HHS Public Access

Author manuscript

Prev Sci. Author manuscript; available in PMC 2022 August 01.

Published in final edited form as:

Prev Sci. 2021 August ; 22(6): 758–768. doi:10.1007/s11121-020-01171-x.

A Marijuana Consequences Checklist for Young Adults with Implications for Brief Motivational Intervention Research

Christine M. Lee[1], **Jason R. Kilmer**[1], **Clayton Neighbors**[2], **Jennifer M. Cadigan**[1], **Anne M. Fairlie**[1], **Megan E. Patrick**[3], **Diane E. Logan**[4], **Theresa Walter**[1], **Helene R. White**[5]

[1]University of Washington, Department of Psychiatry and Behavioral Sciences, Seattle, WA, 98105

[2]University of Houston, Department of Psychology, Houston, TX, 77204

[3]Institute for Translational Research in Children's Mental Health and Institute of Child Development, University of Minnesota, 1100 Washington Ave S., Suite 101, Minneapolis, MN 55414, USA

[4]West Hawaii Community Health Center, Kailua-Kona, HI 96740

[5]Rutgers University, Center of Alcohol and Substance Studies, 607 Allison Road, Piscataway, NJ 08854-8001

Abstract

Measures assessing marijuana-related consequences or problems experienced by young adults have typically been adapted from measures assessing alcohol consequences. These measures may not fully reflect the specific unwanted or perceived "not so good" effects of marijuana that are experienced by young adults. Thus, using these measures may present a gap, which needs to be addressed, given that reports of consequences are often utilized in brief motivational personalized feedback interventions. Data from three different studies of young adults were used to: 1) examine self-reported "not so good" effects or consequences of marijuana use among frequent marijuana using college students (Study 1), 2) create a new version of a marijuana consequences list and compare it to an existing marijuana consequences measure (Study 2), and 3) assess convergent and divergent validity between a finalized Marijuana Consequences Checklist (MCC, 26-items) and

Christine M. Lee, Jason R. Kilmer, Anne M. Fairlie, Theresa Walter and Jennifer M. Cadigan, Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA; Clayton Neighbors, Department of Psychology, University of Houston, Houston, TX; Megan E. Patrick, Institute for Translational Research in Children's Mental Health and Institute of Child Development, University of Minnesota; Diane E. Logan, West Hawaii Community Health Center, Kailua-Kona, HI, and Helene R. White, Rutgers University, Center of Alcohol and Substance Studies, Piscataway, NJ.

Disclosure of potential conflicts of interest: The authors declare that they have no conflict of interest.

Ethical approval: All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

marijuana use and risk for cannabis use disorder (Study 3). The most frequently-endorsed self-reported effects of marijuana included the impact on eating (the “munchies”), dry mouth, trouble concentrating, and acting foolish or goofy. Higher scores on the MCC were associated with more frequent use and a higher probability of meeting criteria for cannabis use disorder. The MCC represents a range of negative consequences of marijuana use derived from frequent users’ own accounts and includes consequences not assessed by other measures. The MCC captures marijuana-specific negative consequences relevant for young adults, which can be incorporated in brief motivational personalized feedback interventions.

Keywords

marijuana; cannabis; consequences; young adults

Marijuana is one of the most widely used substances by young adults (Schulenberg et al. 2018) and use has been associated with acute effects (e.g., increased heart rate, decreased cognitive performance) and longer-term negative developmental consequences (e.g., Volkow et al. 2014). Young adults are at the peak risk in the life course for needing treatment for marijuana use (e.g., a cannabis use disorder, CUD; Lipari et al. 2016).

Motivational Enhancement Therapy (MET) interventions, including brief motivational personalized feedback interventions (PFIs), can be implemented to reduce marijuana use and/or related harms for individuals who are motivated to make such changes. These interventions focus on eliciting personally-relevant reasons for change and exploring and resolving ambivalence, including consideration of the “good” and “not so good” things about substance use, that could prompt contemplation of or commitment toward change (e.g., Miller and Rollnick, 2013; Walker et al. 2006). MET interventions and PFIs have been shown to reduce marijuana use among nontreatment-seeking adolescents and college students (e.g., Lee et al. 2013; Walker et al. 2011). These interventions generate a personalized feedback report, based on participants’ self-reports, that is used to highlight things such as their pattern of use, their perceptions of others’ use, and consequences experienced from their use with the goal of facilitating contemplation of and/or commitment to change, and to consider how making changes could result in reduced harms. The key is to generate accurate, meaningful, believable, personalized feedback with the best chance to facilitate consideration of change. Accordingly, the measures used to generate feedback must be accurate and relevant for young adults and specific to the targeted substance(s).

Notably, despite being a key component that is used in creating the personalized feedback, measures of young adult marijuana use and consequences are not as well developed or standardized as they are for alcohol. In fact, many of the current young adult measures of marijuana consequences have been adapted from measures assessing alcohol-related consequences, impairment, or problems (e.g., White et al. 2005; Simons et al. 2012). Many studies have measured negative marijuana consequences based on the Rutgers Alcohol Problem Index (White and Labouvie 1989) by simply substituting “marijuana” for “alcohol,” with inconsistency in assessment timeframes and number of items (ranging from 18–26). These measures include the Rutgers Marijuana Problem Index (RMPI, White et al.

2005), Marijuana Problem Inventory (MPI; e.g., Johnson and White 1989; Simons and Carey 2002), and Marijuana Adolescent Problem Inventory (e.g., Knapp et al. 2018; Walker et al. 2011). Research using these measures has shown that marijuana consequences are positively correlated with marijuana use (Lee et al. 2010; Simons et al. 2005), descriptive norms (Neighbors et al. 2008), and motivations and affective states (Lee et al. 2009; Simons et al. 2005) and used as outcomes in several randomized controlled trials of marijuana interventions (e.g., Esposito-Smythers et al. 2011; Lee et al. 2013; Walker et al. 2011).

