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Young Adult Cannabis Users Report Greater Propensity for Risk-Taking Only in Non-Monetary Domains

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Abstract

BACKGROUND—Though substance use is often associated with elevated risk-taking in real-world scenarios, many risk-taking tasks in experimental psychology using financial gambles fail to find significant differences between individuals with substance use disorders and healthy controls. We assessed whether participants using marijuana would show a greater propensity for risk-taking in distinct domains including, but not limited to, financial risk-taking.

METHODS—In the current study, we assessed risk-taking in young adult (age 18–25) regular marijuana users and in non-using control participants using a domain-specific risk-taking self-report scale (DOSPERT) encompassing five domains of risk-taking (social, financial, recreational, health/safety, and ethical). We also measured behavioral risk-taking using a laboratory monetary risk-taking task.

RESULTS—Marijuana users and controls reported significant differences on the social, health/safety, and ethical risk-taking scales, but no differences in the propensity to take recreational or financial risks. Complementing the self-report finding, there were no differences between marijuana users and controls in their performance on the laboratory risk-taking task.

CONCLUSIONS—These findings suggest that financial risk-taking may be less sensitive than other domains of risk-taking in assessing differences in risky behavior between those who use marijuana and those who do not. In order to more consistently determine whether increased risk-taking is a factor in substance use, it may be necessary to use both monetary risk-taking tasks and complementary assessments of non-monetary-based risk-taking measures.

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Contributors

Jodi M. Gilman was primarily responsible for the design of the study, conducting the data analysis, and writing the first draft of the manuscript. Vanessa Calderon assisted with data collection and analysis. Max T. Curran was responsible for programming of tasks, and assisted with data analysis. A. Eden Evins provided assistance in study design, interpretation of findings and feedback on drafts of the manuscript. All authors have read and approve the final version of the manuscript.

Conflict of Interest

A. Eden Evins received grant support from Pfizer and Forum Pharmaceuticals in the past year. and consulting fees from Reckitt Benckiser Pharmaceuticals. No conflict declared for Jodi M. Gilman, Vanessa Calderon, and Max T. Curran.

Keywords

Risk-taking; substance use; marijuana; cannabis; decision-making

1. INTRODUCTION

Substance use disorder is characterized by an increased engagement in naturalistic risk-taking behavior, such that individuals continue to use a substance despite adverse consequences. Research on risk behavior has shown an association between substance use and self-reported engagement in risky behaviors, including extreme sports, delinquent and criminal behavior, and precocious sexual activity (Arnett et al., 1997; Zuckerman, 2007). However, many studies using traditional neuroeconomic tasks which assess monetary risk-taking fail to find differences between individuals who engage in substance use and non-using controls. In fact, in a recent systematic literature review of functional neuroimaging studies examining risk-related monetary decision making in individuals with substance use disorders, less than half of the cited studies reported behavioral differences between individuals with substance use disorders and control participants (Gowin et al., 2013).

Risk-taking is a broad concept that is often assumed to be a stable personality trait (Hansen, 2001). Neuro- and behavioral economists have developed models of risk-taking predominantly based on decision-making regarding monetary rewards, and these models often characterize individuals as either “risk-taking” or “risk-averse.” The standard microeconomic model of choice under risk, classical Expected Utility Theory, states that valuations of risk involve estimations of the reward magnitude and likelihood with which some outcome can be obtained (Bernoulli, 1958; von Neumann, 1944). Though Expected Utility Theory has proven to be a useful construct for predicting animal and human choices (Camerer, 1995), this model of risk-taking does not account for differences within independent domains of risk-taking across varied situations (Schoemaker, 1990). For example, laboratory studies have shown that people differ in the manner in which they make work-related versus personal decisions that involve risk and uncertainty (MacCrimmon, 1990). Differences have also been shown in propensity to take risks when individuals are asked to make decisions about personal versus company money, or about financial versus recreational risks (MacCrimmon, 1990). These studies question the assumption that risk attitude is a personality trait encompassing a single domain, and raise the question of whether risk-taking across multiple domains should be measured independently, particularly in clinical populations, where risk-taking in some domains may be abnormal while risk-taking in other domains may be intact.

