Subjective effects to marijuana associated with marijuana use in community and clinical subjects

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ABSTRACT

Introduction: Marijuana is the most commonly used illicit drug among adolescents. Marijuana use induces both psychological and physiological responses, which can be interpreted by an individual in a variety of ways (i.e. subjective effects). We have examined subjective effects in adolescent, young adult community, and clinical populations to determine how patterns of use may be predicted by an individual's subjective experiences with the drug.

Method: Participants were community and clinical sample subjects drawn from the Colorado Center of Antisocial Drug Dependence (CADD) and a sample of adjudicated youth from the Denver metropolitan area (aged 11–30). They were evaluated with the Composite International Diagnostic Interview—Substance Abuse Module (CIDI-SAM) and the Lyons battery for subjective effects. Scales for subjective effects were created using Mokken scale analysis. Multivariate linear and logistic regression was used to examine associations between the subjective scales and marijuana outcomes.

Results: Mokken scaling revealed two subjective effects scales, positive and negative. Both scales were significantly positively associated with marijuana abuse or dependence in both the community and clinical sample and regular use in the community sample. The negative scale was negatively associated with past six-month use in the community sample ($p < 0.05$) and clinical sample, after controlling for age and gender effects.

Conclusions: These findings suggest that diverse subjective experiences with marijuana can be ordered hierarchically and that the resulting short scales can be used in either clinical or community settings. Further, they suggest that the potential for marijuana use problems is related to the type of subjective experience from marijuana exposure.

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1. Introduction

Among illicit drugs, marijuana is the most commonly used, with approximately half of all adolescents experimenting with the drug at least once during their lifetime (Perkonigg et al., 2008; von Sydow et al., 2002; Fergusson and Boden, 2008). As with many drugs of abuse, physiological and psychological responses vary between individuals and can be a function of the level of prior exposure. Though the etiological factors involved in regular use, abuse, and subsequent dependence are complex and multifaceted, subjective experiences following marijuana exposure have been useful in identifying those at risk (Grant et al., 2005; Fergusson et al., 2003). Moreover, as prevention efforts target initial use and treatment paradigms emphasize mitigating withdrawal experiences, examining subjective experiences may aid the refinement of these programs.

Interest in the subjective experiences with marijuana use grew from the belief in the 1950s that use involved the process of learning to identify and enjoy the effects (Green et al., 2003; Becker, 1953). Salient features of self-reported experiences often include relaxation, enhanced cognition and perception, improved mood, paranoia, depression and anxiety, and hallucinations. Heightened sexual pleasure and appetite, feelings of guilt, and talkativeness

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have also been endorsed. Generally, across both laboratory and questionnaire-based studies, it has been observed that these and other subjective experiences group into two broad categories of positive (e.g. euphoric, relaxed, less inhibited) and negative (e.g. depressed, sad, angry, ill) experiences (Green et al., 2003; Rossi et al., 1978; Block et al., 1998), despite seemingly opposite types of experiences being reported together (Grant et al., 2005; Davidson and Schenk, 1994; Wachtel et al., 2002).

Research examining subjective experiences using questionnaires has sought to elucidate the relationship between the experience of a drug and subsequent patterns of use. Results regarding positive experiences have been consistent across studies showing positive associations with measured phenotypes; findings with the negative subjective effects have been ambiguous though. For example, Davidson and Schenk (1994) reported correlations between a positive experience factor and latency to second use and level of lifetime use with no correlations observed with a negative factor and these outcomes. Similarly, Fergusson et al. (2003) reported a strong relationship between positive experiences with marijuana use prior to age 16 and dependence during young adulthood, but found no associations with negative experiences. Lyons et al. (1997) found that negative subjective experiences may be protective against length of regular use while Grant et al. (2005) found that both positive and negative experiences have been associated with marijuana abuse and dependence in an adult sample. Most recently, in a sample of adolescents, Scherrer et al. (2009) found that high responders (i.e. endorsed both positive and negative subjective effects), positive and mixed/relaxed responder classes were all significantly more likely than the low responders (i.e. very low endorsement for most subjective effects) to be heavier cannabis users with high responders having significantly larger odds of DSM-IV cannabis abuse and dependence.

A number of limitations exist in the study of subjective effects of marijuana. Although there is relative consistency regarding the relationship between positive subjective effects and marijuana use phenotypes, the relationship between negative subjective experiences and marijuana use phenotypes is unclear. Also, there has not been a study of self-reported subjective effects to marijuana in a clinical population outside the laboratory. Lastly, the number of studies examining adolescents has been relatively small.

To address these limitations, we examined retrospectively reported subjective experiences with marijuana in a large community sample and a treatment-based clinical sample assessed using the Lyons battery (Lyons et al., 1997) and scaled using Mokken scale analysis (MSA). Our study was designed to examine (1) whether there are associations between subjective responses to marijuana use and patterns of use, abuse, dependence in an adolescent and young adult sample and (2) to determine whether Mokken scaling and potential associations are comparable for community and clinical subjects. The expectation was that there would be differential predictive power between positive and negative subjective effects with the negative subjective effects being protective against the studied phenotypes and that individuals in treatment would be more extreme in their responses with regards to subjective effects to marijuana.

