



## Psychometric assessment of the marijuana adolescent problem inventory

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### HIGHLIGHTS

- Marijuana Adolescent Problem Inventory (MAPI) indexes cannabis use problem severity.
- Psychometric findings suggest that the MAPI is internally consistent and reliable.
- Factor structure analyses support a one-component solution.
- Initial tests suggest the MAPI is a promising measure to assess problem severity.

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### ABSTRACT

Cannabis is one of the most commonly used psychoactive substances among adolescents in the United States. Adolescent cannabis use has multiple consequences including academic, health, and psychiatric problems. The Marijuana Adolescent Problem Inventory (MAPI) is a 23-item scale adapted from the Rutgers Alcohol Problem Index and used in the current literature to assess cannabis use problem severity. Psychometric testing for the MAPI has yet to be reported. The current investigation assessed the psychometric characteristics of the MAPI with cannabis-using adolescents ( $n = 727$ ) from school and outpatient settings who enrolled in five separate randomized clinical trials focused on treatment of substance use. Findings suggested that the MAPI is internally consistent and reliable. Factor structure analyses suggested that the MAPI measures one latent construct, with no differences in factor structure between the outpatient and school settings, supporting a one-factor model. External validity of the MAPI was also demonstrated as evidenced by significant relations with concurrent diagnosis of cannabis dependence and abuse, longitudinal frequency of cannabis use, and mean times used per day. Overall, this initial test of the psychometric characteristics of the MAPI suggests that it can be considered a reliable and valid measure of problems associated with cannabis use among adolescents. Future work is now needed to replicate these findings by testing the psychometric properties of the MAPI in more diverse samples and developing a short version to be used as a brief assessment tool.

### 1. Introduction

In the United States (U.S.), cannabis is the most widely used psychoactive substance among youth (Center for Behavioral Health Statistics and Quality, 2016). Multiple short-term and long-term problems are associated with adolescent cannabis use (Fergusson, Horwood, & Swain-Campbell, 2002; Silins et al., 2014). For example, a recent longitudinal study detected relations between persistent adolescent cannabis use and neuropsychological impairment in adulthood, suggesting persistent use during the developmental period of

adolescence may have negative consequences on neurodevelopment (Meier et al., 2012). This combined with the changing status of cannabis laws in the U.S. and decrease in perceived risk of regular cannabis use (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2016) underscore the importance of the need for valid assessment tools measuring key problems related to adolescent cannabis use.

The Rutgers Alcohol Problem Index (RAPI) (White & Labouvie, 1989) was developed to measure problems related to alcohol use specifically, and has contributed to the understanding of risky adolescent and young adult alcohol use in several ways. The RAPI has been used to

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identify adolescent problem trajectories, elucidate the drinking indices that predict the most risk among young adults, evaluate efficacy of interventions targeting alcohol use, and predict future diagnosis of alcohol dependence (Borsari & Carey, 2005; Borsari, Neal, Collins, & Carey, 2001; Dick, Aliev, Viken, Kaprio, & Rose, 2011; Diestelkamp et al., 2014; Warner, White, & Johnson, 2007). The RAPI evidences sound psychometric characteristics and is recommended for use as a unidimensional scale to measure problem drinking (White & Labouvie, 1989).

Two scales have been commonly used to index problem severity specific to cannabis use among youth. The Marijuana Adolescent Problems Inventory (MAPI) (Johnson & White, 1989) was adapted from the RAPI to measure problems related to youth marijuana use. While different names for this instrument have been used in the existing literature (e.g., Rutgers Marijuana Problem Index; Marijuana Problems Index; Marijuana Problem Inventory) (Blevins, Walker, Stephens, Baner, & Roffman, 2018; Esposito-Smythers, Spirito, Kahler, Hunt, & Monti, 2011; Vandrey, Budney, Kamon, & Stanger, 2005), this 23-item, problem index has adolescents rate each item on a 0–4 scale and yields one total scale score. Studies to date have used the MAPI as a unidimensional scale to investigate predictors of adolescent cannabis withdrawal, evaluate the longitudinal effects of interventions targeting youth cannabis use, and examine the utility of the Comprehensive Marijuana Motives Questionnaire in high school clinical populations (Blevins, Baner, Stephens, Walker, & Roffman, 2016; Vandrey et al., 2005; Walker et al., 2011). The other measure indexing youth marijuana-related problems, the 27-item Adolescent Cannabis Problems Questionnaire (CPQ-A) (Martin, Copeland, Gilmour, Gates, & Swift, 2006), has youth endorse yes or no to each problem item, and yields a total score and scores on three problem subscales (i.e., financial/psychosocial, physical, and acute negative consequences). The CPQ-A has been used to evaluate the validity of the Cannabis Use Problems Identification Test among adolescents and adults, characterize the psychiatric profile of treatment-seeking adolescents and adults with cannabis dependence and mental health problems, and examine the effects of an adolescent cannabis intervention among non-treatment seeking youth (Bashford, Flett, & Copeland, 2010; Ewing et al., 2013; Norberg, Battisti, Copeland, Hermens, & Hickie, 2012).