Furthermore, neuroeconomic models of risk-taking have had limited success in differentiating substance-using from non-substance-using populations. In experimental psychology, a standard battery of gambling-type games is often used to measure risk-taking behavior in the laboratory, such as the Iowa gambling task (Bechara et al., 1994), Balloon analog risk task (BART; Lejuez et al., 2002), Wheel of fortune (Ernst et al., 2004), Game of chicken (Bjork et al., 2008), and Cambridge risk task (Rogers et al., 1999). In each of these tasks, participants are required to choose between “safe” and “risky” monetary gambles. Many studies fail to report performance differences between individuals with substance use

disorders and control participants (e.g., Acheson et al., 2009; Adinoff et al., 2003; Bjork et al., 2008; Bolla et al., 2003; Cousijn et al., 2013; Ersche et al., 2005; Tanabe et al., 2007; Vaidya et al., 2012); but see (Bolla et al., 2005; Fein et al., 2004; Fishbein et al., 2005; Lane et al., 2010). These mixed results in risk-taking behavior have been replicated by our own group, which investigated risk-taking behavior in treatment-seeking alcoholic patients compared to controls and found no behavioral differences (e.g., Gilman et al., 2014). These laboratory results conflict with epidemiological evidence of increased real life risk-taking in individuals with alcohol use disorders (e.g., increased aggression, criminal activities, risky sexual activity and unsafe driving; see Corte, 2005 for a review). While it is possible that common risk-taking tasks used in experimental psychology do not relate to real-world risk-taking, it is also possible that a single domain of risk taking, limited to monetary-based decisions, is not fully representative of the multiple domains of risk-related decision making.

Marijuana users in particular may show increased rates of risk-taking in specific domains. Chronic marijuana users show impairments relative to controls behavioral and cognitive processes, including response perseveration, adaptation, and flexibility decision making, using laboratory tests such as the Wisconsin Card Sort Task (WCST), the Stroop Test, and the Iowa Gambling Task (Bolla et al., 2002; Pope et al., 2003; Solowij et al., 2002; Whitlow et al., 2004), all of which may relate to increased risk-taking. Marijuana also disrupts processes involving learning and motivation (Lane et al., 2005, 2004; Paule et al., 1992), which may also affect propensity for risk-taking. Many of these cognitive processes appear to be related to deficiencies in mesolimbic and prefrontal regions of the brain, regions high in cannabinoid receptors (Quickfall and Crockford, 2006), the targets of delta-9-tetrahydrocannabinol (THC; the principle active constituent of marijuana). Indeed, adolescent marijuana users compared to non-users demonstrated greater rates of impulsive decision-making (Solowij et al., 2012) and higher levels of risky sexual behavior among young adult marijuana users (Schuster et al., 2012). It is not known whether marijuana users show increased rates of risk-taking across other domains.

In the current study, we assessed risk-taking in young adult (age 18–25) regular marijuana users and in non-using control participants using both a domain-specific risk-taking self-report scale (DOSPERT; Blais, 2006; Weber, 2002), and a laboratory risk-taking task (Lane and Cherek, 2000). The DOSPERT was developed to captures an individual's likelihood of engaging in hypothetical risk behaviors across five risk domains; financial, health, social, recreational, and ethical. The DOSPERT has been shown to have high reliability and consistency (Weber, 2002), and is associated with real-life risk-taking activities within a number of the same domains (Hanoch et al., 2006). Based on previous literature and our prior study, we hypothesized that monetary risk-taking would not be different between groups, but that marijuana users would score higher than controls in health/safety or ethical risk-taking domains that may be more relevant to drug-taking.

2. MATERIAL AND METHODS

2.1. Participants

Participants in this study were 70 young adults, age 18–25; 36 who regularly used marijuana, and 34 non-using controls. Marijuana users used marijuana at least once a week,

and were asked to refrain from using substances on the day of the study. Marijuana users completed a time-line follow-back (Sobell et al., 1986) asking them to indicate, for the past 90 days, the days that they smoked marijuana, along with how much they smoked (in joint equivalents) on any given occasion. Controls had used marijuana on less than 5 lifetime occasions, and had not used marijuana in the past 3 months. All participants also completed a time-line follow-back for alcohol use (Sobell et al., 1986). All participants were medically healthy, with no current psychiatric disorders (verified by the Structured Clinical Interview for DSM-IV (SCID; First, 2002) except for cannabis use disorders in the marijuana group. Participants were not excluded if they had used other illegal drugs in the past; however, they were excluded if they met abuse or dependence criteria for any drug, including alcohol and nicotine. Twelve marijuana users met DSM-IV criteria for marijuana abuse and two for marijuana dependence. Three marijuana users had past depression, and one control had past panic disorder. No participants were regular cigarette smokers; three marijuana participants reported smoking cigarettes in the past year (two smoked one cigarette per month, and one smoked one cigarette per week).

Before study procedures were initiated, we performed a qualitative urine drug screen (Medimpex United, Inc.) that tested for marijuana, amphetamines, methamphetamines, cocaine, and opiates, in order to ensure that no participant tested positive for any drug other than cannabis, and that no control participants tested positive for cannabis. Of 36 marijuana users, 25 tested positive for cannabis (approximately 70%), indicating recent use. No participant was visibly intoxicated during the study visit.

Participants completed a written, documented informed consent form prior to initiation of study procedures. All study procedures were approved by the Partners Human Research Committees.