Another measure, the Marijuana Consequences Questionnaire (Simons et al. 2012), was modeled after the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read et al. 2006) and uses 50 items to assess marijuana problems in the last 6 months in eight areas: social-interpersonal, impaired control, self-perception, self-care, risk behaviors, academic/occupational, physical dependence, and blackouts. Adaptations from the alcohol scale were made, including substituting “marijuana” for “alcohol.” Items related to alcohol withdrawal were adapted to reflect marijuana withdrawal, and hangover items were altered to better reflect marijuana’s effects (i.e., “felt in a fog, sluggish, tired, or dazed the morning after using marijuana”). The 50-item scale has good convergent and divergent validity, as does a brief unidimensional 21-item version, and these scales provide an index of severity (Simons et al. 2012).

The measures described above are the most widely used when assessing young adult marijuana-related consequences or problems. However, given their derivation from existing measures of alcohol consequences, negative effects of marijuana use, which are unique to marijuana and not typically experienced as a consequence of alcohol, are not included in these measures (e.g., dry mouth; impaired concentration; feelings of paranoia). Thus, although existing measures have been successful in documenting general marijuana-related harms that are similar to alcohol-related harms, it is unclear to what extent these measures fail to capture consequences that are commonly related to marijuana but not alcohol.

The Current Study

The overarching goals of this research were to identify the most relevant and common negative effects or consequences experienced by young adult marijuana users and to develop a relevant and meaningful checklist of consequences, which would be better suited for use in future brief intervention studies using personalized feedback reports. While MET interventions and PFIs often discuss both positive and negative aspects of marijuana use (usually in the initial session to build rapport with the client), we focus this checklist on negative experiences related to use, as this is typically a formal component of personalized feedback reports, which provides the client a list of the negative consequences they have experienced as a result of their substance use. For initial exploration of items, we chose to approach data gathering using the term “not so good” rather than more loaded or potentially judgmental terms such as “bad” or “negative” so as to get a larger range of experiences. However, the final checklist would not use the phrase “not so good” in the instructions to describe the list of consequences but rather just asked the frequency with which each consequence may have occurred. Our ultimate goal was to develop a checklist that would (1) accurately and comprehensively capture the actual frequency of negative effects of

marijuana that are experienced by young adults, (2) be broad enough to capture domains that are relevant and meaningful to a wide range of young adults, particularly because motives for marijuana use vary (e.g., Lee et al. 2009), and (3) have face validity such that the overall credibility of intervention feedback would provide a relatively good representation of the types of negative consequences that individual marijuana users experienced. We also expected the resulting checklist might serve more broadly as an alternative measure for problematic marijuana use in research studies of adolescents and young adults.

Utilizing data from three different studies of college students and young adults, the purpose of the present manuscript is to document self-identified consequences of marijuana use among frequent marijuana-using college students (Study 1), identify areas not assessed in existing young adult measures of marijuana consequences (Study 2), and create a Marijuana Consequences Checklist and examine convergent and divergent validity between the checklist and marijuana use and risk for CUD (Study 3).

Study 1-Document Self-identified Consequences of Marijuana Use

Methods

Participants and Procedures—Participants for Study 1 were 207 undergraduate college students from two public west coast campuses, 177 who participated in a study testing the efficacy of an indicated marijuana intervention (see Lee et al. 2013 for details), and 30 who were recruited at the same time but not part of the intervention trial. Across the two campuses, at the 6-month assessment, mean age was 19.9 (SD = 1.4), 44% were female, and the ethnicity breakdown was 74.3% Caucasian, 11.2% Asian or Pacific Islander, and 14.6% other. Briefly, 242 undergraduate college students were screened for past-month marijuana use from a random sample of students provided by the university's registrars' lists. Those who indicated using marijuana five or more times in the prior month were invited participate in the longitudinal intervention study with 212 responding and enrolling in the study. Participants completed online 3- and 6-month follow-ups; with 83.5% completing the 6-month. All procedures were approved by the university IRBs and a federal Certificate of Confidentiality was obtained from the National Institutes of Health. No adverse events were reported. An additional 30 students who were recruited at the same time from the two campuses and who met marijuana use criteria but who were not part of the intervention trial also completed a web-based survey asking the same marijuana-related questions. The sample for the present manuscript includes responses from a total of 207 students.

Measures—*Self-generated marijuana consequences* were assessed with an open-ended question that asked "think about the times you have used marijuana. Briefly list up to five effects of marijuana that have happened to you while you were using marijuana that may not have been so good."

Coding of Consequences—To develop a coding system, the first, second, third, and seventh authors independently reviewed the list of marijuana effects generated by the 207 students (with 805 total consequences generated), leading to 30 consequence categories reflecting the effects participants generated. The development team discussed the categories and developed initial rules for coding, and independently coded all 805 responses to assess

initial interrater reliability (see Table 1 for 30 categories). Initial agreement on items only requiring a single code was 91.2%, and decision rules were generated for how to handle multiple codes (i.e., when students listed more than one unwanted effect in a single response). The development team further solidified instructions, examples, and qualifiers for the list of 30 categories.

Once the finalized consequence descriptions and coding instructions were established, a team of undergraduate research assistants were trained on the coding system and subsequently coded each of the 805 responses. Across the coders, there was 82% agreement on single items. One final round of instructions was generated and sent out for coding by two additional naive undergraduate research assistants. Agreement on single codes increased to 86%; 77 of the 107 cases in which there was disagreement were due to inattention to specific coding instructions. For remaining items on which there was disagreement, the development team reviewed each item and agreed on recoding it into one of the existing categories. Ultimately, each of the 805 responses was coded into one of the 30 categories.

