An Improved Brief Measure of Cannabis Misuse: The Cannabis Use Disorders Identification Test – Revised (CUDIT-R)

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Abstract

Background: Cannabis is widely used and significant problems are associated with heavier consumption. When a cannabis misuse screening tool, the CUDIT, was originally published it was noted that although it performed well there was concern about individual items.

Methods: 144 patients enrolled in a clinical trial for concurrent depression and substance misuse were administered an expanded CUDIT, containing the original 10 items and 11 candidate replacement items. All patients were assessed for a current cannabis use disorder with the SCID.

Results: A revised CUDIT-R was developed containing 8 items, two each from the domains of consumption, cannabis problems (abuse), dependence, and psychological features. Although the psychometric adequacy of the original CUDIT was confirmed, the CUDIT-R was shorter and had equivalent or superior psychometric properties. High sensitivity (91%) and specificity (90%) were achieved.

Conclusions: The eight-item CUDIT-R has improved performance over the original scale and appears well suited to the task of screening for problematic cannabis use. It may also have potential as a brief routine outcome measure.

Key words cannabis, marijuana, screening, cannabis dependence, motivation
1. Introduction

Cannabis is the most commonly used illicit drug in the western world (United Nations Office on Drugs and Crime, 2007). This is cause for considerable concern given a range of adverse potential effects from cannabis use, including impaired cognitive functioning (Bolla et al., 2002; Pope et al., 2001), reduced educational attainment (Fergusson et al., 2000), road accidents (Fergusson et al., 2008; Ramaekers et al., 2004), poor lung functioning (Tashkin, 1999), and contentiously, as a gateway to other substance use (Fergusson and Horwood, 2000).

The most robust evidence for a causal association between cannabis use and poor mental health is in the area of psychosis, with prospective longitudinal data, controlling for confounders, showing a dose-response association, and evidence of a putative brain mechanism, relating to dopamine activity (Fergusson et al., 2006). In contrast, while there is clear evidence for an association between cannabis and low mood from a range of epidemiological studies, there is argument about whether common risk factors account for part or all of this association. At most the association is modest once confounders are controlled for and if such an association does exist it appears to be in the direction of cannabis use leading to depression rather than the reverse (Degenhardt et al., 2003). Regardless of the causal nature of the association, the presence of concurrent depression and cannabis use leads to increased risk of treatment dropout, poorer treatment outcomes, increased risk of suicide ideation and behaviours, and higher rates of relapse (Kaminer et al., 2008; Kay-Lambkin et al., 2004).

The above harms associated with cannabis use do not mean that use per se is harmful, with two-thirds of adults who reported use on five or more times in the past year not reporting any adverse effects of their use (Degenhardt and Hall, 2001). On the other hand, the risk of developing cannabis dependence is about one in ten among those who ever use the drug and rises to around one in two among daily users (Hall and Pacula, 2003). As far as we know, no systematic attempts have been
made to identify what constitutes a safe level of use. Given the prevalence of cannabis use and the extent of potential problems, however, there is clearly a need for suitable instruments to identify problematic cannabis use.

In a review of brief scales of cannabis-related problems, Piontek et al. (2008) identified four scales. Two were tested in both general population and specific user samples: the Severity of Dependence Scale (SDS; Gossop et al., 1995) and the Cannabis Use Disorders Identification Test (CUDIT; Adamson and Sellman, 2003). The other two scales were tested in general population samples only: the Cannabis Abuse Screening Test (CAST; Legleye et al., 2007), and the Polish language Problematic Use of Marijuana (PUM; Okulicz-Kozaryn, 2007).

The SDS was the most extensively evaluated instrument identified by Piontek and colleagues, with eight studies, compared to the CUDIT (two studies), CAST and PUM (one study each). The five-item SDS was supported as a valid diagnostic screening instrument for both general and specific user populations. The CUDIT performed as well as the SDS in a clinical sample (Adamson and Sellman, 2003) but was inferior, although adequate, in a youth general population sample (Annaheim et al., 2008). Piontek et al. (2008) highlight the concern, also stated in the original CUDIT publication (Adamson and Sellman, 2003), that some of the CUDIT items are not optimal and require modification or replacing.

