Time for marijuana specific screening methods? *Journal of Social Work Practice in the Addictions 3,* 5-28.

28. **Dennis, C., Babor, T.F., Roebuck, C., & Donaldson, J.** (2002). Changing the focus: The case for recognizing and treating cannabis use disorders. *Addiction 97,* 4-15.

29. **Roffman, R.A. & Stephens, R.S. (eds.).** (2006). *Cannabis Dependence: Its nature, consequences and treatment.* International Research Monographs in the Addictions. London: Cambridge University Press.

30. **Wolff, K., Farrell, M., Monteiro, M.G., Ali, R., Welch, S., & Strang, J.** (1999). A review of biological indicators of illicit drug use, practical considerations and clinical usefulness. *Addiction 94,* 1279-1298.

31. **Carroll, K.M.** (1995). Methodological issues and problems in the assessment of substance use. *Psychological Assessment 7,* 349-358.

32. **Roche, A.M., Hotham, E.D. & Richmond, R.L.** (2002). The general practitioner's role in AOD issues: Overcoming individual, professional, and systemic barriers. *Drug and Alcohol Review 21,* 223-230.

33. **Babor, T.F.** (2006). The diagnosis of cannabis dependence. **In R.A. Roffman & R.S. Stephens (eds.).** *Cannabis dependence: Its nature, consequences, and treatment* (pp. 21-36). Cambridge: Cambridge University Press.

34. **Babor, T.F.** (2002). Is there a need for an international screening test? The Middle East as a case in point. **In: R. Isralowitz & R. Rawson** (eds.). *Drug problems, cross cultural policy and program development* (pp. 165-179). Westport, CT: Auburn House.

35. **McPherson, T.L., & Hersch, R.K.** (2000). Brief substance use screening instruments for primary care settings: A review. *Journal of Substance Abuse Treatment 18,* 193-202.

36. **Ashton, C.H.** (2001). Pharmacology and effects of cannabis: A brief review. *British Journal of Psychiatry 178,* 101-106.

37. **Copeland, J., Gerber, S. & Swift, W.** (2006). *Evidence-based answers to cannabis questions: A review of the literature*. Report to the Australian National Council on Drugs, Canberra.

38. **Earleywine, M.** (2002). *Understanding marijuana: A new look at the scientific evidence*. New York: Oxford University Press.

39. **Fried, P.A.** (2002). The consequences of marijuana use during pregnancy: A review of the human literature. *Journal of Cannabis Therapeutics 2,* 85-104.

40. **Hall, W.D. & Pacula, R.L.** (2003). *Cannabis use and dependence: Public health and public policy*. Cambridge, UK: Cambridge University Press.

41. **Hall, W. & Solowij, N.** (2006). The adverse health and psychological consequences of cannabis dependence. **In R.A. Roffman & R.S. Stephens (eds.).** *Cannabis dependence: Its nature, consequences, and treatment* (pp.106-128). Cambridge: Cambridge University Press.

42. **Hall, W., Degenhardt, L. & Lynskey, M.** (2001). *The health and psychological effects of cannabis use*. National Drug and Alcohol Research Centre Monograph Series No. 44 (2nd ed.). Sydney: NDARC, University of New South Wales.

43. **Hollister, L.E.** (1998). Health aspects of cannabis: Revisited. *International Journal of Neuropsychopharmacology 1,* 71-80.

44. **Hollister, L.E.** (2001). Marijuana (cannabis) as medicine. *Journal of Cannabis Therapy,* 29-42.

45. **Institute of Medicine.** (1999). *Marijuana and medicine: Assessing the science base*. Washington, DC: National Academy Press.

46. **Todd, F., McLean, S., Krum, H., Martin, J., & Copeland, J.** (2002). Cannabis. **In G. Hulse, J. White & G. Cape (eds.).** *Management of alcohol and drug problems* (pp. 141-157). Victoria, Australia: Oxford University Press.

47. **Johns, A.** (2001). Psychiatric effects of cannabis. *British Journal of Psychiatry 178,* 116-122.

48. **Kalant, H.** (2004). Adverse effects of cannabis on health: An update of the literature since 1996. *Progress in Neuro-Psychopharmacology & Biological Psychiatry 28,* 849-863.

49. **Joy, J.E., Watson, S.J. & Benson, J.A. (eds.).** (1999). *Marijuana and medicine: Assessing the science base*. Washington, DC: National Academy Press.

50. **Solowij, N. & Michie, P.T.** (2007). Cannabis and cognitive dysfunction: Parallels with endophenotypes of schizophrenia? Review paper. *Journal of Psychiatry and Neuroscience 32,* 30-52.

51. **Stephens, R.S.** (1999). Cannabis and the hallucinogens. **In B.S. McCrady & E.E. Epstein (eds.).** *Addictions: A comprehensive guidebook* (pp. 121-140). New York: Oxford Press.

52. **World Health Organization.** (1997). *Cannabis: A health perspective and research agenda*. Geneva, Switzerland: Author.

53. **Zimmer, L. & Morgan, J.P.** (1997). *Marijuana myths, marijuana facts: A review of the scientific evidence*. New York: Lindesmith Center.

54. **American Psychiatric Association.** (2000). *Diagnostic and statistical manual of mental disorders, 4th edition, Text Revision, (DSM-IV-TR)*. Washington, DC: Author.

55. **Adams, I.B. & Martin, B.R.** (1996). Cannabis: Pharmacology and toxicology in animals and humans. *Addiction 91,* 1585-1614.

56. **Hall, W. & Swift, W.** (2000). The THC content of cannabis in Australia: Evidence and implications. *Australian and New Zealand Journal of Public Health 24,* 503-508.

57. **Babor, T.F. & Del Boca, F.K.** (1992). Just the Facts. **In R.Z. Litten & J.P. Allen (eds.).** *Measuring alcohol consumption: Psychosocial and biochemical methods* (pp. 3-19). Totowa, NJ: The Humana Press Inc.

58. **Del Boca, F.K. & Noll, J.A.** (2000). Truth or consequences: The validity of self-report data in health services research on addictions. *Addiction 96,* S347-S360.

59. **Maisto, S., McKay, J. & Connors, G.** (1990). Self-report issues in substance abuse: State of the art and future directions. *Behavioral Assessment 2,* 117–134.

60. **Dawe, S., Loxton, N.J., Hides, L., Kavanagh, D.J., & Mattick, R.P.** (2002). *Review of diagnostic screening instruments for alcohol and other drug use and other psychiatric disorders* (2nd ed.). Canberra: Australian Government Publishing Service.

61. **Buchan, B.J., Dennis, M.L., Tims, F.M., & Diamond, G.S.** (2002). Cannabis use: Consistency and validity of self-report, on-site urine testing and laboratory setting. *Addiction 97,* 98-108.

62. **Frances, A., First, M.B. & Picus, H.A.** (1995). *DSM-IV Guidebook*. Washington: American Psychiatric Press.

63. **Reid, A., Lynskey, M. & Copeland, J.** (2000). Cannabis use among Australian adolescents: Findings from the 1998 National Drug Strategy Household Survey. *Australian and New Zealand Journal of Public Health 24,* 596-602.

64. **Winters, K.C.** (2003). Assessment of alcohol and other drug use behaviors among adolescents. **In J.P. Allen & V.B. Wilson (eds.).** *Assessing alcohol problems* (2nd ed.). NIH Publication No. 03-3745. Bethseda, MD: National Institute on Alcohol Abuse and Alcoholism.

65. **Darke, S.** (1998). Self-report among injecting drug users: A review. *Drug and Alcohol Dependence 51,* 253-263.

66. **Saunders, J. & Young, R.** (2002). Assessment and diagnosis. **In G. Cape, G. Hulse & J. White (eds.).** *Management of alcohol and drug problems* (pp. 45-58). Victoria, Australia: Oxford University Press.

67. **Akinci, I.H., Tarter, R.E. & Kirisci, L.** (2001). Concordance between verbal reports and urine of recent marijuana use in adolescents. *Addictive Behaviors 26,* 613-619.

68. **Gignac, M., Wilens, T.E., Biederman, J., Kwon, A., Mick, E., & Swezey, A.** (2005). Addressing cannabis use in adolescents and young adults. What do urine screens and parental reports tell you? *Journal of Child and Adolescent Pharmacology 15,* 742-750.

69. **Lynskey, M.T., Fergusson, D.M. & Horwood, L.J.** (1998). The origins of the correlations between tobacco, alcohol, and cannabis use during adolescence. *Journal of Child Psychology and Psychiatry 39,* 995-1005.

70. **Martin, G., Copeland, J. & Swift, W.** (2005). The Adolescent Check-up: Feasibility of a brief intervention for young cannabis users. *Journal of Substance Abuse Treatment 29,* 207-213.

71. **Mieczkowski, T., Newel, R. & Wraight, B.** (1998). Using hair analysis, urinalysis, and self-reports to estimate drug use in a sample of detained juveniles. *Substance Use and Misuse 33,* 1547-1567.

72. **Finch, E. & Strang, J.** (1998). Reliability and validity of self-report: On the importance of considering context. *Drug and Alcohol Dependence 51,* 269.

73. **McPhillips, M.A., Kelly, F.J., Barnes, T.R., Duke, P.J., Gene-Cos, N., & Clark, K.** (1997). Detecting comorbid substance use among people with schizophrenia in the community: A study comparing the results of questionnaires with analysis of hair and urine. *Schizophrenia Research 25,* 141-148.

74. **Wolford, G.L., Rosenberg, S.D., Drake, R.E., Mueser, K.T., Oxman, T.E., & Hoffmann, D.** (1999). Evaluation of methods of detecting substance use disorder in persons with severe mental illness. *Psychology of Addictive behaviors 13,* 313-326.

75. **Schwarz, N.** (1999). Self-reports: How the questions shape the answers. *American Psychologist 54,* 93-105.

76. **Aquilino, W.S., Wright, D. & Supple, M.S.** (2000). Response effects due to bystander presence in CASI and paper- and-pencil surveys of drug use and alcohol use. *Substance Use and Misuse 35,* 845-867.

77. **Brody, B.B., McMullin, D., Winters, K.C., Rosen, C.S., Downing, D.R., & Koble, J.M.** (2007). Adolescent substance use assessment in a primary care setting. *American Journal of Drug and Alcohol Abuse 33,* 447-454.

78. **Babor, T.F. & Higgins-Biddle, J.C.** (2000). Alcohol screening and brief intervention: Dissemination strategies for medical practice and public health. *Addiction 95,* 677-686.

79. **American Psychiatric Association.** (1994). *Diagnostic and statistical manual of mental disorders* (4th edition). Washington, DC: Author.

80. **World Health Organization.** (1992). *International Classification of Diseases-Tenth Revision (ICD-10).* Geneva, Switzerland: Author.

81. **Cottler, L.B., Grant, B.F., Blaine, J., Mavreas, V., Pull, C., Hasin, D., Compton, W., Rubio-Stepic, M., & Mager, D.** (1997). Concordance of DSM-IV alcohol and drug use disorder criteria and diagnoses as measured by AUDADIS-ADR, CIDI and SCAN. *Drug and Alcohol Dependence 47,* 195-205.

82. **Crowe, M.** (2000). Constructing normality: A discourse analysis of the DSM-IV. *Journal of Psychiatric and Mental Health Nursing 7,* 69-77.

83. **Hasin, D., Grant, B.F., Cottler, L., Blaine, J., Towle, L., Ustun, B., & Sartorius, N.** (1997). Nosological comparisons of alcohol and drug diagnoses: A multisite, multi-instrument international study. *Drug and Alcohol Dependence 47,* 217-226.

84. **Hasin, D., Hatzenbucher, M.L., Keyes, K., & Ogburn, F.** (2006). Substance use disorders: Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) and International Classification of Diseases, tenth edition (ICD-10). *Addiction 101,* 59-75.