Results for Study 1

Self-generated negative consequences from marijuana use—Table 1 shows the 30 coding categories, grouped within broader themes, along with percentage of times each code was mentioned in relation to all 805 coded responses. Sleep as well as cognitive (including attention and concentration), motivational, and memory issues were the most frequently listed self-generated negative effects of marijuana among this sample of young adult students. In fact, 15.2% of all coded consequences revolved around cognitive and memory issues, while another 15.2% related to productivity issues. Other self-generated types of consequences included: eating (e.g., eating too much); problems with lungs or coughing; feeling antisocial or experiencing social awkwardness; physical difficulties (e.g., feeling dizzy, sick, uncoordinated); not getting things done; and spending too much money. As such, Study 1 allowed us to examine qualitative user-generated reports of marijuana's "not so good" effects to generate a more comprehensive list of marijuana consequences compared to existing measures with content largely adapted from alcohol consequence measures (e.g., RMPI and MACQ).

Study 2-Initial Evaluation of New Marijuana Consequences List

The purpose of Study 2 was to create an initial list of marijuana consequence items based on the self-generated consequences and coding scheme from Study 1 and compare the newly developed list of marijuana consequences with the 18-item RMPI (White et al. 2005).

Participants and Procedures—Participants were 410 undergraduate college student drinkers from two west coast universities who participated in a study comparing the efficacy of injunctive, descriptive, and combined normative feedback in reducing alcohol use and negative consequences. Data came from the 12-month assessment, mean age was 20.8 (SD = 1.3). 55.1% were female, and the ethnicity breakdown was 70.7% Caucasian, 13.2% Asian or Pacific Islander, and 16.2% other.

Approximately 5990 undergraduate students were randomly selected from the university's registrars' lists and invited to participate in the research study. Over 2,680 participants consented to participate and completed an online screening survey assessing alcohol use and other substance use (44.8% response rate). Participants who completed the screening survey and met eligibility criteria (consuming 4+ drinks for women/5+ for men at least once during the past month, $N = 1494$) were immediately invited to the larger study. Of those invited, 1367 responded and completed the baseline assessment. Participants also completed 3-, 6- and 12-month follow-ups. Only the 12-month follow-up was used in the current study. All procedures were approved by the university IRBs and a federal Certificate of Confidentiality was obtained from the National Institutes of Health. No adverse events were reported.

Measures

Marijuana Use.: Participants were asked "In the past 30 days, how many days did you use marijuana" with an opened-ended response format from 0 to 30 days.

New Marijuana Consequences were assessed with 22-items created from the open-ended consequences identified with the coding scheme developed in Study 1. Based on Study 1, we selected 22 items for assessing negative consequences. For each of the categories discussed in Study 1, we identified or adapted one item that best represented the self-reported consequences as we were ultimately interested in creating a checklist of items or a problem index rather than a measure with multiple-items for each category. There were 8 categories that were not included out of the initial 30 due to low endorsement (i.e., bad breath, problems cooking, day after effects), ability to combine with another category (i.e., negative outcomes from eating), overly general or broad categories (i.e., bad outcomes) or not negative outcomes from marijuana (i.e., positive effects, unclear). Respondents indicated how many times, from 0 (never) to 4 (more than 10 times), they experienced each of 22 consequences due to marijuana use in the past 30 days (see Table 2 for items). Responses were coded as indicating whether they experienced the item at all in the past 30 days (1) or not (0) due to their marijuana use. Two variables were calculated: 1) the sum of the dichotomized items that reflected if the consequence did not occur (coded as 0) or occurred one or more times (coded as 1) (Cronbach's $\alpha = .91$; possible range 0–22) and 2) the sum of the frequency of endorsement (Cronbach's $\alpha = .94$; possible range 0–88).

Marijuana-related consequences were also assessed with the 18-item RMPI (White et al. 2005). Respondents indicated how many times, from 0 (never) to 4 (more than 10 times), they experienced each of 18 negative consequences due to marijuana use in the past 30 days. Responses were coded to indicate whether they experienced the item in the past 30 days (1) or not (0) due to marijuana use in the past 30 days. From this, two variables were calculated, 1) the sum of 18 dichotomized items that reflected if the consequence did not occur (coded as 0) or occurred one or more times (coded as 1) (Cronbach's $\alpha = .91$; possible range 0–18) and 2) the sum of the frequency of all items endorsed (Cronbach's $\alpha = .93$; possible range 0–72).

Results

Table 2 shows the 22 consequences and their frequency of endorsement. The top ten consequences on the new marijuana consequence list were: had the munchies, experienced dry mouth, acted foolish or goofy, had trouble remembering things, had trouble concentrating or paying attention, had low motivation, felt paranoid, felt antisocial or intentionally avoided others, developed a cough or had trouble breathing, and had problems following through on things. Of these ten most frequently endorsed effects, only one (i.e., had trouble concentrating or paying attention) was partially reflected on the RMPI (i.e., not able to do your homework, study for a test or complete a work assignment). The consequence on the RMPI with the most endorsement was noticed a change in your personality.

In comparing the extent to which the new marijuana consequences list reflected common experiences of marijuana users relative to the RMPI, we examined differences in the number of items endorsed and the average frequency of items endorsed. On average, participants endorsed significantly more ($t(408) = 16.02$, $p < .001$) of the new consequences list items (31.1% [6.82/22]) than the RMPI items (18.8% [3.39/18 items]). Given differing number of items on the two scales, we rescaled endorsement to a common metric (new consequences list * 9; and RMPI *11) prior to evaluating differences in number/proportion of items endorsed. The correlation between the total scores on the MCC and RMPI ($r = .90$). A repeated measures negative binomial regression model indicated that participants endorsed significantly more items on the new consequences list than the RMPI ($Z = 5.30$, $p < .001$). The same procedure was used to compare the frequency with which consequences were endorsed. The sum of frequencies for RMPI items was $M = 5.82$ ($SD = 9.57$) with a maximum possible score of 72 whereas the sum of frequency for the new consequences list was $M = 11.83$ ($SD = 13.28$) with a maximum possible score of 88. With scores adjusted to a common metric, a repeated measures negative binomial analysis indicated consequences described by the new consequences list were experienced significantly more frequently than those on the RMPI ($Z = 7.19$, $p < .001$), suggesting some of the most frequently experienced negative effects of marijuana may not be captured by measures based on alcohol's effects and instead need to be generated specifically with marijuana in mind.