The CUDIT was developed as a brief (ten-item) instrument that would identify individuals who were using cannabis in problematic or harmful ways during the preceding six months. It was a direct modification of the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993). In a small cannabis-using alcohol-dependent sample Cronbach’s alpha was 0.84. Sensitivity and specificity were 73% and 95% for current cannabis use disorder (Adamson and Sellman, 2003). An advantage the CUDIT has over alternative measures is its breadth, with neither the SDS, CAST
nor PUM measuring pattern of cannabis use, and the SDS in particular being focussed solely on dependence features (as is its intention), with no measure of problems related to cannabis use. The CAST and PUM are ill-served to screen for current cannabis use disorder as both enquire about lifetime use, in contrast to the focus on the past six months for the CUDIT and past year for the SDS.

Since first publication, the CUDIT has been translated into a number of languages including French (Guillem et al., submitted), Dutch and German (Rigter, 2005) and Italian (Annaheim et al., 2008) and has been used in general population surveys in Canada (Ialomiteanu and Adlaf, 2009) and Switzerland (Annaheim et al., 2008).

The CUDIT was described as a prototype when originally published (Adamson and Sellman, 2003). It was found to have adequate psychometric properties in a small (n=53) cannabis using alcohol dependent sample. Several items were identified as potentially not optimal, most notably item 9 (use causing injury) which was not endorsed by any respondents in the original sample. Both the adequate performance of the overall scale and problems with specific items have been confirmed in a Swiss general population sample (Annaheim et al, 2008), and a French clinical sample (Guillem et al., submitted).

This paper outlines a CUDIT revision focused on analyses of individual items to improve performance of the scale as a brief screening tool and rating scale for cannabis use disorders.
2. Methods

2.1. Item Pool

A 20 item version of the CUDIT was constructed. This consisted of 10 new candidate items and the 10 original CUDIT items, except that item 2 “How many hours were you “stoned” on a typical day when you had been using cannabis” was modified to include a fifth lower level item of “less than 1”. This allowed for the generation of two items: 2a for which “less than 1” and “1 or 2” hours were combined as a single response (less than 2) and 2b for which “7 to 9” and “10 or more” hours were combined (7 or more), so that both 2a and 2b had five response categories, with the original 2a allowing better differentiation at the upper levels of use and 2b allowing better differentiation at lower levels of use. This separation of item 2 into 2a and 2b means there were in effect 21 items in the trial version of the CUDIT, which are shown in Table 1, with items from the original CUDIT in bold.

The 21 items displayed in Table 1 are grouped in a similar fashion to the categories identified by the authors of the AUDIT (i.e. consumption, cannabis problems (abuse), dependence, and psychological features; Saunders, et al., 1993), which formed the basis from which the CUDIT has been developed. Item 2b was included due to the high proportion of respondents in the original validation study (Adamson and Sellman, 2003) endorsing the lowest category for frequency of use. Item 17 was trialled due to concerns for the overly literal translation of 6 standard drinks per occasion to 6 hours “stoned”, which was felt in retrospect to be a much higher level of use. Items 11, 12, 13, and 20 represent four dependence criteria for consideration. Items 15, 16, and 18 represent alternative abuse items. In particular item 15, which enquires about use in hazardous situations, was constructed as a candidate to replace item 9, use causing injury, which had been noted as being particularly ineffective when the original scale was validated. Items 14 and 19 represent alternative psychological symptoms, with item 14 intended to clarify what was believed to
be an ambiguity in the wording of the original CUDIT that could lead respondents to confuse acute effect of cannabis intoxication and sustained effect of cannabis use on memory functioning.