2. Methods

2.1. Subjects

Our community-based sample was drawn from participants in the Colorado Center on Antisocial Drug Dependence (CADD), a large collaborative study that includes the Colorado Twin Registry (Rhea et al., 2006), the Colorado Adoption Project (Petrill et al., 2003), and the control sample of the Colorado Adolescent Substance Abuse Family Study (ASA; Stallings et al., 2003). Our clinical sample was drawn from adolescents in treatment for substance abuse (not exclusively marijuana) and delinquency, recruited as part of the ASA, and an additional 61 (12% of the clinical sample) adolescents who had been convicted and placed on probation

(e.g. adjudicated) in the Denver metropolitan area (Hartman et al., 2008). The subjects in the present study were selected because they have used marijuana six or more times and had data available for the assessments described below.

2.2. Assessment

Patterns of marijuana use and abuse and dependence symptomatology were collected using the Composite International Diagnostic Interview—Substance Abuse Module (CIDI-SAM; Cottler et al., 1995). An additional set of supplemental questions for the CIDI-SAM was asked to evaluate age at first use and whether subjects progressed to regular use (i.e. use once/month for at least 6 months). Subjects who indicated that they had "used marijuana more than five times" in their lifetime were asked follow-up questions concerning abuse and dependence symptoms. Scoring algorithms based on whole life substance-related problems were used to derive the number of Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) for life-time abuse and dependence symptoms for marijuana.

Self-report subjective experiences were collected using a questionnaire developed by Lyons et al. (1997). This 23-item inventory assessed subjective responses for 10 classes of drugs, including marijuana. These questions included, "In the period shortly after you used marijuana, did it make you feel {subjective effect}?", to which subjects answered yes or no. Responses were scored as 0/1, with 1 indicating they had such an experience. From this pool of items, Lyons et al. (1997) identified two primary factors for marijuana: a positive scale with an internal consistency, based on Kuder–Richardson formula 20, of 0.79 and a negative scale with an internal consistency of 0.63 (Lyons et al., 1997).

In the current study, a total of 1912 subjects were assessed using versions of the Lyons questionnaire, of which 1296 (68%) subjects were asked all 23 items. In response to interview length, a factor analysis was conducted on the Lyons questionnaire and 10 items with lower loadings were dropped. Thus, the remaining 32% of the study population were given a shortened 13-item version (see Table 2). The 10 items dropped from the 23 item version were primarily negative or mixed items (i.e., confused, anxious, jumpy, paranoid, depressed, laugh/cry, hear/see things not present, keyed-up, irritable, and confident). A post hoc comparison using Mokken scaling showed that clustering of items for the Mokken scales was similar for the full Lyons questionnaire and the shortened 13-item questionnaire. To maximize sample size, all analyses were conducted using the 13-item sub-set.

2.3. Statistical analyses

While our primary interest was to examine the usefulness of MSA for subjective effects, we also performed confirmatory factor analysis (CFA) to compare the dimensionality from this sample to that obtained by Lyons et al. (1997). Because the results from CFA correlated highly with results from MSA (0.99 for the positive scale and 0.98 for the negative scale), we report only MSA-based analyses. Mokken scaling starts with a matrix containing information on the strength of the bivariate relationships between the J items under study. In factor analysis, this is either a correlation or covariance matrix. Mokken scaling uses a matrix with H-coefficients (van Abswoude et al., 2004). Furthermore, Mokken scaling provides a nonparametric, iterative scale-building technique that identifies the smallest set of internally consistent scales from a given item pool. This model assumes the presence of latent traits that can be measured by subject responses to a set of items (Luinge et al., 2006; Watson et al., 2008). Mokken scaling is probabilistic and hierarchical, meaning that the items can be ordered by a degree of "difficulty"; individuals who agree with a more difficult item will tend to agree with less difficult items (DeJong and Molenaar, 1987; Meijer and Sijtsma, 1990; Luinge et al., 2006; Watson et al., 2007; Wismeijer et al., 2008). The scales are formed by taking pairs of items with the highest correlation and including other items that fit into the scale until there is no further improvement (Webber and Huxley, 2007). Loevinger's H coefficients, which indicate the fit of an item to the scale, were computed for each item (H_i) within a scale and for the scale as a whole (H). $H \geq 0.4$ are considered strong scales (Watson et al., 2007). In MSA, an item(s) can remain "unscaled" because it could not be added to one of the alternative scales without weakening the scale's homogeneity.

An advantage of MSA is the ability for direct comparability of scaling results between groups, which was evaluated by comparison of items selected for each scale and inspection of the H coefficients for items across subsamples. Mokken scaling was performed separately for the community and clinical samples. Furthermore, separate scaling was done by age (<17 vs. ≥17) and gender to test for potential differences and to ensure that scaling on the entire sample would not be a confounder. Since no differences were seen between any of the sub-groups, scaling was performed using the entire sample. Independent-sample t-tests were performed to detect any differences in sample means as a function of age, gender and group status (i.e. community vs. clinical) for the consensus positive and negative response scales.

To determine the relationship between positive and negative subjective experiences and marijuana use phenotypes, we conducted linear and logistic regression analyses, with the marijuana phenotype as the dependent variable and the two MSA-derived subjective experience scales as independent variables. Past six-month use was examined in two ways. First we treated it as a continuous variable (range 0–180 days) and applied linear regression models to test the association with our two subjective experiences scales. Second, to understand the relationship between