We also examined number of items endorsed and frequency of consequences on the new consequences list compared to the RMPI with respect to associations with marijuana use, assessed by number of days used in the past 30 (range = 1–30). Zero-truncated negative binomial models were used to examine associations between each scale and use independently and simultaneously. When examined independently, the number of items endorsed on the RMPI ($b = .139$, $se = .025$, $Z = 5.44$, $p < .001$, $IRR = 1.085$) and new consequences list ($b = .082$, $se = .017$, $Z = 4.86$, $p < .001$, $IRR = 1.149$) were both associated with past 30-day use. When entered simultaneously, the new consequences list was not uniquely associated with use ($b = .017$, $se = .024$, $Z = 0.72$, $p = .470$, $IRR = 1.018$) but RMPI was ($b = .120$, $se = .035$, $Z = 3.38$, $p = .001$, $IRR = 1.127$). When examined independently, the frequency of consequences endorsed (i.e., the sum of frequencies) on the RMPI ($b = .065$, $se = .013$, $Z = 5.02$, $p < .001$, $IRR = 1.067$) and new consequences list ($b = .051$, $se = .008$, $Z = 6.02$, $p < .001$, $IRR = 1.052$) were both associated with past 30-day

use. When entered simultaneously, the frequency of the new consequences list (i.e., the sum of frequencies) was uniquely associated with use ($b = .042$, $se = .011$, $Z = 3.69$, $p < .001$, $IRR = 1.043$) but RMPI frequency was not ($b = .018$, $se = .016$, $Z = 1.09$, $p = .276$, $IRR = 1.018$). In sum, endorsing more items on the RMPI, which tend to be endorsed at lower rates, was associated with greater use relative to the new consequences list. In contrast, the frequency of experiencing consequences described on the new consequences list was more strongly associated with use relative to the RMPI.

Study 3-Refinement of Marijuana Consequences Checklist and Convergent and Divergent Validity with Marijuana Use and Risk for Cannabis Use Disorder

The purpose of Study 3 was to further refine and finalize a new marijuana consequences measure using a community sample of young adults. This study enabled us to see whether the newly developed brief consequences list, now referred to as the Marijuana Consequences Checklist (MCC), was associated with marijuana use and a screening measure for CUD and also to see if the MCC accounted for unique variance in the screening measure for CUD above and beyond marijuana use. We also demonstrated divergent validity by examining correlations between marijuana consequences with alcohol use/consequences.

Participants and Procedures—Participants from Study 3 included 336 young adults (ages 18–23) who were participating in a larger longitudinal study of alcohol use and social role transitions. Recruitment strategies included online and print advertisements in local newspapers, Craigslist, and social networking sites, flyers around the local area, in-person tabling at community college events and outreach to community agencies. All recruitment materials had a URL to the study website and/or the study telephone number. Those interested were asked to complete a brief eligibility survey. Eligible participants for the larger study were 18–23 years old, resided within the greater Seattle metropolitan area (i.e., 60 miles from study offices), had a valid email address, reported drinking alcohol at least once in the last year, and were willing to come to the study office for an initial appointment for age verification, consent, and to complete a baseline assessment. Among the 779 young adults who completed the baseline survey, 55.3% (n = 431) did not report marijuana use in the past 30 days and 1.5% (n = 12) had missing values for marijuana use. The remaining 43.1% (n = 336) reported marijuana use in the past 30 days and were included in the current analyses. All procedures were approved by the university Institutional Review Board and a federal Certificate of Confidentiality was obtained. No adverse events were reported.

Participants had a mean age of 20.5 ($SD = 1.6$) and 49.1% were female. More than half (67.8%) identified as White/Caucasian, 13.2% Asian or South Asian, 11.1% more than one race, and the remaining 7.8% indicating another race. Less than 10% (8.4%) identified as Hispanic or Latino/Latina. About two-thirds were students at a 4-year or 2-year college.

Measures

Marijuana Consequences Checklist.: The 22 items described in Study 2 were assessed plus four items that were added after final review of the checklist and in consultation with the last author, as the consequences list from Study 2 did not have items assessing these types of consequences. Three of the added items were taken from the RMPI: "Caused shame or embarrassment to someone;" "Not able to do your homework, study for a test, or complete a work assignment;" and "Noticed a change in your personality." The fourth added item ("Got into legal trouble because of marijuana") was selected by the research team. The final checklist consisted of 26 items. Participants were asked, "How many times did these things happen to you while you were using marijuana (or because of your marijuana use) during the past 30 days?" using a response scale from 0 = "0 times" to 4 = "more than 10 times." Two summary scores were calculated: a sum of the frequency of the 26 items (Cronbach's α = .91; possible range 0–104) and a sum of dichotomized items coded "0" if the consequence did not occur and coded "1" if it occurred one or more times in the past 30 days (Cronbach's α = .86; possible range 0–26).

Marijuana use was assessed with three items, defining marijuana as "any form of the drug cannabis, including marijuana (weed, pot), hashish or kief and any method of use, including dried buds/flowers/leaves for smoking or in edibles, or hash oil." Participants reported: (1) the *number of days they used marijuana* in the past 30 days ranging from 0 to 30 days and (2) the *number of hours high from marijuana in a typical week* in the past 30 days, which was calculated using the 7-item Marijuana Diary Questionnaire (Lee et al. 2013); for each day of the week, participants responded on a 13-point scale ranging from 0 = "0 hours" to 12 = "12 or more hours" and the 7 days were summed to form a total score.