2.2. Sample

Participants were patients taking part in a clinical trial of cognitive behavioural therapy for depression and substance misuse (Kay-Lambkin et al., 2008). A total of 250 patients were recruited to the Self-Help for Alcohol/drug use and Depression (SHADE) study who met criteria for current depressive symptoms, scored 17 or greater on the Beck Depression Inventory II (BDI-II; Beck, 1993) and had concurrent hazardous use of alcohol, cannabis and/or amphetamines. Approximately 50% (n=124) reported having used cannabis in the proceeding 6 months to baseline, and completed the trial CUDIT and Structured Clinical Interview for DSMIV (SCID, Research Version; Spitzer et al., 1988). A further 15 patients were identified at 6 months follow-up and five patients at 12 months follow-up, generating a sample of 144 cannabis using patients with available data.

2.3. Procedure

Patients were administered the trial CUDIT at intake, six months and 12 months. At each time point formal diagnoses of cannabis abuse or dependence were made using the SCID. Past month level of cannabis use was also measured using the “Q-score” of the Opiate Treatment Index (OTI; Darke et al., 1991) and motivation was assessed with a cannabis modified version of the Readiness to Change Questionnaire – Treatment Version (RCQ-TV; Heather et al., 1999). One week following the baseline assessment the trial CUDIT was re-administered to consenting participants (n=66).

2.4. Analysis

Suitability of individual items for inclusion in a revised CUDIT was considered separately for each of the four categories identified in Table 1. Item selection was based on item-total correlation, test-
retest reliability (Spearman’s correlation coefficient), and ability to differentiate between those with and without a current cannabis use diagnosis (Mann Whitney U). When a revised scale was identified this was compared to the original CUDIT, contrasting internal consistency, discriminant validity (SCID diagnosis yes/no, receiver operating characteristics (ROC)) and test-retest reliability, while a factor analysis was also conducted. As the CUDIT is a simple screening measure, producing a single summary score, it would be expected to consist of a single factor.

The final revised CUDIT-R was further evaluated by examining its predictive validity, reporting sensitivity and specificity across a range of cut-off scores, and extending discriminant validity by separating cannabis abuse and dependence diagnoses. Predictive validity was explored by examining the relationship between CUDIT-R score and motivation, as measured by the RCQ-TV, and the relationship between CUDIT-R score and cannabis use level, as measured by the OTI cannabis Q-score.

3. Results

The sample was 61% male, with a mean age of 36.7 years (SD 8.9), 24% were in de facto or married relationships, 59% were parents, with 25% of the total sample having children living with them. Twenty-nine percent were in paid employment.

Of the 144 patients reporting cannabis use in the six months prior to assessment, 87 (60%) received a SCID diagnosis of cannabis dependence during the same timeframe, and 17 (12%) a diagnosis of cannabis abuse, while 40 (28%) did not meet criteria for a current cannabis use disorder. Average age of first regular cannabis use was 18.7 years (SD 5.8). Almost half (45%) of the sample reported currently using six or more days per week while 27% reported using cannabis less than weekly. Current alcohol dependence was diagnosed for 61% of the sample and amphetamine dependence
for 18% of the sample. A current depressive disorder was diagnosed for 78% of the sample with a further 22% reporting sub-threshold symptoms. One week following the first administration of the trial CUDIT 66 patients (46%) completed the retest.

When the cannabis-using portion of the SHADE sample was compared with those not using cannabis (and therefore not represented in this paper), it was found that the excluded SHADE patients were older (mean 43.1 years, SD 11.6, t=4.924, df=246, p<.001), more likely to be in a de facto or married relationship (42%, $\chi^2=7.820$, df=1, p=.005), more likely to be parents (72%, $\chi^2=4.602$, df=1, p=.032), more likely to be employed (45%, $\chi^2=8.808$, df=1, p=.003), more likely to be alcohol dependent (85%, $\chi^2=10.653$, df=1, p<.001) and less likely to be amphetamine dependent (4%, $\chi^2=12.876$, df=1, p<.001). There was no difference in the proportion with children living in their home, or in depression diagnosis or BDI-II profiles.