85. **Kutchins, H., & Kirk, S.A.** (1997). *DSM- The psychiatric bible and the creation of mental disorders.* New York: The Free Press.

86. **Lemperiere, T.** (1995). The importance of classification in psychiatry. *Encephale 5,* 3-7.

87. **Room, R.** (1998). Alcohol and drug disorders in the International Classification of Diseases: A shifting kaleidoscope. *Drug and Alcohol Review 17,* 305-317.

88. **Ustun, B., Compton, W., Mager, D., Babor, T., Baiyewu, O., Chatterij, S., Cottler, L., Gogus, A., Mavreas, V., Peters, L., Pull, C., Saunders, J., Smeets, R., Stipec, M., Vrasti, R., Hasin, D., Room, R., Van den Brink, W., Regier, D., Blaine, J., Grant, B., & Sartorivis, N.** (1997). WHO Study on the reliability and validity of the alcohol and drug use disorder instruments: Overview of methods and results. *Drug and Alcohol Dependence 47,* 161-169.

89. **Widiger, T.A. & Clark, L.A.** (2000). Toward DSM-V and the classification of psychopathology. *Psychological Bulletin 126,* 946-963.

90. **Winokur, G., Zimmerman, M. & Cadoret, R.** (1988). 'Cause the bible tells me so. *Archives of General Psychiatry 45,* 683-684.

91. **Winters, K.C., Latimer, W. & Stinchfield, R.D.** (1999). The DSM-IV criteria for adolescent alcohol and cannabis use disorders. *Journal of Studies on Alcohol 60,* 337-334.

92. **Hasin, D. & Paykin, A.** (1998). Dependence symptoms but no diagnosis: 'Diagnostic orphans' in a community. *Drug and Alcohol Dependence 50,* 19-26.

93. **Agrawal, A. & Lynskey, M.** (2007). Does gender contribute to heterogeneity in criteria for cannabis abuse and dependence? Results from the national epidemiological survey on alcohol and related conditions. *Drug and Alcohol Dependence 88,* 300-307.

94. **Grant, J.D., Scherrer, J.F., Neuman, R.J., Todorov, A., Price, R.K., & Bucholz, K.K.** (2006). A comparison of latent class structure of cannabis problems among adult men and women who have used cannabis repeatedly. *Addiction 101,* 1133-1142.

95. **Martin, C.S., Chung, T., Kirisci, L., & Langenbucher, J.W.** (2006). Item response theory analysis of diagnostic criteria for alcohol and cannabis use disorders in adolescents: Implications for DSM-V. *Journal of Abnormal Psychology 115,* 807-814.

96. **Rosenberg, M.F. & Anthony, J.C.** (2001). Early clinical manifestations of cannabis dependence in a community sample. *Drug and Alcohol Dependence 64,* 123-131.

97. **Budney, A.J.** (2006). Are specific criteria necessary for different substances: How can research on cannabis inform this issue? *Addiction 101,* 125-133.

98. **Copersino, M.L., Boyd, S.J., Tashkin, D.P., Huestis, M.A., Heishman, S.J., Dermand, J.C., Simmons, M.S., & Gorelick, D.A.** (2006). Cannabis withdrawal among non-treatment-seeking adult cannabis users. *American Journal on Addictions 15,* 8-14.

99. **Budney, A.J. & Hughes, J.R.** (2006). The cannabis withdrawal syndrome. *Current Opinion in Psychiatry 19,* 233-238.

100. **Lichtman, A.H. & Martin, B.R.** (2006). Understanding the pharmacology and physiology of cannabis dependence. **In R.A. Roffman & R.S. Stephens (eds.).** *Cannabis dependence: Its nature, consequences, and treatment* (pp.37-57). Cambridge: Cambridge University Press.

101. **Budney, A.J., Novy, P. & Hughes, J.R.** (1999). Marijuana withdrawal among adults seeking treatment for marijuana dependence. *Addiction 94,* 1311-1322.

102. **Budney, A.J., Hughes, J.R., Moore, B.A., & Novy, P.L.** (2001). Marijuana abstinence effects in marijuana smokers maintained in their homes. *Archives of General Psychiatry 58,* 917-924.

103. **Budney, A.J., Moore, B.A., Vandrey, R.G., & Hughes, J.R.** (2003). The time course and significance of cannabis withdrawal. *Journal of Abnormal Psychology 112,* 393-402.

104. **Budney, A.J., Hughes, J.R., Moore, B.A., & Vandrey, R.G.** (2004). A review of the validity and significance of the cannabis withdrawal syndrome. *American Journal of Psychiatry 161,* 1967-1977.

105. **Haney, M.** (2005). The marijuana withdrawal syndrome: Diagnosis and treatment. *Current Psychiatry Reports 7,* 360-366.

106. **Kouri, E.M. & Pope, H.G.** (2000). Abstinence symptoms during withdrawal from chronic marijuana use. *Experimental and Clinical Psychopharmacology 8,* 483-492.

107. **Stephens, R.S., Babor, T.F., Kadden, R., Miller, M., & The Marijuana Treatment Group.** (2002). The Marijuana Treatment Project: Rationale, design, and participant characteristics. *Addiction 97,* 109-124.

108. **Crowley, T.J., MacDonald, M.J., Whitmore, E.A., & Mikulich, S.K.** (1998). Cannabis dependence, withdrawal, and reinforcing effects among adolescents with conduct symptoms and substance use disorders. *Drug and Alcohol Dependence 50,* 27-37.

109. **Dawes, M.A., Liguori, A. & Dougherty, D.M.** (2006). Cannabis withdrawal among adolescent cannabis users in an outpatient research setting. *American Journal of Addiction 15,* 485-486.

110. **Nocon, A., Wittchen, H.U., Pfister, H., Zimmerman, P., & Lieb, R.** (2006). Dependence symptoms in young cannabis users? A prospective epidemiological study. *Journal of Psychiatric Research 40,* 394-403.

111. **Weisback, G.A., Schuckit, M.A., Kalmijn, J.A., Tipp, J.E., Bucholz, K., & Smith, T.L.** (1996). An evaluation of the history of a marijuana withdrawal syndrome in a large population. *Addiction 91,* 1469-1478.

112. **Smith, N.T.** (2002). A review of the published literature into cannabis in human users. *Addiction 97,* 621-632.

113. **Soellner, R.** (2005). Dependence on cannabis – an ever lasting issue. *Substance Use and Misuse 40,* 857-867.

114. **Crowley, T.J.** (2006). Adolescents and substance-related disorders: Research agenda to guide decisions on Diagnostic and Statistical Manual of mental Disorders, fifth edition (DSM-V). *Addiction 101,* 115-124.

115. **McCrae, A.L., Budney, A.J. & Brady, K.T.** (2003). Treatment of marijuana dependence: A review of the literature. *Journal of Substance Abuse Treatment 24,* 369-376.

116. **Brody, J.L. & Waldron, H.B.** (2000). Ethical issues in research on the treatment of adolescent substance use disorders. *Addictive Behaviors 25,* 217-228.

117. **Muthen, B.** (2006). Should substance use disorders be considered as categorical or dimensional? *Addiction 101,* 6-16.

118. **Chung, T. & Martin, C.** (2005). Classification and short-term course of DSM-IV cannabis, hallucinogen, cocaine, and opioid disorders in treated adolescents. *Journal of Consulting and Clinical Psychology 73,* 995-1004.

119. **Deas, D., Roberts, J. & Grindlinger, D.** (2005). The utility of DSM-IV criteria in diagnosing substance abuse/dependence in adolescents. *Journal of Substance Use 10,* 10-21.

120. **Feingold, A., & Rounsaville, B.** (1995). Construct validity of the dependence syndrome as measured by DSM-IV for four different psychoactive substances. *Addiction 90,* 1661-1669.

121. **Feingold, A. & Rounsaville, B.** (1995). Construct validity of the abuse-dependence distinction as measured by DSM-IV criteria for different psychoactive substances. *Drug and Alcohol Dependence 39,* 99-109.

122. **Fulkerson, J.A., Harrison, P.A. & Beebe, T.J.** (1999). DSM-IV substance dependence and abuse: Are there really two dimensions of substance use disorders in adolescents? *Addiction 94,* 495-506.

123. **Gillespie, N.A., Neale, M.C., Prescott, C.A., Aggen, S.H., & Kendler, K.S.** (2007). Factor and item-response analysis of DSM-IV criteria for abuse and dependence on cannabis, cocaine, hallucinogens, sedatives, stimulants, and opiates. *Addiction 102,* 920-930.

124. **Langenbucher, J.W., Labouvie, E., Martin, C.S., Sanjuan, P.M., Bayly, L., Kirisci, L., & Chung, T.** (2004). An application of item response theory analysis to alcohol, cannabis, and cocaine criteria in *DSM-IV. Journal of Abnormal Psychology 113,* 72-80.

125. **Nelson, C.B., Rehm, J., Ustun, T.B., Grant, B., & Chatterji, S.** (1999). Factor structures for DSM-IV substance disorder criteria endorsed by alcohol, cannabis, cocaine and opiate users: Results from the WHO reliability and validity study. *Addiction 94,* 843-855.

126. **Swift, W., Hall, W. & Teesson, M.** (2001). Characteristics of DSM-IV and ICD-10 cannabis dependence among Australian adults: Results from the National Survey of Mental Health and Wellbeing. *Drug and Alcohol Dependence 63,* 147-153.

127. **Teesson, M., Lynskey, M., Manor, B., & Baillie, A.** (2002). The structure of cannabis dependence in the community. *Drug and Alcohol Dependence 68,* 255-262.

128. **Denson, T.F. & Earlywine, M.** (2006). Pothead or pot smoker? A taxometric investigation of cannabis dependence. *Substance Abuse Treatment, Prevention and Policy 10,* 1-22.

129. **Edwards, G., Arif, A. & Hodgson, R.** (1981). Nomenclature and classification of drug problems. *Bulletin of the World Health Organization 59,* 225-242.

130. **Langenbucher, J.W., Morgenstern, J. & Miller, K.J.** (1995). DSM-III, DSM-IV and ICD-10 as severity scales for drug dependence. *Drug and Alcohol Dependence 39,* 139-150.

131. **Helzer, J.E., van den Brink, W. & Guth, S.E.** (2006). Should there be both categorical and dimensional criteria for the substance use disorders in DSM-V? *Addiction 101,* 17-22.

132. **Kendell, R.E.** (1975). *The role of diagnosis in psychiatry.* Oxford, UK: Blackwell Scientific Publications.

133. **Swift, W., Copeland, J. & Hall, W.** (1998). Choosing a diagnostic cut-off for cannabis dependence. *Addiction 93,* 1681-1692.

134. **American Academy of Child and Adolescent Psychiatry.** (1997). Practice parameters for the assessment and treatment of children and adolescents with substance use disorders. *Journal of the American Academy of Child and Adolescent Psychiatry 36,* 140-156.

135. **Bailey, S., Martin, C., Lynch, K., & Pollock, N.** (2000). Reliability and concurrent validity of DSM-IV sub-clinical rating for alcohol use disorder among adolescents. *American Clinical and Experimental Research 24,* 1795-1802.

136. **Bukstein, O., Dunne, J., Ayres, W., Arnold, V., Benedek, E., Benson, R.S., Bernet, W., Bernstein, G., Gross, R.L., King, R., Kinlan, J., Leonard, H., Licamele, W., McLellan, J., & Shaw, K.** (1997). Practice parameters for the assessment and treatment of children and adolescents with substance use disorders. *Journal of the American Academy of Child and Adolescent Psychiatry 36,* 140-157.

137. **Martin, C.S., Kaczynski, N.A., Maisto, S.A., Bukstein, O.M., & Moss, H.** (1995). Patterns of DSM-IV alcohol abuse and dependence symptoms in adolescent drinkers. *Journal of Studies on Alcohol 56,* 672-680.