The *Cannabis Use Disorder Identification Test - Revised* (CUDIT-R) was used (Adamson et al., 2010). The CUDIT-R has documented reliability and validity in samples of young adults (Adamson et al. 2010). One item measured frequency of use from 0 = "never" to 4 = "4 or more times a week." Another item measured number of hours "stoned" on a typical day when using cannabis from 0 = "less than 1" to 4 = "7 or more." Five items measured how often the participant experienced problems (e.g., failed to do what was normally expected) from 0 = "never" to 4 = "daily or almost daily." The final item asked if the participant had ever thought about cutting down or stopping use of cannabis, with responses: 0 = "never," 1 = "yes, but not in the past year," and 3 = "yes, during the past year." A sum of the eight items was calculated.

Alcohol use was assessed with the Daily Drinking Questionnaire (Collins, Parks, & Marlatt 1985). Participants reported how much alcohol, on average, they consumed on each day of a typical week by providing the number of standard drinks. A sum score was calculated for the typical number of drinks per week. *Alcohol consequences* were measured with the 24-item Brief-YAACQ (Kahler, Strong, & Read 2005). Participants reported whether or not each of 24 consequences occurred in the past month, and a sum score was calculated.

Study 3 Results

Descriptive statistics were calculated for each of the 26 MCC items assessing marijuana consequences in the past 30 days (see Table 3). The median number of days participants used marijuana in the past 30 days was 4 days, and the median number of hours high in a typical week was 5 hours. Of the 26 different marijuana consequences assessed, participants experienced a mean of 7.63 consequences in the past 30 days (median = 7). As shown in Table 3, the most commonly experienced consequences in the past 30 days were: had the munchies, experienced dry mouth, had trouble concentrating or paying attention, acted foolish or goofy, and had trouble remembering things, each of which was reported by more than half of the sample.

Spearman correlations were computed among biological sex, age, the two measures of past 30-day marijuana use, CUDIT-R, and the two summary scores for the MCC (see Table 4). Being male was significantly and positively correlated with the two measures of marijuana use, CUDIT-R, and MCC (sum for frequency of occurrence). Age was not significantly correlated with marijuana use measures. The two summary scores (i.e., number of items and frequency) for the MCC were significantly and positively correlated with measures of marijuana use as well as the CUDIT-R, demonstrating good convergent validity. We also examined divergent validity by testing correlations between the MCC with alcohol use/consequences (n = 319 with available alcohol data). Divergent validity was demonstrated by low correlations between marijuana consequences with alcohol use (r = .16 for frequency of occurrence and r = .14 for number of items endorsed) and alcohol consequences (r = .21 for frequency of occurrence and r = .27 for number of items endorsed).

Hierarchical regression was used to determine whether the MCC was associated with CUDIT-R scores, above and beyond the number of days of marijuana use in the past 30 days. In Step 1, biological sex, age, and past 30-day use significantly predicted CUDIT-R scores (F[3, 332] = 90.01, p < .001, R^2 =.45, adjusted R^2 = .44). In Step 2, the MCC frequency score was added to the model (F[4, 331] = 144.72, p < .001, R^2 =.64, adjusted R^2 = .63). After adding the MCC frequency score, the change in R^2 was .19 (F[1, 331] = 170.77, p < .001). Similarly in a separate model, adding the MCC count score, the change in R^2 was .16 (F[1, 331] = 136.54, p < .001). In sum, both summary scores of the MCC accounted for unique variance in CUDIT-R scores, above and beyond biological sex, age, and marijuana use.

Overall Discussion

This research was motivated by the recognition that existing marijuana consequence measures based on alcohol consequences do not appear to capture many of the commonly reported perceived negative effects of marijuana that young adults report experiencing. Thus, existing measures have potentially limited utility in intervention efforts designed to provide relevant personalized feedback, as they may miss many experiences of young adults that might be relevant hooks for discussion. To address this need, we utilized data from three different studies of college students and young adults to: document user-identified negative consequences of marijuana use (Study 1), create a new list of marijuana consequences and identify areas not assessed in existing measures of marijuana consequences (Study 2), and

assess convergent and divergent validity between our newly created MCC and marijuana outcomes (Study 3).

We began with a qualitative examination of self-reported effects of marijuana that young adults consider “not so good” as a result of their marijuana use and identified a set of negative consequences of marijuana use that were commonly experienced by young adult marijuana users, ranged in frequency, and spanned various domains including physical, interpersonal, cognitive, and motivational (Study 1).

In Study 2, we found that our newly created list of marijuana consequences included several areas not assessed in other consequence measures based on measures of alcohol consequences (i.e., RMPI). The number of items endorsed and the frequency with which they were experienced were found to be positively associated with past month marijuana use. Further, the frequency of experiencing consequences on the new consequences list was more strongly associated with use relative to the RMPI.

In Study 3, we demonstrate that the newly developed MCC has good convergent and divergent validity. The MCC could be scored in two ways, by summing the total number of items endorsed or by adding the total frequency of endorsement across all items, with both showing positive associations with the CUDIT-R, a screener for cannabis use disorder, beyond a measure of marijuana use frequency.

Overall, findings document that young adults experience a wide range of negative effects from marijuana use and the MCC has utility for clinical interventions and research. Although there is some overlap or similarities in consequence items between the MCC, RMPI and MACQ, there are notable differences and MCC items are more frequently endorsed. Providing a relevant checklist of effects that more thoroughly captures experiences of young adults provides more content for use in clinical settings. We found a number of consequence items in our checklist not included in other measures that represent acute effects from marijuana such as experiencing dry mouth, having the munchies, feeling antisocial or intentionally avoiding others, feeling increased anxiety or worry, developing a cough or trouble breathing, noticing too much money spent on marijuana, and experiencing legal trouble. These acute effects could be important opportunities for discussion in interventions and could enhance the effectiveness of brief motivational interventions using personalized feedback to address unwanted effects of marijuana use.