### 3.1. Scale Construction

The performance of all 21 items of the trial CUDIT is shown in Table 1 All references to item number in this paper correspond to item numbering as used in Table 1 (items 1-20) and not to the renumbered items as presented in the CUDIT-R at the end of this paper. For measures of consumption the optimal items initially identified were frequency (item 1), quantity (item 2b) and frequency of heavier use (item 3). However, when these three items were entered into separate ANCOVAs, controlling for the remaining two items, item 3 was not significantly associated with current cannabis diagnosis (F=1.954, df=1, 140, p=.164), whereas items 1 (F=31.224, df=1, 140, p<.001) and 2b (F=11.631, df=1, 140, p=.001) made a unique contribution to discrimination, and so item 3 was dropped.

Table 1 about here
Of the six abuse items outlined in Table 1, two were selected for inclusion, the original item relating to failure to fulfil role obligations (item 5) and use in physically hazardous situations (item 15). The three dependence items initially selected were dyscontrol (item 4), devoting large amounts of time to using (item 11), and tolerance (item 13). When these three items were entered in separate ANCOVAs, controlling for the remaining two items, item 13 was not significantly associated with current cannabis use diagnosis (F=1.194, df=1, 140, p=.276), whereas items 4 (F=7.13, df=1, 140, p=.009) and 11 (F=30.555, df=1, 140 p<.001) made a unique contribution to discrimination, and so item 13 was dropped.

Of the psychological features items outlined in Table 1, the poorest performer was one of the original CUDIT items, relating to feelings of guilt or remorse (item 7), while the strongest was a new item asking about whether or not the respondent had thought about modifying their cannabis use (item 19). Of the two questions relating to memory problems due to cannabis use, the original wording (item 8) was found to be more effective on all dimensions than was the case for the revised wording (item 14).

On the basis of these data an eight item CUDIT-R was constructed comprising items 1, 2b, 4, 5, 8, 11, 15, and 19. When this revised scale was compared to the original CUDIT it was found to have equivalent internal consistency, with Cronbach’s alpha = 0.914 (CUDIT-R) compared to 0.907 (CUDIT). Discriminant validity (criterion: current SCID cannabis use disorder) improved, with the area under the ROC curve increasing from 0.934 to 0.960 and an increased difference in mean score, with Mann Whitney U Z score increasing from 8.054 to 8.547. Test-retest reliability improved slightly from r=0.849 to r=0.871. The original CUDIT was found to consist of two factors, accounting for 56.0% and 10.4% of variance, while the revised version was found to have a
one factor solution, accounting for 63.6% of variance. The complete CUDIT-R, with items renumbered, is presented as an appendix.

3.2. Discriminant Validity

Sensitivity and specificity of the 8-item CUDIT-R, which has possible scores ranging from 0 to 32, is shown in Table 2, together with positive and negative predictive values. An optimal solution occurs with CUDIT-R scores of 13 or above (Youden index = 0.813), with 91.3% of patients with a current cannabis use disorder scoring at or above this level and 90.0% of patients without a current cannabis use disorder scoring below this level.

| Mean CUDIT-R scores were compared, using one-way ANOVA, across the three diagnostic levels identified by the SCID and were found to be highly distinct: no diagnosis (n=40, mean=5.90, SD=4.52), cannabis abuse (n=17, mean=13.82, SD=4.36), and cannabis dependence (n=87, mean=23.95, SD=6.53, F=136.39, df=2, p<.001), with all pairwise comparisons also significant at p<.001.

3.3. Predictive Validity

CUDIT-R score, which reflects the level of cannabis use problems over the preceding six months, was highly correlated with recent cannabis use frequency as measured by the OTI Q score (Spearman’s rho=.705, p<.001). The correlation between the CUDIT-R and OTI Q score remained strong when the two cannabis consumption items were removed (Spearman’s rho=0.662, p<.001).