138. **Bashford, J.L.** (2007). *The Cannabis Use Problems Identification Test (CUPIT): Development and psychometrics.* Unpublished Doctoral thesis. Palmerston North, New Zealand: Massey University.

139. **Chen, K. & Anthony, J.** (2003). Possible age-associated bias in reporting of clinical features of drug dependence: Epidemiological evidence on adolescent onset marijuana use. *Addiction 98,* 71-82.

140. **Mikulich, S.K., Hall, S.K., Whitmore, E.A., & Crowley, T.J.** (2001). Concordance between DSM-III-R and DSM-IV diagnoses of substance use disorders in adolescents. *Drug and Alcohol Dependence 61,* 237-248.

141. **Hasin, D. & Paykin, A.** (1999). Dependence symptoms but no diagnosis: 'Diagnostic orphans' in a 1992 national sample. *Drug and Alcohol Dependence 53,* 215-222.

142. **Pollock, N.K. & Martin, C.S.** (1999). Diagnostic orphans: Adolescents with alcohol symptoms who do not qualify for DSM-IV abuse or dependence diagnoses. *American Journal of Psychiatry 156,* 897-901.

143. **Degenhardt, L., Lynskey, M., Coffey, C., & Patton, G.** (2002). 'Diagnostic orphans' among young adult cannabis users: Persons who report symptoms but do not meet diagnostic criteria. *Drug and Alcohol Dependence 67,* 205-212.

144. **Martin, G., Copeland, J., Gilmour, S., Gates, P., & Swift, W.** (2006). The Adolescent Cannabis Problems Questionnaire (CPQ-A): Psychometric properties. *Addictive Behaviors 31,* 2238-2248.

145. **Degenhardt, L., Coffey, C., Carlin, J.B., Swift, W., & Patton, G.C.** (2008). Are diagnostic orphans at risk of developing cannabis abuse or dependence? Four-year follow-up of young adult cannabis users not meeting diagnostic criteria. *Drug and Alcohol Dependence 92,* 86-90.

146. **Deas, R., Riggs, P., Langenbucher, J., Goldman, M., & Brown, S.** (2000). Adolescents are not adults: Developmental considerations in alcohol users. *Alcohol Clinical and Experimental Research 24,* 232-237.

147. **Foley, J.D.** (2006). Adolescent use and misuse of marijuana. *Adolescent Medicine 17,* 319-334.

148. **Weinberg, N.Z., Rahdert, E., Colliver, J.D., & Glantz, M.D.** (1998). Adolescent substance abuse: A review of the past 10 years. *Journal of the American Academy of Child and Adolescent Psychiatry 37,* 252-261.

149. **Edwards, A.G.K. & Rollnick, S.** (1997). Outcome studies of brief alcohol intervention in general practice: The problem of lost subjects. *Addiction 92,* 1699-1704.

150. **Vendetti, J., McRee, B., Miller, M., Christiansen, K., Herrell, J., & The Marijuana Treatment Project Research Group (MTPRG).** (2002). Correlates of pre-treatment dropout among persons with marijuana dependence. *Addiction 97,* 125-134.

151. **Weisner, C., Mertens, J., Tam, T., & Moore, C.** (2001). Factors affecting the initiation of substance abuse treatment in managed care. *Addiction 96,* 705-716.

152. **Stephens, R.S. & Roffman, R.A.** (2006). The Marijuana Check-Up. **In R.A. Roffman & R.S. Stephens (eds.).** *Cannabis dependence: Its nature, consequences, and treatment* (pp. 177-203). Cambridge: Cambridge University Press.

153. **Prochaska, J.** (2000). How do people change, and how can we change to help more people? **In M. Hubble, B. Duncan & S. Miller. (eds.).** *The heart and soul of change* (pp. 227-255). Washington, DC: American Psychological Press.

154. **Steinberg, K.L., Roffman, R.A., Carroll, K.M., Kabela, E., Kadden, R., Miller, M., Duresky, D., & The Marijauna Treatment Project Research Group** (2002). Tailoring cannabis dependence treatment for a diverse population. *Addiction 97,* 135-142.

155. **Brodey, B.B., McMullin, D., Winters, K.C., Rosen, C.S., Downing, D.R., & Koble, J.M.** (2007). Adolescent substance use assessment in a primary care setting. *The American Journal of Drug and Alcohol Abuse 33,* 447-454.

156. **Diamond, G.S., Liddle, H.A., Wintersteen, M.B., Dennis, M.L., Godley, S.H., & Tims, F.** (2006). Early therapeutic alliance as a predictor of treatment outcome for adolescent cannabis users in outpatient treatment. *American Journal of Addiction 15*, 26-33.

157. **Silber, T.J.** (1987). Adolescent marijuana use: The role of the physician. *Adolescence 22,* 363-370.

158. **Meyers, K., Hagart, T. & Zanis, D.** (1999). Critical issues in adolescent substance use assessment. *Drug and Alcohol Dependence 55,* 235-246.

159. **Copello, A. & Orford, J.** (2002). Addiction and the family: Is it time for services to take notice of the evidence? *Addiction 97,* 1361-1363.

160. **Liddle, H.A.** (2004). Family-based therapies for adolescent alcohol and drug use: Research contributions and future needs. *Addiction 88,* 76-92.

161. **Kendler, K.S., Myers, J. & Prescott, C.A.** (2007). Specificity of genetic and environmental risk factors for symptoms of cannabis, cocaine, alcohol, caffeine, and nicotine dependence. *Archives of General Psychiatry 64,* 1313-1320.

162. **Wilson, C.R., Sherritt, L., Gates, E., & Knight, J.R.** (2004). Are clinical impressions of adolescent substance use accurate? *Pediatrics 114,* 536-540.

163. **Anastasi, A. & Urbina, S.** (1997). *Psychological testing*. New Jersey: Prentice-Hall.

164. **Streiner, D.L. & Norman, G.R. (eds.).** (1995). *Health measurement scales: A practical guide to their development and use* (2nd ed.). Oxford: Oxford University Press.

165. **Lucas, J.W.** (2003). Theory-testing, generalization, and the problem of external validity. *Sociological Theory 21,* 236-252.

166. **Shadish, W., Cook, T. & Campbell, D.** (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton-Mifflin.

167. **McLellan, T. & Dembo, R.** (1993). *Screening and assessment of alcohol and other drug-abusing adolescents*. Rockville: Center for Substance Abuse Treatment.

168. **Heustis, M.A., Gustafson, R.A., Moolchan, E.T., Barnes, A., Bourland, J.A., Sweeney, S.A., Hayes, E.F., Carpenter, P.M., & Smith, M.L.** (2007). Cannabinoid concentrations in hair from documented cannabis users. *Forensic Science International 169,* 129-136.

169. **Mura, P., Klintz, P., Papet, Y., Ruesch, G., & Piriou, A.** (1999). Evaluation of six rapid tests for screening of cannabis in sweat, saliva and tears. *Acta Clinica Belgica 1,* 35-38.

170. **Staub, C.** (1999). Chromatographic procedures for determination of cannabinoids in biological samples, with special attention to blood and alternative matrices like hair, saliva, sweat and meconium. *Journal of Chromatography B: Biomedical Sciences and Applications 733,* 116-126.

171. **Rehnstrom, A.L., Briner, R.C. & Frazier, C.L.** (1989). Evaluation of EMIT as a qualitative screening test for marijuana use. *Journal of Chemical Education 66,* 346-348.

172. **Schwartz, J.G., Zollars, P.R., Okorodudu, A.O., Carnahan, J.J., Wallace, J.E., & Briggs, J.E.** (1991). Accuracy of common drug tests. *American Journal of Emergency Medicine 9,* 166-170.

173. **Leino, A., Saaramies, J., Gronholm,. M., & Lillesunde, P.** (2001). Comparison of eight commercial on-site screening devices for drugs of abuse testing. *Scandanavian Journal of Clinical Laboratory Investigation 61,* 325-331.

174. **Baselt, R.** (2000). *Disposition of toxic drugs and chemicals in man*. (5th ed.). Foster City, CA: Chemical Toxicology Institute.

175. **Fals-Sewart, W., O'Farrell, T.J., Freitas, T.T., McFarlin, S.K., & Rutigliano, P.** (2000). The timeline followback reports of psychoactive substance use by drug-abusing patents: Psychometric properties. *Journal of Consulting and Clinical Psychology 68,* 134-144.

176. **Skopp, G., Strohbeck-Kuehner, P., Mann, K., & Hermann, D.** (2006). Deposition of cannabinoids in hair after long-term use of cannabis. *Forensic Science International 170,* 46-50.

177. **Uhl, M. & Sachs, H.** (2004). Cannabinoids in hair: Strategy to prove marijuana/hashish consumption. *Forensic Science International 145,* 143-147.

178. **United Nations.** (1998). *Guidelines for testing drugs under international control in hair, sweat, and saliva.* New York: Author.

179. **Niedbala, S., Kardos, K. & Salamone, S.** (2004). Passive cannabis smoke exposure and oral fluid testing. *Journal of Analytical Toxicology 28,* 546-542.

180. **Lozano, J., Garcia-Algar, O., Marchei, E., Vall, O., Monleon, T., Giovannandrea, R., & Pichini, S.** (2007). Prevalence of gestational exposure to cannabis in a Mediterranean city by meconium analysis. *Acata Paediatrica 96,* 1734-1737.

181. **Tarter, R.E. & Hegedus, A.M.** (1991). The Drug Use Screening Inventory: Its applications in the evaluation and treatment of alcohol and other drug abuse. *Alcohol Health and Research World 15,* 65-75.

182. **Kirisci, L., Mezzich, A. & Tarter, R.** (1995). Norms and sensitivity of the adolescent version of the Drug Use Screening Inventory. *Addictive Behaviors 20,* 149-157.

183. **Latimer, W.W., Winters, K.C. & Stinchfield, R.D.** (1997). Screening for drug abuse among adolescents in clinical and correctional settings using the Problem-Oriented Screening Instrument for Teenagers. *American Journal of Drug Abuse 23,* 79-98.

184. **Winters, K.C.** (1992). Development of an adolescent substance abuse screening instrument. *Addictive Behaviors 17,* 479-490.

185. **Gavin, F.H., Ross, H.E. & Skinner, H.A.** (1989). Diagnostic validity of the drug abuse screening test in the assessment of DSM-III drug disorders. *British Journal of Addiction 84,* 301-307.

186. **Skinner, H.A.** (1982). The drug abuse screening test. *Addictive Behaviors 7,* 363-371.

187. **Martino, S., Grilo, C.M. & Fehon, D.CV.** (2000). Development of the Drug Abuse Screening Test for Adolescents (DAST-A). *Addictive Behaviors 25,* 57-70.

188. **Brown, R.L. & Rounds, L.A.** (1995). Conjoint screening questionnaires for alcohol and other drug abuse: Criterion validity in a primary care practice. *Wisconsin Medical Journal 94,* 135-140.

189. **Knight, J.R., Sherritt, L., Shrier, L.A., Harris, S.A.K., & Chang, G.** (2002). Validity of the CRAFFT Substance Abuse Screening Test among adolescent clinic patients. *Archives of Pediatric and Adolescent Medicine 156,* 607-614.

190. **WHO ASSIST Working Group.** (2002). The Alcohol, Smoking and Substance Involvement Screening Test (ASSIST): Development, reliability and feasibility. *Addiction 97,* 1183-1194.

191. **Berman, A.H., Bergman, H., Palmstierna, T., & Schlyter, F.** (2005). Evaluation of the Drug Use Disorders Identification Test (DUDIT) in criminal justice and detoxification settings and in a Swedish population sample. *European Addiction Research 11,* 22-31.