The most frequently endorsed was marijuana’s impact on eating (i.e., “the munchies”) could be a potentially useful hook for PFIs. For example, many college students are increasingly mindful of watching what they eat, exercising, and having a positive body image and healthy life style; for those who are also using marijuana, there could be a discrepancy between these values and goals and their marijuana use. Inclusion of these effects in PFIs could increase discrepancies between lifestyle goals and marijuana use (e.g., “I worked out for an hour today, but undid that when I ate a whole box of cookies when I was high”) and promote change talk.

Other harms related to cognitive functioning were very noteworthy among young adults, including having trouble concentrating or paying attention and having troubles with

memory, yet do not appear on most measures of marijuana-related negative effects. With research clearly showing an association between marijuana use and more skipped classes, lower grade point average, and taking longer to graduate (e.g., Arria, Caldeira, Bugbee, Vincent, & O'Grady 2015), highlighting these connections can be important to legitimizing and validating help-seeking when students with marijuana use are struggling academically (Arria & Wagley 2019). Properly capturing the experiences of young adults who use marijuana, and, as Arria and Wagley (2019) encourage, publicizing the evidence for these experiences, can be part of campus-wide prevention and/or a strategic plan to addressing marijuana use.

Results should be viewed in light of certain limitations. The three samples were relatively small, ranging from 207–410; therefore, results should be interpreted with caution until subsequent studies can evaluate the utility of the MCC with larger samples. The MCC did not include abuse or dependence items. We considered including these items but ultimately chose to focus on indicators of acute consequences. Future research could explore how young adults evaluate acute consequences, as sometimes they are not perceived as negative. For instance, hangovers and blackouts are included on most alcohol consequences measures, yet for some young adults they are rated as neutral or positive (e.g., Mallett et al. 2008). Therefore, future research could ask individuals to rate each item, for example, using a scale like "not so good," "maybe not so good," and "good." While the MCC focused on effects typically viewed as more negative, future research could also include effects perceived as traditionally more positive. Within the context of MET/PFIs, both positive and negative experiences with marijuana are often discussed to create rapport and to understand the context of and reasons for use; thus, there may be utility in developing a checklist for perceived positive effects as well.

The stem of our original question in Study 1 (which affects subsequent studies since items were generated from there) may have missed some types of consequences because the measure specified "not-so-good" instead of some other more valenced wording that highlighted the acute consequences as memorable and negative. We compared the MCC to the RMPI for predicting marijuana frequency but could not compared these two instruments in their ability to predict CUDIT-R scores because all three measures were not simultaneously included in the assessment battery (no CUDIT-R in Study 2 and no RMPI in Study 3). Thus, additional research is needed comparing both instruments in terms of predictive validity. Furthermore, our samples were limited to young adults from Washington State and may not generalize, and all analyses presented were cross-sectional. There may be potential utility of understanding the impact of negative effects or consequences resulting from co-occurring and/or simultaneous use with alcohol and other drugs, as well as the epidemiological surveillance of certain consequences.

In sum, the present findings suggest there are a number of negative marijuana-related consequences young adults experience not assessed in currently published research. The newly-developed MCC offers additional acute negative effects specific to marijuana use that young adults may experience. Therefore, it would be a good candidate for use in brief motivational interventions and as a supplement to other indices, such as the RMPI, in clinical assessments and research studies.

Funding:

Data collection and manuscript preparation were supported by grants from the National Institute on Drug Abuse (R21DA025833, PI: Lee) and the National Institute on Alcohol Abuse and Alcoholism (R01AA022087, PI: Lee; R01AA012547, PI: Larimer). Manuscript preparation was also supported by grant R01AA025037 (MPI: Lee & Patrick) and grant F32AA025263 (PI: Cadigan). The content of this manuscript is solely the responsibility of the author(s) and does not necessarily represent the official views of the NIDA, NIAAA, or the National Institutes of Health.

REFERENCES

Adamson SJ, Kay-Lambkin FJ, Baker AL, Lewin TJ, Thornton L, Kelly BJ, and Sellman JD. (2010). An improved brief measure of cannabis misuse: The Cannabis Use Disorders Identification Test - Revised (CUDIT-R). Drug and Alcohol Dependence, 110, 137–143. [PubMed: 20347232]

Arria AM, Caldeira KM, Bugbee BA, Vincent KB, & O'Grady KE (2015). The academic consequences of marijuana use during college. Psychology of Addictive Behaviors, 29, 564–575. [PubMed: 26237288]

Arria A, & Wagley G (2019). Addressing college drinking and drug use: A primer for trustees, administrators, and alumni. American Council of Trustees and Alumni and University of Maryland School of Public Health.

Collins RL, Parks GA, & Marlatt GA (1985). Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. Journal of Consulting and Clinical Psychology, 53, 189–200. [PubMed: 3998247]

Esposito-Smythers C, Spirito A, Kahler CW, Hunt J, & Monti P (2011). Treatment of co-occurring substance abuse and suicidality among adolescents: a randomized trial. Journal of Consulting and Clinical Psychology, 79, 728–739. [PubMed: 22004303]

Johnson V, & White HR (1989). An investigation of factors related to intoxicated driving behaviors among youth. Journal of Studies on Alcohol, 50, 320–330. [PubMed: 2787875]

Kahler CW, Strong DR, & Read JP (2005). Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: The Brief Young Adult Alcohol Consequences Questionnaire. Alcoholism: Clinical & Experimental Research, 29(7), 1180–1189.

Knapp AA, Babbin SF, Budney AJ, Walker DD, Stephens RS, Scherer EA, & Stanger C (2018). Psychometric assessment of the marijuana adolescent problem inventory. Addictive Behaviors, 79, 113–119. [PubMed: 29288984]

Lee CM, Kilmer JR, Neighbors C, Atkins DC, Zheng C, Walker DD, & Larimer ME (2013). Indicated prevention for college student marijuana use: A randomized controlled trial. Journal of Consulting and Clinical Psychology, 81, 702–709. [PubMed: 23750464]

Lee CM, Neighbors C, Hendershot CS, & Grossbard JR (2009). Development and preliminary validation of a Comprehensive Marijuana Motives Questionnaire. Journal of Studies on Alcohol and Drugs, 70, 279–287. [PubMed: 19261240]

Lee CM, Neighbors C, Kilmer JR, & Larimer ME (2010). A brief, web-based personalized feedback selective intervention for college student marijuana use: a randomized clinical trial. Psychology of Addictive Behaviors, 24, 265–273 [PubMed: 20565152]

Lipari RN, Park-Lee E, and Van Horn S (2016). America's need for and receipt of substance use treatment in 2015. The CBHSQ Report: September 29, 2016. Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, Rockville, MD.