Current motivation was measured using the RCQ-TV, which was modified for cannabis use from its original alcohol-focused form. The original RCQ-TV (Heather et al., 1999) was devised by
selecting items which conformed to a three-factor solution, with factors corresponding to the Precontemplation (PC), Contemplation (C), and Action (A) stages of the transtheoretical model of change (Prochaska and DiClemente, 1986). Factor analysis of our cannabis modified version with varimax rotation (n=132) identified a three factor solution. However, the three factors were PC/C, A, and item 7 “I am a fairly normal cannabis user” which is intended to form part of the PC scale. The three factors accounted for 31.5%, 29.2%, and 7.6% of variance respectively. Removing item 7 generated a two factor solution consisting of PC/C and A items. Item-total correlation for the PC scale ranged from 0.34 to 0.69 excluding item 7, which had a correlation of 0.00. Item total correlations for the C scale ranged from 0.47 to 0.76, and for the A scale from 0.75 to 0.81. Cronbach’s alphas for the three scales were PC=0.69, C=0.85, and A=0.91. The removal of item 7 from PC improved alpha to 0.79.

The PC scale was re-calculated by deleting item 7 and pro-rating the remaining four items to generate a score equivalent to the 5-item C and A scales. There was no significant difference in CUDIT-R scores between patients categorised as PC/C (n=80, mean=18.75, SD=9.68) and those categorised as A (n=52, mean=18.37, SD=9.66; t=0.810, df=130, p=.824). However with the separation of PC (n=35, mean=11.29, SD=8.74) and C (n=45, mean=24.56, SD=5.53), there was a significant difference between the three groups (one-way ANOVA, F=25.74, df=2, p<.001), with those categorised as A scoring higher on the CUDIT-R than those categorised as PC (Mann-Whitney Z score = 3.35, p=.001) and lower than those categorised as C (Mann-Whitney Z score = 3.03, p=.002).

When a continuous RCQ total score was calculated, as outlined by Budd and Rollnick (1996) a strong correlation with the CUDIT-R was found (Spearman’s rho = 0.586, p<.001), comprising strong correlations with the PC (rho = -0.599, p<.001) and C scales (rho = 0.721, p<.001), but a weaker association with the A scale (rho = 0.247, p=.004).
4. Discussion

When first published, the CUDIT was found to have adequate psychometric properties, despite obvious problems with one item (use causing injury) and the suspicion that several other items may not be optimal. While confirming the adequacy of the original CUDIT, the current study presents an improved and abbreviated CUDIT-R which overcomes the problems identified with the original (Adamson and Sellman, 2003).

The CUDIT-R contains eight items, comprising four items from the original 10-item CUDIT and four new items. This included a small adjustment to the response options for the quantity item to allow for better discrimination at the lower end of the use range. This item proved more effective than the original item even in this relatively heavy using sample. For lighter using populations this amendment is likely to be even more important.

As was expected, item 9, which rates the occurrence of injury due to the respondent’s cannabis use, was removed from the scale. The most successful of the three candidate alternative cannabis abuse items was in fact the item which most closely related to risk of injury. In contrast to the low rate of self-reported cannabis-related injury in the sample (1% in the past six months and only 8% ever), there was a substantial level of use in potentially hazardous situations, with a quarter of the sample reporting such events on a daily or almost daily basis. The question provides examples to prompt respondents: “..such as driving, operating machinery, or caring for children”. It is not possible to know which situations respondents were acknowledging with their answers but it is notable that over half smoked daily and half were usually affected by cannabis for more than five hours, so that driving whilst under the influence of cannabis is likely to have been common amongst those who were driving. A relatively low proportion of the sample, one quarter, had children living at home with them. We felt it was important, however, to include childcare as a potentially hazardous
situation as the nature of cannabis use means that it is often taken whilst users go about their daily routines without due consideration of the potential hazards of this, as is clearly indicated by the attitude of many cannabis users to driving while affected by cannabis (Jones et al., 2007). Hazardous use is something that could be followed up in any associated clinical interaction.

Morning use was removed while a new dependence item, devoting large amounts of time to using, was added. As originally devised for the AUDIT, morning use is likely to have been an indicator of the presence of alcohol withdrawal symptoms, i.e. relief use. In the case of cannabis however it may be that this item mixes both relief use and heavy use patterns.