192. **Hannifin, J.** (1990). *The cannabis abuse syndrome screening test: A brief report.* Unpublished report. Wellington: Drugs Advisory Committee.

193. **National Health Committee.** (1999). *Guidelines for recognizing, assessing, and treating alcohol and cannabis abuse in primary care.* Wellington: Ministry of Health.

194. **Saunders, J.B., Aasland, O.G., Amunsden, A., & Grant, M.** (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption: II. *Addiction 88,* 791-804.

195. **Adamson, S. & Sellman, J.D.** (2003). A prototype screening instrument for cannabis use disorder: The Cannabis Use Disorders Identification Test (CUDIT) in an alcohol dependent clinical sample. *Drug and Alcohol Review 22,* 309-315.

196. **Swift, W., Hall, W. & Teesson, M.** (2001b). Characteristics of DSM-IV and ICD-10 cannabis dependence among Australian adults: Results from the National Survey of Mental Health and Wellbeing. *Drug and Alcohol Dependence 63,* 147-153.

197. **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.

198. **Binder, K.** (2005). Validierung des Cannabis Use Disorders Identification Test (CUDIT) an einer studentischen Stichprobe. Epidemiologie des Cannabiskonsums, Substanzstörungen und Drogenwirkungserwartungen bei Erstsemestern. [Validation of the Cannabis Use Disorders Identification Test (CUDIT) in a Sample of First Year University Students: Epidemiology of Cannabis Use, Cannabis Induced Disturbances, and Expected Drug Effects]. Münster: Westfälische Wilhelms Universität [Unveröffentlichte Diplomarbeit].

199. **Alexander, D.** (2003). A Marijuana Screening Inventory (Experimental Version): Description and preliminary psychometric properties. *American Journal of Drug and Alcohol Abuse 29,* 619-646.

200. **Alexander, D.** (2003). Clinical pilot experiences using the Marijuana Screening Inventory (MSI-X): Screening guidelines and case illustrations. *Journal of Social Work Practice in the Addictions 3,* 29-51.

201. **Alexander, D. & Leung, P.** (2004). The Marijuana Screening Inventory (MSI-X): Reliability, factor structure, and scoring criteria with a clinical sample. *American Journal of Drug and Alcohol Abuse 30,* 321-351.

202. **Alexander, D. & Leung, P.** (2006). The Marijuana Screening Inventory (MSI-X): Concurrent, convergent and discriminant validity with multiple measures. *American Journal of Drug and Alcohol Abuse 32,* 351-378.

203. **Legleye, S., Karila, L., Beck, F., & Reynaud, M.** (2007). Validation of the CAST, a general population Cannabis Abuse Screening Test. *Journal of Substance Use 12,* 233-242.

204. **Okulicz-Kozaryn, K.** (2007). Psychometric properties of the Problematic Marijuana Use (PUM) test for adolescents. *Post Psychiatry and Neurology 16,* 105-111.

205. **Rosenberg, S.D., Drake, R.E., Wolford, G.L., Muester, K.T., Oxnam, T.E., Vidaver, R.M., Carrieri, K.L., & Luckoor, R.** (1998). The Dartmouth Assessment of Lifestyle Inventory (DALI): A substance use screen for people with severe mental illness. *American Journal of Psychiatry 153,* 232-238.

206. **Australian Institute of Health and Welfare.** (2005). *2004 National Drug Strategy Household Survey: Detailed findings.* Drug Statistics Series No.16.Canberra: AIHW

207. **Clough, A., D'Abbs, P., Cairney, S., Gray, D., Maruff, P., & Parker, R.** (2004). Emerging patterns of cannabis and other substance use in Aboriginal communities in Arnhem Land, Northern Territory: A study of two communities. *Drug and Alcohol Review 23*, 381-390.

208. **Clough, A.R., Lee, K.S., Cairney, S., Maruff, P., O'Reilly, B., D'Abbs, P., & Conigrave, K.M.** (2006). Changes in cannabis use and its consequences over 3 years in a remote indigenous population in northern Australia. *Addiction 101,* 696-705.

209. **Schlesinger, C.M., Ober, C., McCarty, M., Watson, J.D., & Seinen, A.** (2007). The development and validation of the Indigenous Risk Impact Screen (IRIS): A 13-item screening instrument for alcohol and drug and mental health risk. *Drug and Alcohol Review 26,* 109-117.

210. **World Health Organization.** (1997). *Composite International Diagnostic Interview Core version 2.1.* Geneva: Author.

211. **Kessler, R.C., Wittchen, H.U., Kendler, K., McGonagle, K.A., Zhao, S., Nelson, C.B., Hughes, M., & Eshleman, S.** (1994). Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: Results from the National Comorbidity Survey. *Archives of General Psychiatry 51,* 8-19.

212. **Wittchen, H.U., Beloch, E., Garczynski, E., Holly, A., Lachner, G., Perkonigg, A., Pfutze, E.M., Schuster, P., Vodermaier, A., Vossen, A., Wunderlich, U., & Zieglgansberger, S.** (1995). Munchener Composite International Diagnostic Interview (M-CIDI) (Version 2.2/2/95). Max-Planck-Institut fur Psychiatrie, Klinische Psychologie und Epidemiologie, Munchen.

213. **Horton, J., Compton, W.M. & Compton, L.B.** (2000). Reliability of substance use disorder diagnoses among African-Americans and Caucasians. *Drug and Alcohol Dependence 57,* 203-209.

214. **Lachner, G., Wittchen, H.U., Perkonigg, A., Holly, A., Schuster, P., Wunderlich, U., Turk, D., Garczynski, E., & Pfister, H.** (1998). Structure, content, and reliability of the Munich-Composite International Diagnostic Interview (M-CIDI) substance use sections. *European Addiction Research 4,* 28-41.

215. **Langenbucher, J., Morgenstern, J., Labouvie, E., & Nathan, P.E.** (1994). Lifetime DSM-IV diagnosis of alcohol, cannabis, cocaine and opiate dependence: Six-month reliability in a multi-site clinical sample. *Addiction 89,* 1115-1127.

216. **Wittchen, H.U.** (1994). Reliability and validity studies of the WHO-Composite International Diagnostic Interview (CIDI): A critical review. *Journal of Psychiatric Research 28,* 57-84.

217. **World Health Organization.** (1997). *Composite International Diagnostic Interview, 2.1, Computerized Version (CIDI-Auto).* Geneva, Switzerland: Author.

218. **Wittchen, H.U., Lachner, G., Wunderlich, U., & Pfister, H.** (1998). Test-retest reliability of the computerized DSM-IV version of the Munich-Composite International Diagnostic Interview (M-CIDI). *Social Psychiatry and Psychiatric Epidemiology 33,* 568-578.

219. **Kedzior, K.K., & Martin-Iverson, M.T.** (2007). Concurrent validity of cannabis misuse on CIDI-Auto 2.1 in low-level cannabis users from the general population. *Australian Journal of Psychology 59,* 169-175.

220. **Rubio-Stipec, M., Peters, L. & Andrews, G.** (1999). Test-retest reliability of the computerized CIDI (CIDI-Auto): Substance abuse modules. *Substance Abuse 20,* 263-272.

221. **Reed, V., Gander, F., Pfister, H., Steiger, A., Sonntag, H., Trenkwalder, C., Sonntag, A., Hundt, W., & Wittchen, H.U.** (1998). To what degree does the Composite International Diagnostic Interview (CIDI) correctly identify DSM-IV disorders? Testing validity in a clinical sample. *International Journal of Methods in Psychiatric Research 7,* 142-155.

222. **Andrews, G. & Peters, L.** (1998). The psychometric properties of the Composite International Diagnostic Interview. *Social Psychiatry Psychiatric Epidemiology 33,* 80-88.

223. **Winters, K.C. & Henly, G.** (1993). *Adolescent Diagnostic Interview (ADI) Manual.* Los Angeles, CA: Western Psychological Services.

224. **First, M.B., Spitzer, R.L., Gibbon, M., & Williams, J.B.** (1997). *Structured Clinical Interview for DSM-IV Axis I Disorders,* (*SCID-I*), *Clinician Version.* Washington, DC: American Psychiatric Association.

225. **First, M.B., Gibbon, M., Williams, J. B., Spitzer, R.L., & the MHS Staff.** (2001). *SCID Screen Patient Questionnaire (SSPQ) and SCID Screen patient Questionnaire - Extended (SSPQ-X): Computer programs for Windows software manual.* Canada: Multi-Health Systems/ American Psychiatric Press.

226. **World Health Organization.** (1992). *Schedules for Clinical Assessment in Neuropsychiatry* (SCAN). Geneva, Switzerland: Author.

227. **Easton, C., Meza, E., Mager, D., Ulug, B., Kilic, C., Gogus, A., & Babor, T.** (1997). Test-retest reliability of the alcohol and drug use disorder sections of the schedules for clinical assessment in neuropsychiatry (SCAN). *Drug and Alcohol Dependence 47,* 187-194.

228. **Kranzler, H.R., Kadden, R.M., Babor, T.F., Tennen, H., & Rounsaville, B.J.** (1996). Validity of the SCID in substance abuse patients. *Addiction 91,* 859-868.

229. **Martin, C.S., Pollock, N.K., Bukstein, O.G., & Lynch, K.G.** (2000). Inter-rater reliability of the SCID alcohol and substance use disorders section among adolescents. *Drug and Alcohol Dependence 59,* 173-176.

230. **Winters, K.C., Stinchfield, R.D., Fulkerson, J., & Henly, G.A.** (1993). Measuring alcohol and cannabis use disorders in an adolescent clinical sample. *Psychology of Addictive Behaviors 7,* 185-196.

231. **Hasin, D.S., Trautman, K., Miele, G.M., Samet, S., Smith, M., & Endicott, J.** (1996). Psychiatric Research Interview for Substance and Mental Disorders (PRISM): Reliability for substance abusers. *American Journal of Psychiatry 153,* 1195-1201.

232. **Hasin, D., Samet, S., Nunes, E., Meydan, J., Matseoane, K., & Waxman, R.** (2006). Diagnosis of psychiatric disorders in substance users assessed with the Psychiatric Research Interview for Substance and Mental Disorders for DSM-IV. *American Journal of Psychiatry 163,* 689-696.

233. **Bucholz, K.K., Cadoret, R., Cloninger, C.R., Dinwidie, S., Hesselbrock, V., Laster, L., Nurenberger, J., Reich, T., & Schukit, M.** (1994). A new, semi-structured psychiatric interview for use in genetic linkage studies: A report in the reliability of the SSAGA. *Journal of Studies on Alcohol 55,* 149-158.

234. **Bucholz, K.K., Hesselbrock, V., Shayka, J., Nurnberger, J., Schuckit, M., Schmiolt, I., & Reicht, T.** (1995). Reliability of individual diagnostic criterion items for psychoactive substance dependence and the impact on diagnosis. *Journal of Studies on Alcohol 56,* 500-505.

235. **Hesselbrock, M., Easton, C., Bucholz, K.K., Schuckit, M., & Hesselbrock, V.** (1999). A validity study of the SSAGA – a comparison with the SCAN. *Addiction 94,* 1361-1370.

236. **Shaffer, D., Fisher, P., Lucas, C., Dulcan, M., & Schwab-Stone, M.** (2000). NIMH Diagnostic Interview Schedule for Children, Version IV (NIMH DISC-IV): Description, differences from previous versions, and reliability of some common diagnoses. *Journal of the American Academy of Child and Adolescent Psychiatry 39*, 28-38.

237. **Dennis, M.L., Titus, J.C., White, M., Unsicker, J., & Hodgkins, D.** (2003). Global Appraisal of Individual Needs (GAIN): Administration guide for the GAIN and related measures. (Version 5 ed.). Bloomington, IL: Chestnut Health Systems.