Miller WR & Rollnick S (2013). Motivational interviewing: Helping people change (3rd ed.). New York: Guilford Press.

Neighbors C, Geisner IM, & Lee CM (2008). Perceived marijuana norms and social expectancies among entering college student marijuana users. Psychology of Addictive Behaviors, 22, 433–438. [PubMed: 18778137]

Read JP, Kahler CW, Strong DR, & Colder CR (2006). Development and preliminary validation of the young adult alcohol consequences questionnaire. Journal of Studies on Alcohol, 67, 169–177. [PubMed: 16536141]

Schulenberg JE, Johnston LD, O'Malley PM, Bachman JG, Miech RA, & Patrick ME (2018). Monitoring the Future national survey results on drug use, 1975–2017: Volume II, college students and adults ages 19–55. Ann Arbor: Institute for Social Research, The University of Michigan, 454 pp.

Simons JS, & Carey KB (2002). Risk and vulnerability for marijuana use problems: the role of affect dysregulation. Psychology of Addictive Behaviors, 16, 72–75. [PubMed: 11934090]

Simons JS, Dvorak RD, Merrill JE, & Read JP (2012). Dimensions and severity of marijuana consequences: Development and validation of the marijuana consequences questionnaire (MACQ). Addictive Behaviors, 37, 613–621. [PubMed: 22305645]

Simons JS, Gaher RM, Correia CJ, Hansen CL, & Christopher MS (2005). An affective-motivational model of marijuana and alcohol problems among college students. Psychology of Addictive Behaviors, 19, 326–334. [PubMed: 16187813]

Volkow ND, Baler RD, Compton WM, & Weiss SRB (2014). Adverse health effects of marijuana use. The New England Journal of Medicine, 370, 2219–2227. [PubMed: 24897085]

Walker DD, Stephens R, Roffman R, DeMarce J, Lozano B, Towe S, & Berg B (2011). Randomized controlled trial of motivational enhancement therapy with nontreatment-seeking adolescent cannabis users: a further test of the teen marijuana check-up. Psychology of Addictive Behaviors, 25, 474–484. [PubMed: 21688877]

White HR & Labouvie EW (1989). Towards the assessment of adolescent problem drinking. Journal of Studies on Alcohol, 50, 30–37. [PubMed: 2927120]

White HR, Labouvie EW, & Papadaratsakis V (2005). Changes in substance use during the transition to adulthood: A comparison of college students and their noncollege age peers. Journal of Drug Issues, 35(2), 281–306.

Table 1

Study 1 - Percent endorsement of open-ended self-reported negative marijuana-related consequences (Grouped by general topic)

	%
COGNITIVE ISSUES	
Impaired cognitive abilities, attention, concentration	7.4%
Memory problems	5.6%
Impaired or poor decision making	2.1%
PRODUCTIVITY/NOT GETTING THINGS DONE/IMPACT TO WORK OR SCHOOL	
General apathy, low productivity or motivation, boredom	7.7%
Not getting things done	4.2%
Time-related (e.g., things taking longer, poor time management)	2.4%
Work or school impacts or consequences	0.9%
SOCIALIZING/SOCIAL SITUATIONS/SOCIAL IMPRESSIONS	
Increased antisocial behavior or social awkwardness	4.4%
Relationships	3.4%
Bad breath, appearance of being high or stoned	0.9%
UNWANTED/UNHELPFUL MOODS	
Negative mood or feelings	3.2%
Paranoia	2.8%
Act foolishly	2.1%
Anxiety	1.8%
Panic attacks or “freaking out”	1.7%
ESSENTIALS: SLEEP/EATING ISSUES/MONEY	
Poor sleep or tired/fatigued	8.1%
Hungry or eating more	7.8%
Negative outcomes from eating (e.g., fat, eating until getting sick)	1.5%
Problems cooking or making food (e.g., burning food)	0.5%
Spending too much money	3.6%
PHYSICAL IMPACT; ISSUES RELATED TO DEPENDENCE/ABUSE/MISUSE; DAY AFTER FEELINGS	
Trouble with lungs, coughing, breathing	5.2%
Dry mouth or lip/throat issues	2.9%
Other physical effects not related to lungs, cough, or mouth	4.9%
Issues related to addiction or dependence	2.7%
Day after effects (e.g., difficulty getting up, oversleeping)	0.9%
UNWANTED OUTCOMES	
Bad or disappointing outcomes (e.g., breaking things, messing something up, unsafe situation, etc.)	2.1%
Legal problems or consequences (e.g., getting caught)	1.3%
Driving issues (including accidents and almost accidents)	1.1%
NOT REALLY A CONSEQUENCE or UNCLEAR/UNHELPFUL	
Positive effects	2.0%
Unclear, sarcastic comment, or unable to be interpreted	5.3%

Note. 805 consequences listed by 207 college students.