2.2. Measures

Participants completed the Domain-Specific Risk-taking (DOSPERT) scale (Blais, 2006; Weber, 2002), a psychometric scale that assesses self-report of risk-taking in five content domains: social risk (e.g., disagreeing with a parent, wearing unconventional clothing), recreational risk (e.g., bungee jumping, downhill skiing), financial risk (investing and gambling risk), health/safety risk (e.g., engaging in unprotected sex, riding a bicycle without a helmet), and ethical risk (e.g., shoplifting, cheating on an exam). The questionnaire was completed twice by each participant, to measure two separate indices; the first asked participants to rate, on a scale of 1–5, their likelihood of engaging in each activity (risk *behavior*), and the second asked participants to rate, on a scale of 1–5, how risky they perceived each activity to be (risk *perception*).

Participants then performed a behavioral risk-taking task, a modified version of the Lane risk-taking task (Lane and Cherek, 2000), which has been described previously (Gilman et al., 2014, 2012). Briefly, at the beginning of each trial, participants were shown two white squares. One of the squares displayed a question mark beneath it. If the participant chose the square *without* the question mark (the “safe” square), they were guaranteed to win a low amount (from $0.05 – $0.25). If the participant chose the square *with* the question mark (the “risky” square), they could win $1.00 or $5.00, but they also risked losing $1.00 or $5.00.

Fifty percent of risky squares resulted in wins and 50 percent resulted in losses, but the participants had no knowledge of these probabilities. Wins and losses were pseudorandomized. Prior to the experiment, participants were read an instruction script describing the task, and performed practice trials. Participants played two 7-minute runs of the game, and the money from both runs was added together for total game earnings. Participants were informed that they would receive half of the money they won. Previous studies have shown that experiments using either fractions of rewards or hypothetical rewards yield valid data (e.g., Lagorio and Madden, 2005; Madden et al., 2004; Treadway et al., 2009).

Participants also completed a brief cognitive test battery that included measures with demonstrated validity, including a test of intellectual ability (Wechsler Test of Adult Reading (WTAR; Wechsler, 2001), and the Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995), a questionnaire designed to assess the personality/behavioral construct of impulsiveness.

2.3. Statistical Analyses

Risk scores in each of the five domains were initially analyzed using between-groups independent t-tests to test for differences between controls and marijuana participants. To adjust for the multiple comparisons on the set of means derived from the DOSPERT, we used a Bonferroni correction to correct for 10 t-tests (five for risk behaviors in the domains of Social, Health, Ethical, Recreational and Financial, and five for risk attitude in the domains of Social, Health, Ethical, Recreational and Financial). We therefore set our p value of significance at $p < 0.005$ ($p < 0.05/10$). Cohen's *d* values were calculated to measure effect sizes (Lakens, 2013). Next, in order to investigate whether other variables accounted for differences between groups, risk scores were entered as dependent variables into separate ANCOVAs (IBM SPSS version 19) which tested for an effect of group (marijuana users or controls), and controlled for age, sex, level of education, and impulsivity scores on the BIS (motor, nonplanning, and attentional subscales). Effect sizes and 95% confidence intervals were computed using Prism 6 software (GraphPad Software, Inc). Percentage of risky choices from the risk-taking task were also entered into between-groups independent t-tests and ANCOVAs.

To determine whether risk-taking in the five domains were independent from one another, we ran Pearson's correlations among these measures in each group. Additionally, performance on the behavioral risk-taking task was correlated with the five domains of the risk-taking self-report scale.

3. RESULTS

Marijuana users and controls did not differ in age, gender, estimated IQ, or alcohol use. Educational attainment was greater in controls (Table 1). Marijuana users reported greater impulsivity on the BIS motor and non-planning impulsivity subscales; the groups did not differ in attentional impulsivity.

3.1. Domain-specific Risk-attitude Scale

For self-report of risk behavior (how likely the individual reported they were to engage in risky activities in their lives), *t*-tests revealed that marijuana users scored higher than controls in social risk ($t = 3.26$, $p = 0.002$, Cohen's $d = 0.78$), health risk ($t = 6.37$, $p < 0.001$, Cohen's $d = 1.55$), and ethical risk ($t = 2.89$, $p = 0.005$, Cohen's $d = 0.70$). Each of these *p* values met significant thresholds when adjusted for multiple comparisons. There were no significant differences between the groups in self-report of recreational or financial risk-taking (figure 1).

Because two of the questions on the health risk behavior scale specifically asked about substance use (one about illegal drugs and one about alcohol), we recalculated the health risk scores after omitting these two questions in order to examine whether marijuana users scored higher on health-related risk independent of their substance use. When we recalculated these scores, we found that marijuana users still scored significantly higher on health risk than controls, though the effect size decreased ($t = 3.24$, $p = 0.002$, Cohen's $d = 0.79$).