238. **New South Wales Department of Health.** (2007). *New South Wales drug and alcohol withdrawal clinical practice guidelines.* Mental Health and Drug and Alcohol Office, New South Wales Department of Health.

239. **McLellan, A.T., Kushner, H., Metzger, D., Peters, R., Smith, I., Grissom, G., Pettinati, H., & Argeriou, M.** (1992). The fifth edition of the Addiction Severity Index. *Journal of Substance Abuse Treatment 9,* 199-213.

240. **Kirisci, L. Tarter, R.A., Vanyukov, M., Martin, C., Mezzich, A., & Brown, S.** (2006). Application of item response theory to quantify substance use disorder severity. *Addictive Behaviors 31,* 1035-1039.

241. **Langenbucher, J.W., Morgenstern, J. & Miller, K.J.** (1995). DSM-III, DSM-IV and ICD-10 as severity scales for drug dependence. *Drug and Alcohol Dependence 39,* 139-150.

242. **Marijuana Treatment Project Research Group.** (2004). Brief treatments for cannabis dependence: findings from a randomized multi-site trial. *Journal of Consulting and Clinical Psychology 72,* 455-456.

243. **Stephens, R.S., Roffman, R.A. & Curtin, L.** (2000). Comparison of extended versus brief treatments for marijuana use. *Journal of Consulting and Clinical Psychology 68,* 898-908.

244. **Woody, G.E., Cottler, L.B. & Cacciola, J.** (1993). Severity of dependence: Data from the DSM-IV field trials. *Addiction 88,* 1573-1579.

245. **Miele, G.M., Carpenter, K.M., Cockerham, M.S., Trautman, K.D., Blaine, J., & Hasin, D.S.** (2000). Substance Dependence Severity Scale (SDSS): Reliability and validity of a clinician-administered interview for DSM-IV substance use disorders. *Drug and Alcohol Dependence 59,* 63-75.

246. **Miele, G.M., Carpenter, K.M., Cockerham, M.S., Trautman, K.D., Blaine, J., & Hasin, D.S.** (2001). Substance Dependence Severity Scale reliability and validity for ICD-10 substance use disorders. *Addictive Behaviors 26,* 603-612.

247. **Gossop, M., Darke, S., Griffiths, P., Hando, J., Powis, B., Hall, W., & Strang, J.** (1995). The Severity of Dependence Scale (SDS): Psychometric properties of the SDS in English and Australian samples of heroin, cocaine and amphetamine users. *Addiction 90,* 607-614.

248. **Martin, G., Copeland, J., Gates, P., & Gilmour, S.** (2006). The Severity of Dependence Scale (SDS) in an adolescent population of cannabis users: Reliability, validity and diagnostic cut-off. *Drug and Alcohol Dependence 83*, 90-93.

249. **Hides, L., Dawe, S., Young, R.M., & Kavanagh, D.J.** (2007). The reliability and validity of the Severity of Dependence Scale for detecting cannabis dependence in psychosis. *Addiction 102,* 35-40.

250. **Copeland, J., Swift, W., Roffman, R., & Stephens, R.** (2001). A randomized controlled trial of brief cognitive-behavioral interventions for cannabis use disorder. *Journal of Substance Abuse Treatment 21,* 55-64.

251. **Swift, W., Hall, W. & Copeland, J.** (2000). One year follow-up of cannabis dependence among long-term cannabis users in Sydney, Australia. *Drug and Alcohol Dependence 59,* 309-318.

252. **Field, M.** (2005). Cannabis dependence and attentional bias for cannabis-related words. *Behavioural Pharmacology 16,* 473-476.

253. **Gray, K.M.** (2007). Marijuana use, withdrawal, and craving in adolescents. *Psychiatric Times 24,* 1-9.

254. **Field, M., Mogg, K. & Bradley, B.P.** (2004). Cognitive bias and drug craving in recreational cannabis users. *Drug and Alcohol Dependence 74,* 105-111.

255. **Heishman, S.J., Singleton, E.G. & Ligouri, A.** (2001). Marijuana Craving Questionnaire: Development and initial validation of a self-report instrument. *Addiction 96,* 1023-1034.

256. **Singleton, E.G., Trotman, A.J., Zavahir, M., et al.,** (2002). Determination of the reliability and validity of the marijuana craving questionnaire using imagery scripts. *Experimental and Clinical Psychopharmacology 10,* 47-53.

257. **Lundahl, L.H., Borden, K.N. & Lukas, S.E.** (2001). *Marijuana cue-induced craving in cannabis dependent adolescents in psychiatric treatment.* Presented at College on Problems of Drug Dependence Annual Meeting, Scottsdale, Arizona, June 2001.

258. **Gray, K.M., La Rowe, S.D. & Upadhyaya, H.P.** (2006). *Marijuana cue reactivity in adolescents: A pilot investigation.* Presented at College on Problems of Drug dependence Annual Meeting, Scottsdale, Arizona, June 2006.

259. **Sayette, M.A., Shiffman, S., Tiffany, S.T., Niarua, R.S., Martin, C.S., & Shadel, W.G.** (2000). The measurement of drug craving. *Addiction 95,* S189-S210.

260. **Heishman, S.J. & Singleton, E.G.** (2005). Assessment of cannabis craving using the Marijuana Craving Questionnaire. **In E.S. Onaivi (ed.).** *Marijuana and cannabinoid research: Methods and protocols* (pp. 209-216). Totowa, NJ: Humana Press.

261. **Sobell, L.C. & Sobell, M.B.** (1992). Timeline Follow-back, a technique for assessing self-reported alcohol consumption. **In R. Litten & J.Allen (eds.).** *Measuring alcohol consumption* (pp. 41-72). Totowa, NJ: Humana Press.

262. **Sobell, L.C., Sobell, M.B., Buchan, G., Cleland, P.A., & Leo, G.I.** (1996). *The reliability of the Timeline Followback method applied to drug, cigarette, and cannabis use.* Paper presented at the 30th Annual Meeting of the Association for Advancement of Behavior Therapy, New York, November.

263. **Dennis, M.L., Funk, R., Godley, M.D., & Waldron, H.** (2004). Cross-validation of the alcohol and cannabis use measures in the Global Appraisal of Individual Needs (GAIN) and Timeline Followback (TLFB; Form 90) among adolescents in treatment. *Addiction 99,* 120-128.

264. **Levy, S., Sherritt, L., Harris, S.K., Gates, E.C., Holder, D.W., Kulig, J.W., & Knight, J.R.** (2004). Test-retest reliability of adolescents' self-report of substance use. *Alcoholism: Clinical and Experimental Research 28,* 1236-1241.

265. **Sobell, L.C., Toneatto, T. & Sobell, M.C.** (1994). Behavioral assessment and treatment planning for alcohol, tobacco, and other drug problems: Current status with an emphasis on clinical applications. *Clinical Psychology Review 8,* 19-54.

266. **Lang, E., Engelander, M. & Brooke, T.** (2000). Report of an integrated brief intervention with self-defined problem cannabis users. *Journal of Substance Abuse Treatment 19,* 111-116.

267. **Meyers, K., McLellan, A.T., Jaeger, J.L., & Pettinati, H.M.** (1995). The development of the comprehensive addiction severity index for adolescents (CASI-A): An interview for assessing multiple problems of adolescents. *Journal of Substance Abuse Treatment 12,* 181-193.

268. **Carey, K.B., Cocco, K.M. & Correria, C.J.** (1997). Reliability and validity of the Addiction Severity Index among outpatients with severe mental illness. *Psychological Assessment 9,* 422-428.

269. **Stephens, R.S., Roffman, R.A., Fearer, S., Williams, C., & Burke, R.S.** (2007). The Marijuana Check-Up: Promoting change in ambivalent marijuana users. *Addiction 102*, 947-957.

270. **Copeland, J., Swift, W. & Rees, V.** (2001). Clinical profile of participants in a brief intervention for cannabis use disorder. *Journal of Substance Abuse Treatment 20,* 45-52.

271. **Copeland, J., Gilmour, S., Gates, P., & Swift, W.** (2005). The Cannabis Problems Questionnaire: Factor structure, reliability and validity. *Drug and Alcohol Dependence 80,* 313-319.

272. **Degenhardt, L., Hall, W. & Lynskey, M.T.** (2001). The relationship between cannabis use and other substance use in the general population. *Drug and Alcohol Dependence 64,* 319-327.

273. **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 users in outpatient treatment. *Addiction 97,* 46-57.

274. **Degenhardt, L., Hall, W. & Lynskey, M.T.** (2001). Alcohol, cannabis, and tobacco use among Australians: A comparison of their associations with other drug use and use disorders, affective and anxiety disorders, and psychosis. *Addiction 96,* 1603-1614.

275. **Grant, B.F., Stinson, F.S., Dawson, D.A., Chou, S.P., Dufour, M.C., Compton, W.M., Pickering, R.P., & Kaplan, K.B.** (2004). Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry 61,* 807-816.

276. **Perkonigg, A., Lieb, R., Hofler, 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.

277. **Winters, K.C. & Lee, C.Y.** (2007). Likelihood of developing an alcohol and cannabis use disorder during youth: Association with recent use and age. *Drug and Alcohol Dependence,* in press.

278. **Reid, A., Lynskey, M. & Copeland, J.** (2000). Cannabis use among Australian adolescents: Findings of the 1998 National Drug Strategy Household Survey. *Australian and New Zealand Journal of Public Health 24,* 596-602.

279. **Sobell, L.C., Kwan, E. & Sobell, M. B.** (1995). Reliability of a Drug History Questionnaire (DHQ). *Addictive Behaviors 20,* 233-241.

280. **Arendt, M. & Munk-Jorgensen, P.** (2004). Heavy cannabis users seeking treatment: Prevalence of psychiatric disorders. *Social Psychiatry and Psychiatric Epidemiology 39,* 97-105.

281. **Bovasso, G.B.** (2001). Cannabis abuse as a risk factor for depression. *American Journal of Psychiatry 158,* 2033-2037.

282. **Zvolensky, M.J., Bernstein, A., Sachs-Ericsson, N., Schmidt, N.B., Buckner, J.D., & Bonn-Miller, M.O.** (2006). Lifetime associations between cannabis use, abuse, and dependence and panic attacks in a representative sample. *Journal of Psychiatric Research 40,* 477-486.

283. **Copeland, J.** (2006). Editorial. Cannabis use, depression and public health. *Addiction 191,* 1380.

284. **Degenhardt, L., Hall, W. & Lynskey, M.** (2003). Exploring the association between cannabis use and depression. *Addiction 98,* 1493-1504.

285. **Diamond, G., Panichelli-Mindel, S.M., Shera, D., Dennis, M., Tims, F., & Ungemack, J.** (2006). Psychiatric syndromes in adolescents with marijuana abuse and dependency in outpatient treatment. *Journal of Child & Adolescent Substance Abuse 15*, 37-54.

286. **Di Forti, M., Morrison, P.D., Butt, A., & Murray, R.M.** (2007). Review paper. Cannabis use and psychiatric and cognitive disorders: The chicken or the egg? *Current Opinion in Psychiatry 20,* 228-234.

287. **D'Souza, D.C., Abi-Saab, W.M., Madonick, S., Fornelius-Bielen, K., Doersch, A., Braley, G., Gueorguieva, R., Cooper, T.B., & Krystal, J.H.** (2005). Delta-9-tetrahydrocannabinol effects in schizophrenia: Implications for cognition, psychosis, and addiction. *Biological Psychiatry 57,* 594-608.

288. **Farrell, M., Howes, S., Taylor, C., Lewis, G., Jenkins, R., Bebbington, P., Jarvis, M., Brugha, T., Gill, B., & Meltzer, H.** (2003). Substance misuse and psychiatric comorbidity: An overview of the OPCS National Psychiatric Morbidity Study. *International Review of Psychiatry 15,* 43-49.