Two candidate items that did not make it into the CUDIT-R were designed in response to specific concerns with the original CUDIT. It was thought that item 3, frequency of being “stoned” for six or more hours, might set too high a bar for “binge” use and so an alternate item substituting three or more hours was examined. This alternative item was found to be inferior to the original item on test-retest reliability and item-total correlation. The original item itself was also subsequently dropped from the scale when it was shown to contribute little to predicting a cannabis diagnosis beyond frequency and quantity items. The other modification of an original item was item 14, which we anticipated would be more effective than item 8 by clarifying the difference between acute intoxication and sustained memory effects. This proved not to be the case and so the original item was retained.

Examining the discriminant validity of the CUDIT-R incidentally shed light on the validity of a popular scale for measuring motivation, the RCQ-TV, which has been designed for alcohol misuse in clinical settings. Although the original RCQ (Rollnick et al, 1992) has been used in a number of cannabis populations (e.g. Litt et al, 2008; Stephens et al., 2004), to our knowledge this is the first report of the use of the RCQ-TV for cannabis use. We produced somewhat conflicting results. On
the one hand a two factor solution was produced, in contrast to the three-factors intended to be captured by the RCQ. At the same time we found that using the three subscales corresponding to the intended factors (but with a single problematic item removed) showed good internal consistency and CUDIT scores were well differentiated when patients were assigned to one of the three corresponding stages. This was not the case when PC and C were combined. It is unclear to what extent the high rate of depression in our sample may have influenced the results obtained. These results may reflect the conceptual difficulties (e.g. West, 2005) faced by the transtheoretical model of behaviour change underlying the scale (Prochaska and DiClemente, 1986), but do not undermine the importance of motivation as a clinical concept, which has been demonstrated to be a strong predictor of treatment outcome (Adamson et al., 2009). A growing suite of measures are being developed in relation to cannabis using populations, with motivation an important dimension on clinical and theoretical grounds. Further examination of the RCQ/RCT-TV with cannabis using populations is warranted.

The fact that the CUDIT-R was able to effectively distinguish between different levels of cannabis use, cannabis use disorders and stage of change indicates that this 8-item scale may be of significant clinical utility, not just to identify cases (i.e. screening) but also to rate problem severity, which may facilitate better matching of patients to treatment intensity and assist in prognostication. Such uses would require further testing however, and we are not suggesting that screening tools such as the CUDIT-R should be used as a substitute for clinical diagnosis. Furthermore, we advise that when cannabis use problems are identified using the CUDIT-R this should be followed by further questioning in a clinical interaction that may form the start of the intervention process.

The findings of the current validation study are limited by the nature of the sample. This was a treatment population, with all patients having a mood disorder at entry to the study and a high rate of alcohol and amphetamine use. We believe though that this is not unusual for many cannabis
misuse presentations in clinical settings, where comorbidity and poly-drug issues are the norm (Adamson et al., 2006; Weaver et al., 2003), while representative community samples show higher rates of depression amongst heavy and problem cannabis users (Degenhardt et al., 2003).

The sensitivity and specificity analysis presented in Table 2 is best considered as being for illustrative purposes, with the optimal cut-off of 13 being preliminary only. It is possible that other samples would derive cut-off scores different to this. In particular we would not want to convey the impression that any score below 13 should necessarily be considered non-problematic/hazardous cannabis use. At this “optimal” cut-off, the corresponding positive predictive value (96%) and negative predictive value (80%) are likely to be over- and under-estimates respectively, due to the high rate of cannabis use disorder in this sample, but they do suggest that the CUDIT-R is likely to have considerable utility as a screening instrument.

The CUDIT-R has been demonstrated to be valid and reliable screening test, as well as a useful rating scale for cannabis use disorder severity in a co-existing disorder clinical sample, and it is for these uses in broader clinical samples that we believe the CUDIT-R would be of greatest use. As a brief scale with eight items capturing important features of consumption patterns, cannabis problems (abuse), dependence symptoms, and psychological features, we believe the CUDIT-R also has promise as a brief outcome measure. The original CUDIT has been used and validated in general population samples and it is likely that the CUDIT-R would be similarly effective. The CUDIT-R would benefit from being validated with more diverse populations, including other clinical groups, and community samples. Particularly useful would be validation with youth samples given the disproportionate level of cannabis use in these groups and the potential impact of heavy use on educational attainment.
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