Psychometric testing for the MAPI has yet to be reported. In contrast, the CPQ-A has limited psychometric data reported in a study of 100 older adolescents aged 14–18 years across two interviews approximately a week apart (Martin et al., 2006). Psychometric testing of the MAPI is needed to better inform researchers and clinicians on its utility as an index of problem behavior related to cannabis use. Such data are needed to satisfy fundamental assumptions in data collection, analysis, and interpretation (Kazdin, 2003). It is important to verify the MAPI as a valid and reliable measure if it is to be used to advance knowledge about youth cannabis use. The MAPI has potential utility as a specific measure of cannabis use problem severity.

The current study examined the psychometric properties of the MAPI using a large and diverse sample of cannabis-using adolescents from school and outpatient settings who enrolled in five separate randomized clinical trials focused on treatment of substance use. Several sets of analyses were conducted to evaluate internal and external validity. The MAPI's factor structure, reliability (i.e., internal consistency reliability, internal reliability, and test-retest reliability), and associations with cannabis-related variables (i.e., cannabis use frequencies and diagnosis of cannabis abuse and dependence) were examined. The cannabis-using samples were combined to provide a large enough sample to perform the planned analyses, and the diversity of samples provided variability in responses for the initial test of the MAPI's psychometric characteristics.

## 2. Materials and methods

### 2.1. Participants and procedures

Data were combined from five randomized trials evaluating interventions for adolescent substance use across outpatient (Stanger, Budney, Kamon, & Thostensen, 2009; Stanger, Ryan, Scherer, Norton, & Budney, 2015; Stanger, Scherer, Babbitt, Ryan, & Budney, 2017) and school settings (Walker et al., 2011; Walker et al., 2016). For the present investigation, we only included youth who reported cannabis use during the past 30-days or who had a cannabis-positive urinalysis result at baseline assessment. The final sample size was  $N = 727$  (of 859 possible), with 110 excluded due to no MAPI at baseline and 22 due to no cannabis use at baseline. For the longitudinal analyses, inclusionary criteria comprised of cannabis use reported at that assessment interval; participants that reported no cannabis use or no MAPI at a follow-up assessment interval were excluded for that particular interval.

The purpose of the three outpatient clinical trials was to test interventions designed to increase the efficacy of Motivational Enhancement Therapy combined with Cognitive Behavioral Therapy (MET/CBT) for problematic substance use among clinically referred substance-using youth. All adolescents in the Arkansas 1 (AR-1) (Stanger et al., 2017), Arkansas 2 (AR-2) (Stanger et al., 2015), and the Vermont trials (VT) (Stanger et al., 2009), received 14 weeks of MET/CBT (Sampl & Kadden, 2001; Webb, Scudder, Kaminer, & Kaiden, 2002). Additionally, adolescents were randomly assigned to receive abstinence-based contingency management (CM) or no CM. The Institutional Review Board (IRB) of the University of Arkansas for Medical Sciences approved AR-1 and AR-2 trials, and the IRB at University of Vermont approved the VT trial. The inclusion criteria were as follows: (a) age 12–18 years and living with a legal guardian (b) cannabis use in the past 30-days or a cannabis-positive urinalysis for AR-2 and VT (c) diagnosis of cannabis abuse or dependence for AR-2, and alcohol use in the past 30-days or an alcohol-positive urinalysis and meeting criteria for alcohol abuse or dependence or at least one binge episode in the past 90-days for AR-1. Notably, the majority (71%) of those enrolled in AR-1 reported cannabis use or evidenced a cannabis-positive urinalysis at baseline despite the inclusionary criteria being contingent on alcohol use (Stanger et al., 2017). Adolescents received treatment for 14-weeks and completed follow-up assessments at 3-, 6-, 9-, and 12-months post-baseline (and 15-month post-baseline for AR-1).

The goal of the two school-based trials was to evaluate the efficacy and optimize outcomes for the MET-based intervention, Teen Marijuana Checkup, designed to intervene in schools with adolescents who endorse frequent cannabis use. The first school-based trial, Washington 1 (WA-1) (Walker et al., 2011) had three conditions: MET, Educational Feedback Control (EFC), and Delayed Feedback Control (DFC); however, adolescents in the DFC condition were not included in the current investigation because the MAPI was not administered at baseline. The MET condition included two sessions of MET, and the EFC condition involved two sessions of psychoeducation about cannabis use. MET and EFC conditions were offered four sessions of individual CBT (Sampl & Kadden, 2001). All adolescents in the second school-based trial, Washington 2 (WA-2) (Walker et al., 2016), received the same two-session MET intervention, and were offered optional CBT sessions as needed. Adolescents were randomized to either MET check-in sessions or “assessment-only” check-in sessions. The IRBs from University of Washington and Virginia Tech approved all procedures for WA-1 and WA-2. The inclusion criteria for the school-based trials were ages 14–19 years for WA-1, 14–17 years for WA-2, and at least nine days of cannabis use in the past 30-days for WA-1 and WA-2. Adolescents completed assessments at 3- and 12-months after the baseline assessment for WA-1 and 6-, 9-, 12-, and 15-month post-baseline for WA-2. Additional details are provided elsewhere for the clinical (VT; AR-2; AR-1) (Stanger et al., 2009; Stanger et al., 2015; Stanger et al., 2017) and school trials (WA-1; WA-2) (Walker et al., 2011; Walker et al.,

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