289. **Fergusson, D.M., Horwood, J. & Swain-Campbell, N.** (2002). Cannabis and psychosocial adjustment in adolescent and young adulthood. *Addiction 97,* 1123-1135.

290. **Harder, V.S., Morral, A.R. & Arkes, J.** (2006). Marijuana use and depression amongst adults: Testing for causal associations. *Addiction 101,* 1463-1472.

291. **Obianwu, H.O.** (2005). Emerging serious psychopathology associated with abuse of cannabis (Indian hemp, marijuana). *Tropical Journal of Pharmaceutical Research 4,* 329-330.

292. **Patton, C.C., Coffey, C., Carlin, J.B., Degenhardt, L., Lynskey, M., & Hall, W.** (2002). Cannabis use and mental health in young people: A cohort study. *British Medical Journal 325,* 1195-1198.

293. **Poulin, C., Hand, D., Boudreau, B., & Santor, D.** (2005). Gender differences in the association between substance use and elevated depressive symptoms in a general adolescent population. *Addiction 100,* 525-535.

294. **Stinson, F.S., Ruan, W.J., Pickering, R., & Grant, B.F.,** (2006). Cannabis use disorders in the USA: Prevalence, correlates and co-morbidity. *Psychological Medicine 36*, 1447-1460.

295. **Troisi, A., Pasani, A., Saracco M., & Spalleta, G.** (1998). Psychiatric symptoms in male cannabis users not using other illicit drugs. *Addiction 4,* 487-492.

296. **Wittchen, H.U., Frohlich, C., Behrendt, S., Gunther, A., Rehm, J., Zimmerman, P., Lieb, R., & Perkonigg, A.** (2007). Cannabis use and cannabis sue disorders and their relationship to mental disorders: A 10-year prospective longitudinal community study in adolescents. *Dreug and Alcohol Dependence 88S,* S60-S70.

297. **Fergusson, D.M., Horwood, L.J. & Swain-Campbell, N.R.** (2003). Cannabis dependence and psychotic symptoms in young people. *Psychological Medicine 33,* 15-21.

298. **Fergusson, D.M., Horwood, L.J. & Ridder, E.M.** (2005). Tests of causal linkages between cannabis use and psychotic symptoms. *Addiction 100,* 354-366.

299. **Hayatbakhsh, M.R., Najman, J.M., Jamrozik, K., Mamun, A.A., Alati, R., & Bor, W.** (2007). Cannabis and anxiety and depression in young adults: A large prospective study. *Journal of the American Academy of Child and Adolescent Psychiatry 46,* 408-417.

300. **Henquet, C., Krabbendam, L., Spauwen, J., Kaplan, C., Lieb, R., Wittchen, H.U., & Van Os, J.** (2005). Prospective cohort study of cannabis use, predisposition for psychosis, and psychotic symptoms in young people. *British Medical Journal 330,* 11-16.

301. **Van Os, J., Bak, M., Hanssen, M., Biji, R., de Graaf, R., & Verdoux, H.** (2002). Cannabis use and psychosis: A longitudinal population-based study. *American Journal of Epidemiology 156,* 319-327.

302. **Degenhardt, L. & Hall, W.** (2006). Review. Is cannabis use a contributory cause of psychosis? *Canadian Journal of Psychiatry 51,* 556-565.

303. **Kalant, H.** (2004). Adverse effects of cannabis on health: An update of the literature since 1996. *Progress in Neuro-Psychopharmacology & Biological Psychiatry 28,* 849-863.

304. **Moore, T.H., Zammit, S., Lingford-Hughes, A., Barnes, T.R., Jones, P.B., & Lewis, G.** (2007). Cannabis use and risk of psychotic or affective mental health outcomes: A systematic review. *Lancet 370,* 319-328.

305. **Rey, J.M., Martin, A. & Krabman, P.** (2004). Is the party over? Cannabis and juvenile psychiatric disorder: The past 10 years. *Journal of the Academy of Child and Adolescent Psychiatry 43,* 1194-1205.

306. **Semple, D.M., McIntosh, A.M. & Lawrie, S.M.** (2005). Cannabis as a risk for psychosis: A systematic review. *Journal of Psychopharmacology 19,* 187-194.

307. **Boys, A., Farrell, M., Taylor, C., Marsden, J., Goodman, R., Brugha, T., Bebbington, P., Jenkins, R., & Meltzer, H.** (2003). Psychiatric morbidity and substance use in young people aged 13-15 years: Results from the Child and Adolescent Survey of Mental Health. *British Journal of Psychiatry 182,* 509-517.

308. **Kamon, J., Budney, A. & Stanger, C.** (2005). A contingency management intervention for adolescent marijuana abuse and conduct problems. *Journal of the American Academy of Child and Adolescent Psychiatry 44,* 513-521.

309. **Monshouwer, K., Van Dorsselaer, S., Verdumen, J., Bogt, T.T., de Graaf, R., & Vollebergh, W.** (2006). Cannabis use and mental health in secondary school children. Findings from a Dutch survey. *British Journal of Psychiatry 188,* 148-153.

310. **Cottler, L.B., Compton, W.M., Spitznagel, E.L., & Janca, A.** (1992). Posttraumatic stress disorders among substance abusers from the general population. *American Journal of Psychiatry 149,* 664-670.

311. **Grice, D.E., Brady, K.T., Dustan, L.R., Malcolm, R., & Kilpatrick, D.G.** (1995). Sexual physical assault history and posttraumatic stress disorder in substance-dependent individuals. *American Journal of Addiction 4,* 297-305.

312. **Nelson, E.C., Heath, A.C., Lynskey, M.T., Bucholz, K.K., Madden, P.A.F., Statham, D.J., & Martin, N.G.** (2006). Childhood sexual abuse and risks for licit and illicit drug-related outcomes: A twin study. *Psychological Medicine 36,* 1473-1483.

313. **Pery, S.M.** (1995). Lesbian alcohol and marijuana use: Correlates of HIV risk behaviors and abusive relationships. *Journal of Psychoactive Drugs 27,* 413-419.

314. **Grech, A., van Os, J., Jones, P.B., Lewis, S.W., & Murray, R.M.** (2005). Cannabis use and outcome of recent onset psychosis. *European Psychiatry 20,* 349-353.

315. **Kessler, R.C.** (1995). Epidemiology of psychiatric comorbidity. **In M.T. Tsuang, M. Tohen & G. E.P. Zahner (eds.).** *Textbook in psychiatric epidemiology* (pp. 179-197). New York: Wiley and Sons.

316. **Raphael, B., Wooding, S., Stevens, G., & Connor, J.,** (2005). Comorbidity: Cannabis and complexity. *Journal of Psychiatric Practice 11,* 161-176.

317. **Mueser, K.T., Noordsy, D.L., Drake, R.E., & Fox, L.** (2003). *Integrated treatment for dual disorders: A guide to effective practice.* New York: Guildford Press.

318. **Ball, S.A., Rounsaville, B.J., Tennen, H., & Kranzler, H.R.** (2001). Reliability of personality disorder symptoms and personality traits in substance-dependent inpatients. *Journal of Abnormal Psychology 110,* 341-352.

319. **Ball, S.A. & Cecero, J.J.** (2001). Addicted patients with personality disorders. Traits, schemas, and presenting problems. *Journal of Personality Disorders 15,* 72-83.

320. **Sheehan, D.V., Lecrubier, Y., Harnett-Sheehan, K., Amorim, P., Janvas, J., Weiller, E., Hergueta, T., Baker, R., & Dunbar, G.** (1998). The Mini International Neuropsychiatric Interview (M.I.N.I.). The development and validation of a structured diagnostic interview. *Journal of Clinical Psychiatry 59,* 22-33.

321. **Beck, A.T.** (1978). *Depression Inventory.* Philadelphia: Center for Cognitive Therapy.

322. **Spielberger, C.D.** (1983). *Manual for the State-Trait Anxiety Inventory.* Palo Alto: Consulting Psychologists Press.

323. **Derogatis, L.R.** (1994). *Symptom Checklist 90-R (SCL-90-R): Administration, scoring, and procedures manual (3rd edition).* Minneapolis, MN: National Computing Systems Pearson, Inc.

324. **Derogatis, L.R.** (2000). *Brief Symptom Inventory 18 (BSI 18): Administration, scoring, and procedures manual.* Minneapolis, MN: National Computing Systems Pearson, Inc.

325. **Derogatis, L.R., & Savitz, K.L.** (2000). The SCL-90-R and Brief Symptom Inventory (BSI) in primary care. **In M.E. Maruish (ed.).** *Handbook of psychological assessment in primary care settings* (pp. 297-334). Minneapolis, NJ: Lawrence Erlbaum Associates.

326. **Overall, J.E. & Gorham, D.R.** (1988). The Brief Psychiatric Rating Scale (BPRS): Recent developments in ascertainment and scaling. *Psychopharmacology Bulletin 24,* 97-98.

327. **Lovibond, S.H. & Lovibond, P.F.** (1995). *Manual for the Depression Anxiety Stress Scales (2nd. Ed.)* Sydney: Psychology Foundation.

328. **Anthony, M., Bieling, P.J., Cox, B.J., Enns, M.W., & Swinson, R.P.** (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychological Assessment 10,* 176-181.

329. **Kay, S.R., Fiszbein, A. & Opler, L.A.** (1987). The Positive and Negative Syndrome Scale for schizophrenia. *Schizophrenia Bulletin 13,* 261-276.

330. **Beck, A.T. & Steer, R.A.** (1990). *Beck Anxiety Inventory Manual.* San Antonio, TX: Psychological Corporation.

331. **Kessler, R.C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D.K., Normand, S., Walters, E.E., & Zaslavsky, A.** (2002). Short screening scales to monitor population prevalence and trends in non-specific psychological distress. *Psychological Medicine 32,* 959-976.

332. **Ware, J.E., Kosinki, M. & Keller, S.D.** (1996). A 12-item Short Form Health Survey: Construction of scales and tests of reliability and validity. *Medical Care 34,* 220-233.

333. **Kimmerling, R., Trafton, J.A. & Nguyen, B.** (2006). Validation of a brief screen for Post-Traumatic Stress Disorder with substance use disorder patients. *Addictive Behaviors 31,* 2074-2079.

334. **Degenhardt, L., Hall, W., Korten, A., & Jablensky, A.** (2005). *Use of a brief screening instrument for psychosis: Results of a ROC analysis.* NDARC Technical Report No. 210. Sydney: National Drug and Alcohol Research Centre.

335. **Swartz, J.A. & Lurigio, A.J.** (2006). Screening for serious mental illness in populations with co-occurring substance use disorders: Performance of the K6 scale. *Journal of Substance Abuse Treatment 31,* 287-296.

336. **Bolla, K.I., Brown, K., Eldreth, D., Tate, K., & Cadet, J.L.** (2002). Dose-related neurocognitive effects of marijuana use. *Neurology 59,* 1337-1343.

337. **Block, R. & Ghoneim, M.** (1993). Effects of chronic marijuana use on human cognition. *Psychopharmacology 110,* 219-228.

338. **Jacobsen, L.K., Mencl, W.E., Westerveld, M., & Pugh, K.R.** (2004). Impact of cannabis on brain function in adolescents. *Annals of the New York Academy of Science 1021,* 384-390.

339. **Solowij, N.** (1998). *Cannabis and cognitive functioning.* Cambridge, England: Cambridge University Press.

340. **Solowij, N. & Michie, P.T.** (2007). Review paper. Cannabis and cognitive dysfunction: Parallels with endophenotypes of schizophrenia? *Journal of Psychiatry and Neuroscience 32,* 30-52.