Table 2

Study 2: Endorsement of past 30 day new marijuana consequence items and the 18-item Rutgers Marijuana Problem Index

New marijuana consequences list	% (n)	RMPI	% (n)
Had the munchies	82.6% (338)	Noticed a change in your personality	36.9% (151)
Experienced dry mouth	66.4% (271)	Neglected your responsibilities	33.2% (136)
Acted foolish or goofy	53.9% (220)	Went to work or school high	31.2% (128)
Had trouble remembering things	50.6% (205)	Tried to control your marijuana use by trying to use only at certain times of the day or in certain places	29.5% (121)
Had trouble concentrating or paying attention	49.8% (202)	Felt that you needed more than you used to use in order to get the same effect	27.8% (114)
Had low motivation	48.2% (197)	Not able to do your homework, study for a test or complete a work assignment	27.6% (113)
Felt paranoid	36.5% (148)	Kept using marijuana when you promised yourself not to	23.0% (94)
Felt antisocial or intentionally avoided others	32.8% (134)	Felt that you had a problem with marijuana	19.1% (78)
Developed a cough or had trouble breathing	32.1% (131)	Missed out on other things because you spent too much money on marijuana	16.6% (68)
Had problems following through on things	28.7% (117)	Felt physically or psychologically dependent	16.4% (67)
Had trouble managing your time	26.2% (107)	Missed a day (or part of a day) of school or work	12.7% (52)
Felt increased anxiety or worry	26.2% (107)	Caused shame or embarrassment to someone	10.5% (43)
Spent too much money on marijuana	20.6% (84)	Was told by a friend, relative, or neighbor to stop or cut down your marijuana use	10.3% (42)
Felt down about myself	20.1% (82)	Suddenly found yourself in a place that you could not remember getting to	9.8% (40)
Made decisions later you regretted	17.9% (73)	Got into fights, acted bad, or did mean things	9.0% (37)
Felt dizzy or sick	17.0% (69)	Had withdrawal symptoms, that is, felt sick because you stopped or cut down on marijuana	9.0% (37)
Had trouble sleeping	15.9% (65)	Passed out or fainted suddenly	8.3% (34)
Worried about being addicted to marijuana	15.4% (63)	Friends, neighbors, or relatives avoided you	8.0% (33)
Had your driving affected after using marijuana	13.5% (55)		
Had a panic or anxiety attack	12.3% (50)		
Had relationships with friends, partners, or family impacted negatively	11.0% (45)		
Been in trouble with your school or your employer	6.1% (25)		

Note. Ns for new marijuana consequence list range from 405 to 409. Ns for RMPI range from 408 to 410.

Table 3

Study 3: Item-level descriptive statistics on Marijuana Consequences Checklist experienced in the past 30 days.

Item	% sample reported 1+ times	Mean (SD)	Median	Range
Had the munchies	83.9	1.82 (1.37)	1	0–4
Experienced dry mouth	68.8	1.38 (1.34)	1	0–4
Had trouble concentrating or paying attention	62.5	1.01 (1.06)	1	0–4
Acted foolish or goofy	61.9	1.05 (1.15)	1	0–4
Had trouble remembering things	57.4	0.96 (1.11)	1	0–4
Had low motivation	46.4	0.80 (1.11)	0	0–4
Felt antisocial or intentionally avoided others	41.1	0.65 (0.96)	0	0–4
Had problems following through on things.	36.0	0.59 (0.96)	0	0–4
Felt paranoid	36.0	0.46 (0.69)	0	0–4
Felt increased anxiety or worry	33.6	0.49 (0.80)	0	0–4
Developed a cough or had trouble breathing	307	0.47 (0.85)	0	0–4
Had trouble managing your time	307	0.50 (0.89)	0	0–4
Noticed a change in your personality	27.7	0.40 (0.79)	0	0–4
Felt down about yourself	26.2	0.37 (0.73)	0	0–4
Not able to do your homework, study for a test, or complete a work assignment	18.8	0.25 (0.59)	0	0–4
Felt dizzy or sick	17.9	0.20 (0.47)	0	0–3
Spent too much money on marijuana	17.6	0.30 (0.76)	0	0–4
Had trouble sleeping	15.5	0.27 (0.77)	0	0–4
Made decisions you later regretted	13.7	0.18 (0.53)	0	0–4
Worried about being addicted to marijuana	11.3	0.18 (0.61)	0	0–4
Had relationships with friends, partners, or family impacted negatively	7.7	0.12 (0.50)	0	0–4
Had your driving affected after using marijuana	6.9	0.08 (0.30)	0	0–2
Had a panic or anxiety attack	6.0	0.07 (0.31)	0	0–3
Caused shame or embarrassment to someone	3.9	0.04 (0.23)	0	0–2
Got in trouble with your school or your employer	0.9	0.01 (0.09)	0	0–1
Got into legal trouble because of marijuana	0.0	0.00 (0.00)	0	0

Note. N = 336. Participants were queried: “How many times did these things happen to you while you were using marijuana (or because of your marijuana use) during the past 30 days?” Response options range from 0 = “0 times” to 4 = “More than 10 times.”

Table 4

Study 3: Spearman correlations and descriptive statistics for demographics, marijuana use, and marijuana consequences

	1. Male	2. Age	3. # days	4. # hours per week	5. CUDIT-R	6. MCC (sum using frequency occurrence)	7. MCC (sum of # items endorsed)
1. Male sex							
2. Age	−0.06						
3. # days used marijuana past 30 days	0.18***	0.04					
4. # hours high from marijuana in a typical week in past 30 days	0.19***	−0.01	0.84***				
5. CUDIT-R	0.18***	−0.04	0.70***	0.72***			
6. MCC (sum using frequency occurrence)	0.15**	0.00	0.67***	0.67***	0.72***		
7. MCC (sum # items endorsed)	0.11	0.02	0.47***	0.50***	0.62***	0.93***	
N	336	336	336	334	336	336	336
Mean (SD) or %	50.89%	20.53 (164)	10.46 (10.82)	13.00 (18.18)	8.74 (6.20)	12.65 (11.48)	7.63 (4.86)
Median	-	20	4	5	8	9	7
Range	0–1	18–23	1–30	0–84	0–30	0–69	0–20

Note. For marijuana consequences (sum using frequency of occurrence) response options ranged from 0 = “0 times” to 4 = “More than 10 times.”

* $p < .05$.

** $p < .01$.

*** $p < .001$.