341. **Solowij, N., Stephens, R.S., Roffman, R.A., Babor, T.F., Kadden, R., Miller, M., Christiansen, K., McRee, B., Vendetti, J., & The Marijuana Treatment Group.** (2002). Cognitive functioning of long-term heavy cannabis users seeking treatment. *Journal of the American Medical Association 287,* 1123-1131.

342. **Pope, H.G., Gruber, A.J., Hudson, J.I., Heustis, M., & Yurgelun-Todd, D.** (2002). Cognitive measures in long-term cannabis users. *Journal of Clinical Pharmacology 42,* 41S-47S.

343. **Pope, H.G., Gruber, A.J., Hudson, J.I., Huestis, M.A., & Yugerlun-Todd, D.** (2001). Neuropsychological performance in long-term cannabis users. *Archives of General Psychiatry 58,* 909-915.

344. **Pope, H.G. & Yugerlun-Todd, D.** (1996). The residual cognitive effects of heavy marijuana use in college students. *Journal of the American Medical Association 275,* 521-527.

345. **Ehrenreich, H., Rinn, T., Kunert, H.J., Moeller, M.R., Poser, W., Schilling, L., Gigerenzer, I., & Hoehe, M.R.** (1999). Specific attentional dysfunction in adults following early start of cannabis use. *Psychopharmacology 142,* 295-301.

346. **Harvey, M.A., Sellman, J.D., Porter, R.J., & Frampton, C.M.** (2007). The relationship between non-acute adolescent cannabis use and cognition. *Drug and Alcohol Review 26,* 309-319.

347. **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.

348. **Wilson, W., Mathew, R., Turkington, T., Hawk, T., Coleman, R.E, & Provenzale, J.M.** (2000). Brain morphological changes and early marijuana use: A magnetic resonance and positron emission tomography study. *Journal of Addictive Disorders 19,* 1-22.

349. **Fried, P.A., Watkinson, B. & Gray, R.** (2003). Differential effects on cognitive functioning in 13- to 16-year-olds prenatally exposed to cigarettes and marijuana. *Neurotoxicology and Teratology 25,* 427-436.

350. **Richardson, G.A., Ryan, C., Willford, J., Day, N., & Goldschmidt, L.** (2002). Prenatal alcohol and marijuana exposure: Effects on neuropsychological outcomes at 10 years. *Neurotoxicology and Teratology 24,* 309-320.

351. **Folstein, M.F., Folstein, S.E. & McHugh, P.R.** (1975). "Mini-Mental-State". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research 12,* 189-198.

352. **Rey, A.** (1964). *L'examen clinique en psychologie.* Paris: Presses Universitaires de France.

353. **Buschke, H.** (1973). Selective reminding for analyses of memory and learning. *Journal of Verbal learning and Verbal Behavior 12,* 543-550.

354. **Stroop, J.R.** (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology 18,* 643-662.

355. **Heaton, R.K.** (1981). *Wisconsin Card Sorting Test Manual.* Odessa, FL: Psychological Assessment Resources.

356. **Sakakian, B., & Own, A.** (1992). Computerized assessment in neuropsychiatry using CANTTAB: Discussion paper. *Journal of the Royal Society of Medicine 85,* 399-402.

357. **Miller, W.R. & Rollnick, S.** (2002). *Motivational interviewing: Preparing people to change addictive behavior.* New York: Guilford Press.

358. **Prochaska, J.O. & Di Clemente, C.C.** (1986). Toward a comprehensive model of change. **In W.R. Miller & N. Heather (eds.).** *Treating addictive behaviors: Processes of change* (pp. 3-27). New York: Plenum Press.

359. **Prochaska, J.O., Di Clemente, C.C. & Norcross, J.C.** (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist 47,* 1102-1114.

360. **Di Clemente, C.C. & Hughes, S.O.** (1990). Stages of change profiles in outpatient alcoholism treatment. *Journal of Substance Abuse 2,* 217-235.

361. **Miller, W.R. & Tonigan, J.S.** (1996). Assessing drinkers' motivation for change: The Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES). *Psychology of Addictive Behaviors 10,* 81-89.

362. **Biener, L. & Abrams, D.B.** (1991). The Contemplation Ladder: Validation of a measure of readiness to consider smoking cessation. *Health Psychology 10,* 360-365.

363. **Rollnick, S., Heather, N., Gold, R., & Hall, W.** (1992). Development of a short Readiness to Change Questionnaire for use in brief, opportunistic interventions among excessive drinkers. *British Journal of Addiction 87,* 743-754.

364. **Bandura, A.** (1997). *Self-efficacy. The exercise of control.* New York: Freeman.

365. **Bandura, A.** (1999). A sociocognitive analysis of substance abuse: An agentic perspective. *Psychological Science 10,* 214-217.

366. **Bandura, A.** (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology 52,* 1-26.

367. **Bunton, R., Baldwin, S., Flynn, D., & Whitelaw, J.** (2000). The 'stages of change' model in health promotion: Science and ideology. *Critical Public Health 10,* 55-70.

368. **Littell, J.H. & Girvin, H.** (2002). Stages of Change. A critique. *Behavior Modification 26,* 223-273.

369. **Sutton, S.** (2001). Back to the drawing board: A review of applications of the transtheoretical model to substance use. *Addiction 96,* 175-186.

370. **van Sluijs, E.M., van Poppel, M.N. & van Mechelen, W.** (2004). Stage-based lifestyle interventions in primary care: Are they effective? *American Journal of Preventive Medicine 26,* 330-343.

371. **West, R.T.** (2005). Editorial. Time for a change: Putting the Transtheoretical (Stages of Change) Model to rest. *Addiction 100,* 1036-1039.

372. **Carey, K.B., Purnine, D.M., Maisto, S.A., & Carey, M.P.** (1999). Assessing readiness to change substance abuse: A critical review of instruments. *Clinical Psychology: Science and Practice 6,* 245-266.

373. **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.

374. **Slavet, J.D., Stein, L.A.R., Colby, S.M., Barnett, N.P., Monti, P.M., Colembeske, C., & Lebeau-Craven, R.** (2006). The Marijuana Ladder: Measuring motivation to change marijuana use in incarcerated adolescents. *Drug and Alcohol Dependence 83,* 42–48.

375. **McBride, C.M., Curry, S.J., Stephens, R.S., Wells, E.A., Roffman, R., & Hawkins, J.D.** (1994). Intrinsic and extrinsic motivation for change in cigarette smokers, marijuana smokers and cocaine users. *Psychology of Addictive Behaviors 8,* 243-250.

376. **Downey, L., Rosengren, D.B. & Donovan, D.M.** (2001). Sources of motivation for abstinence. A replication analysis of the Reasons for Quitting Questionnaire. *Addictive Behaviors 26,* 79-89.

377. **Witkiewitz, K. & Marlatt, G.A** (2004). Relapse prevention for alcohol and drug problems: That was Zen, this is Tao. *American Psychologist 59* 224-235.

378. **Irvin, J.E., Bowers, C.A., Dunn, M.E., & Wong, M.C.** (1999). Efficacy of relapse prevention: A meta-analytic review. *Journal of Consulting and Clinical Psychology 67,* 563-570.

379. **Monti, P.M., Kadden, R.M., Rohsenow, D.J., Cooney, N.L., & Abrams, D.B.** (2002). *Treating alcohol dependence: A coping skills training guide.* New York: Guilford Press.

380. **Bandura, A.** (1995). Exercise of personal and collective efficacy in changing societies. **In A. Bandura (ed.).** *Self-efficacy in changing societies* (pp. 1-45). New York: Cambridge Press.

381. **Carroll, K.M.** (1999). Behavioral and cognitive-behavioral treatments. **In B.S. McCrady & E.E. Epstein (eds.).** *Addictions: A comprehensive guidebook* (pp. 250-267). New York: Oxford University Press.

382. **Stephens, R.S., Wertz, J.S. & Roffman, R.A.** (1993). Predictors of marijuana treatment outcomes: The role of self-efficacy. *Journal of Substance Abuse 5,* 341-354.

383. **Stephens, R.S., Roffman, R.A. & Simpson, E.E.** (1995). Self-efficacy and marijuana cessation: A construct validity analysis. *Journal of Consulting and Clinical Psychology 63,* 1022-1031.

384. **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.

385. **Lozano, B.E., Stephens, R.S. & Roffman, R.A.** (2006). Abstinence and moderate use goals in the treatment of marijuana dependence. *Addiction 101,* 1589-1597.

386. **Annis, H.M. & Graham, J.M.** (1988). *Situational Confidence Questionnaire (SCQ-39) User's Guide.* Toronto: Addiction Research Foundation.

387. **Annis, H.M. & Martin, G.** (1985). *The Drug-Taking Confidence Questionnaire.* Toronto: Addiction Research Foundation.

388. **Sklar, S.M., Annis, H.M. & Turner, N.E.** (1997). Development and validation of the Drug-Taking Confidence Questionnaire: A measure of coping self-efficacy. *Addictive Behaviors 22,* 655-670.

389. **Sklar, S.M. & Turner, N.E.** (1999). A brief measure for the assessment of coping self-efficacy among alcohol and other drug users. *Addiction 94,* 723-729.

390. **Martin, G.W., Wilkinson, D.A. & Poulos, C.X.** (1995). The Drug Avoidance Self-Efficacy Scale. *Journal of Substance Abuse 7,* 151-163.

391. **Stephens, R.S., Roffman, R.A., Copeland, J., & Swift, W.** (2006). Cognitive-behavioral and motivational enhancement treatments for cannabis dependence. **In R.A. Roffman & R. S. Stephens (eds.).** *Cannabis dependence: Its nature, consequences, and treatment* (pp. 133-153). Cambridge: Cambridge University Press.

392. **Carver, C.S.** (1997). "You want to measure coping but your protocol's too long: Consider the Brief COPE." *International Journal of Behavioral Medicine 4*, 92-100.

393. **Carver, C.S., Scheir, M.F. & Weintraub, J.K.** (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology 56*, 267-283.

394. **Litt, M.D., Kadden, R.M., Stephens, R.S., & the MTPRG.** (2005). Coping and self-efficacy in marijuana treatment: Results from the Marijuana Treatment Project. *Journal of Consulting and Clinical Psychology 73,* 1015-1025.

395. **Boyd, S.J., Tashkin, D.P., Huestis, M.A., Heishman, S.J., Dermand, J.C., Simmons, M.S., & Gorelick, D.A.** (2005). Strategies for quitting among non-treatment-seeking marijuana smokers. *American Journal on Addictions 14,* 35-42.

396. **Myers, M.G. & Brown, S.A.** (1996). The Adolescent Relapse Coping Questionnaire: Psychometric validation. *Journal of Studies on Alcohol 57,* 40-46.

397. **Schafer, J. & Brown, S.A.** (1991). Marijuana and cocaine effect expectancies and drug use patterns. *Journal of Consulting and Clinical Psychology 59,* 558-565.

398. **Galen, L.W. & Henderson, M.J.** (1999). Validation of cocaine and marijuana effect expectancies in a treatment setting. *Addictive Behaviors 24,* 719-724.

399. **Barnwell, S.S. & Earleywine, M.** (2006). Simultaneous alcohol and cannabis expectancies predict simultaneous use. *Substance Abuse Treatment, Prevention and Policy 1,* 29.

400. **Aarons, G.A., Brown, S.A., Stice, E., & Coe, M.T.** (2001). Psychometric evaluation of the marijuana and stimulant effect expectancy questionnaires for adolescents. *Addictive Behaviors 26,* 219-236.

401. **Vangsness, L., Bry, B.H. & Labouvie, E.W.** (2005). Impulsivity, negative expectancies, and marijuana use: A test of the acquired preparedness model. *Addictive Behaviors 30,* 1071-1076.

402. **Marlatt, G.A. & Gordon, J.R.** (1985). *Relapse prevention: Maintenance strategies in the treatment of addictive behaviors.* New York: Guilford Press.

appendix 1: instruments validated for screening and assessing cannabis use disorder and problems.

Purpose	Domain: content area	Instrument	Author/s	Target population	Format (items)	Window	Psychometric information
Clinical screening	Biochemical: urinary cannabinoids	Svya EMIT II+		Recent users	Urine sample	2 - 30+ days (long-term or heavy use)	Sens. range 67-88% + spec. 95-100% (cut-off threshold for detection 50 ng/ml, and 15 ng/ml GC/MS)
	Severity/degree of psychological dependence	SDS *	Gossop et al. (1992, 1995)	Adults, adolescents	Self (5)	3, 6, or 12 mos	Sens. 64% spec. 82% (cut-off 3) for non-clinical adults (Swift et al., 1998). Sens. 64% spec. 94% (cut-off 4) for non-clinical adolescents (Martin et al., 2006). Sens 86% spec. 83% (cut-off 2) for those in psychosis (Hides et al., 2007). Sensitive to change (Copeland et al., 2001)
Cannabis consumption (and alcohol and other drug use)	Frequency, quantity, and pattern of cannabis use (other drug use)	TLFB +	Sobell & Sobell (1992, 1996)	Adults, adolescents	Semi-structured interview, computer-assisted, self (10-30 mins)	1 week, mos, 3, 6, 9, 12 mos (adaptable to assessment purpose)	Substantial body of accumulated evidence for its excellent psychometric properties, and ability to yield relatively accurate retrospective recall of cannabis (and other drug) use among males and females aged from 14 years in both general and clinical populations
Diagnosis, problem severity, and comprehensive assessment of functioning in multiple life domains	Dependence, abuse, severity, categorization of comorbid alcohol/ drug use and psychiatric disorders (anxiety, depression, schizophrenia, psychoses)	CIDI # UM-CIDI# M-CIDI #	WHO (1997) Kessler et al. (1994) Wittchen et al. (1995)	Adults, youth from 15 years	Fully-structured interview; modularized, computer data entry and scoring programmes	DSM-IV/ICD-10 lifetime 12 mos	Good reliability/validity for dependence, lower reliability for cannabis abuse/ harmful use across a variety of cultures and settings (Cottler et al., 1997; Ustun et al., 1997; Wittchen, 1994)
		CIDI-Auto 2.1+	WHO (1997)	Adults, youth from 15 years	Computer-assisted version; trained lay interviewers, or self	Lifetime, 12 mos	Adequate psychometric properties in clinical and general populations (Andrews & Peters, 1998; Kedzior et al., 2007; Rubio-Stipec et al., 1999; Wittchen et al., 1998). Acceptable to patients

Purpose	Domain: content area	Instrument	Author/s	Target population	Format (items)	Window	Psychometric information
	CIDI Substance Abuse Module: (11 drug classes, or cannabis section only). Diagnoses, and detailed drug-specific history	CIDI-SAM#	WHO (1997) Robins et al. (1990)	Adults, youth from 15 years	Structured interview, trained non-clinicians; computer scoring	DSM-IV ICD-10 Lifetime, 12 mos, current	Good reliability/validity for a variety of populations for diagnoses, specific criteria, age of onset (Cottler et al., 1997; Langenbucher et al., 1994; Swift et al., 1998)
	Also includes psychosocial stressors, school and interpersonal functioning, cognitive impairment	ADI #	Winters & Henly (1993)	Adolescents	Structured interview (50 mins)	DSM-IV lifetime, 12 mos	Good psychometric properties (Winters et al., 1993, 2003)
	Includes diagnoses for APSD, ADHD, behavioral disorders	SCID#	First et al. (1997, 2001)	Adults, youth from 15 years	Semi-structured interview (2 hours)	DSM-IV lifetime, 12 mos	Good psychometric properties for substance use disorders across a variety of age and cultural groups (Deas et al., 2005; Kranzler et al., 1996; Martin et al., 2000)
		SCAN#	WHO (1992)	Adults	Semi-structured interview, computer algorithm for diagnoses	ICD-10 DSM-IV lifetime, 12 mos	Reliability good for dependence, (Easton et al., 1997) poor for harmful use/abuse and cross-culturally. Discordance with CIDI higher for cannabis dependence and abuse diagnoses than for other drugs (Cottler et al., 1997; Ustun et al., 1997)
	Comprehensive bio-psycho-social assessment (Axis I to V) in 8 sections: background, drug use, physical health, risk behaviours, mental health, legal, environment, vocational	GAIN #	Dennis et al. (2003)	Adults, and adolescents from 11 years	Self-administered and/or computer -assisted interview (1-2 hours), or modularized	DSM-IV lifetime, past 12 mos, past month	Good to excellent reliability (scales 0.90; subscales 0.70+), validity, predictive validity for independent psychiatric diagnoses (range 0.82-1.00); sensitive to change in diverse population groups (Dennis et al., 2003, 2004)

Purpose	Domain: content area	Instrument	Author/s	Target population	Format (items)	Window	Psychometric information
	Includes conduct and attention-deficit disorders	DISC-IV#	Shaffer et al. (2000)	Children and adolescents 6-18 years, and parent version	Structured interview, computer-assisted, lay interviewers	DSM-IV lifetime, 12 months, current	Good reliability, validity (Shaffer et al., 2000) in different populations and settings
Dependence–related phenomena	Emotional, physical, and behavioural withdrawal symptoms following abrupt cannabis cessation	MWC +	Budney et al. (2003)	Adults, youth	Self (27)	28-day period (forward) of withdrawal	Internal consistency reliability 0.81; convergent validity with laboratory data and craving scores, and sensitivity to effects of abstinence (Budney et al., 2001, 2003)
	Cognitive-emotional urges to use cannabis (craving)	MCQ +	Budney et al. (2001, 2003)	Adults, youth	Self (10)	28-day period of withdrawal	Total score and (2) subscales showed sensitivity to change over withdrawal period (Budney et al., 2001, 2003)
Negative consequences of cannabis use	Composite problems score and severity ratings in 7 areas: alcohol/drug use, medical, social psychological, psychiatric, legal, employment	ASI#	McLellan et al. (1992)	Adults	Structured interview (40-60 mins), Computer version available (ASI-MV)	DSM-IV lifetime, and recent (past 30 days)	Substantial evidence for reliability and validity. Lower reliability more likely among special populations, e.g., dually-diagnosed, homeless, etc (Carey et al., 1997; Hasin et al., 2006)
	Composite problems score and severity ratings in 7 areas of functioning: alcohol/drug use, peer and family relationships, legal, education, psychiatric distress, use of free time	CASI-A#	Meyers et al. (1995)	Adolescent version of ASI	Partially-structured interview (40-90 mins)	DSM-IV lifetime, and recent (past 30 days)	Favourable preliminary psychometrics (Meyers et al., 1995)

Purpose	Domain: content area	Instrument	Author/s	Target population	Format (items)	Window	Psychometric information
Cognitive impairment	Neuropsychological functioning (executive functioning, attention, memory, learning, spatial)	RAVLT BSRT Stroop WCST CanTab	Rey (1964) Buschke (1973) Stroop (1935) Heaton (1981) Sakakian & Own (1992)	Adults, adolescents	Self (various pen- and paper tests and computerized tasks)	Various	These tests have shown to be most sensitive to deficits after acute and long-term cannabis use (reviewed in Solowij & Michie, 2007)

* requires minimal level of training for administration, scoring, interpretation
+ requires moderate level of training and clinical experience

#requires extensive level of training and clinical experience

appendix 2: screening and assessment instruments currently in development and showing potential for assessment of cannabis use disorder and problems.

Purpose	Domain: content area	Instrument	Author/s	Target population	Format (items)	Window	Psychometric information
Population screening	Dependence, abuse	CUDIT *	Adamson & Sellman (2003)	Adults	Self (10)	6 mos	Sens. 73% spec. 95% (cut-off 8) PPV 84%
	Dependence, abuse, at risk use	MSI-X +	Alexander et al. (2003)	Adults	Self (31)	12 mos	Sens. 83% spec. 89% (cut-off 6) PPV 90%
	Dependence, abuse, at risk use	CUPIT *	Bashford (2007)	Adults and adolescents	Self (16)	12 mos	Sens. 98% spec. 35% (cut-off 12) PPV 95%
	Abuse	CAST *	Legleye et al. (2007)	Adolescents, young adults	Self (6)	Lifetime	Sens. 93% spec. 81% (cut-off 4) PPV 74%
	Abuse	PUM *	Okulicz-Kozaryn (2007)	Adolescents	Self (8)	12 mos	Sens. 80% spec. 88% (cut-off 3)
	Dependence, abuse	DALI #	Rosenberg et al. (1998)	Acute-care psychiatric adults	Interview, self (18)	6 mos	Inter-rater reliability 0.98, test-retest 0.90; classification accuracy 90%
	Alcohol, drugs, (cannabis) and mental health problems	IRIS +	Schlesinger et al. (2007)	Australian indigenous adults	Interview, self (18)	6 mos	Sens. 65%, spec. 86% (cut-off 10) alcohol/drug subscale; Sens. 83% spec. 84% (cut-off 11) for mental health subscale
	Cannabis use-related problems: (medical, social, legal, financial, occupational, cognitive)	MPS +	Stephens et al. (2000, 2002)	Adults	Self (19)	Past 90 days	Internal consistency range of 0.83 to 0.89 in various user populations; sensitive to change (Stephens et al., 2002, 2004, 2007)

Purpose	Domain: content area	Instrument	Author/s	Target population	Format (items)	Window	Psychometric information
Cannabis use problems	Hazardous use, physical, social, interpersonal, psychological, financial problems with 3 additional subscales (spouse, children and employment)	CPQ +	Copeland et al. (2001, 2005)	Adults	Self, or interview (22, 27, 53-item versions)	Past 90 days, 6 mos	Internal consistency 0.93; test-retest 0.92-1.00; sens. 84% , spec. 84% for cannabis dependence, sensitive to change (Copeland et al., 2001, 2005; Bashford, 2007)
	Core item set with 4 additional subscales (parental, school, relationship and employment issues)	CPQ-A +	Martin et al. (2005)	Adolescents	Self, or interview (27, 54-item versions)	Past 90 days, 6 mos	Internal consistency 0.72- 0.88, sens. 90% spec. 78% cannabis dependence (Martin et al., 2006) Sensitive to change (Bashford, 2007)
Cognitive-Behavioural Dimensions (mediators of change)	Problem recognition, Motivation or Readiness to Change (Stages of Change Model)	RTC *	Rollnick et al. (1992)	Adults and adolescents	Self (12)	current	Designed specifically for use in medical settings. Mixed evidence for psychometric properties (Carey et al., 1999). Subscales (3) internal consistency reliability (range 0.78 to 0.87). Reliably distinguished SOC between adult and adolescent treatment-seekers and non-treatment-seekers (Stephens et al., 2004; Martin et al., 2005)
	Marijuana Effect Expectancies (positive and negative)	MEEQ *	Schafer & Brown (1991)	Adults, young adults, adolescents	Self (47)	Future –expected outcomes of use	Discriminated users/nonusers in general population (Schafer & Brown, 1991; Galen et al., 1999) predictive utility for use (Barnwell & Earleywine, 2006) and use/desistance among adolescents over 2 years (Aarons et al., 2001; Vangness et al., 2005)
	Self-efficacy for ability to avoid using cannabis	SE Scale*	Stephens et al. (1993, 1995)	Young adults, adults	Self (20)	Anticipatory, in 'trigger' situations	Internal consistency reliability 0.89 and 0.94 pre/post-treatment; predictive validity for cannabis use (Stephens et al., 1993, 1995; Lozano et al., 2006)

* requires a minimal level of training for administration, scoring, interpretation
\+ requires a moderate level of training
\# requires an extensive level of training and experience in psychopathology