ANCOVAs revealed that group (marijuana users or controls) remained a significant predictor of social, health, and ethical risk taking subscales even after controlling for age, sex, education, as well as self-report of motor, non-planning, and attentional impulsivity as assessed with the BIS. For social risk, group ($F = 6.14$, $p = 0.016$, $\eta p^2 = 0.09$) and motor impulsivity ($F = 7.15$, $p = 0.037$, $\eta p^2 = 0.10$) were significant predictors. For health/safety risk, group was the only significant predictor ($F = 26.94$, $p < 0.001$, $\eta p^2 = 0.30$). For ethical risk, group ($F = 4.56$, $p = 0.037$, $\eta p^2 = 0.07$), age ($F = 9.26$, $p = 0.003$, $\eta p^2 = 0.13$), and motor impulsivity ($F = 9.96$, $p = 0.002$, $\eta p^2 = 0.14$) were significant predictors. When we recalculated the health/safety scores omitting questions about substance use, group remained the only significant predictor ($F = 5.37$, $p = 0.02$, $\eta p^2 = 0.08$).

In Pearson's correlations among the five DOSPERT subscales in each group, the control group demonstrated significant correlations between scores on ethical risk behavior and risk behavior on all other domains (social, recreational, financial, and health, all $p < 0.05$). Marijuana users, in contrast, showed a significant correlation between ethical and health risk behavior ($p < 0.01$), but no other risk domains were correlated (Table 2).

For risk perception (how risky the participant reported they perceived each activity to be), *t*-tests revealed that marijuana users scored lower on perception of health/safety ($t = 2.25$, $p = 0.028$, Cohen's $d = 0.55$) and ethical ($t = 2.13$, $p = 0.036$, Cohen's $d = 0.52$) risk-taking than did controls. Though effect sizes were medium, these differences did not meet significance criteria when adjusted for multiple comparisons. These differences also did not remain significant when controlling for age, sex, education, and impulsivity, and none of these variables were significant predictors of risk perception.

Risk behavior and risk perception were inversely correlated for all domains in both groups (e.g. the more likely one was to engage in a risky behavior, the less risky that individual perceived the behavior to be) (all $p < 0.001$).

3.2. Risk-Taking Task

A subset of participants, 23 controls and 20 marijuana users, completed the risk-taking task. There were no significant differences between groups in the number of safe or risky choices ($F = 0.62$, $p = 0.44$, $\eta p^2 = 0.02$), and age, sex, and education did not predict risk-taking behavior. Controls won an average of $13.73, and marijuana users won an average of $13.54 ($p$ = ns). There were no differences in reaction time between groups, and no difference in reaction times between safe and risky choices.

3.3. Correlations between Risk-Taking Task Performance and Scores on Risk-attitude Scale

The percentage of risky choices observed on the risk taking task was positively associated with self reported financial risk behavior ($r^2 = 0.11$, $p = 0.03$), and with ethical risk behavior ($r^2 = 0.11$, $p = 0.03$), but was not associated with risk behavior in other domains. The percentage of risky choices was not associated with any risk perception domains.

4. DISCUSSION

Epidemiological research has shown an association between self-reported engagement in real-life risky behaviors, and SUD (Arnett et al., 1997; Zuckerman, 2007), and this association has also been shown in non-clinical substance-using populations such as marijuana users (Schuster et al., 2012). The current study is the first, to our knowledge, to use a multidimensional risk-taking scale in a marijuana-using population, and compare it to behavior in a laboratory risk-taking task. We demonstrated that marijuana users and controls reported significant differences in propensity to take risks in social, health, and ethical domains, but did not report differences in propensity for financial or recreational risk-taking. These groups also did not show behavioral differences in a monetary risk-taking task. This indicates that financial risk-taking may be less sensitive to differences between marijuana users and controls than other measures of risk behaviors.

These findings are intriguing because of mixed results reported with standard risk-taking tasks used in experimental psychology, which overwhelmingly use monetary gambles to measure propensity for risk-taking, with regard to risk-taking behavior observed in substance using groups (see Gowin et al., 2013). The findings are particularly mixed regarding risk-taking and marijuana use. In contrast with our task, which found no differences between marijuana users and controls in financial risk-taking (either self-report or in a behavioral task), other studies using laboratory-based monetary tasks do demonstrate greater risk taking behavior in marijuana users (e.g., Schuster et al., 2012, Hanson et al., 2014). Thus, there is a discrepancy between the observation that people engaging in substance use tend to take elevated risks in real-world settings (e.g., increased delinquent behavior, precocious sexual activity), versus mixed results in the literature regarding monetary risk-taking and substance use. Furthermore, many studies have failed to show changes in laboratory risk-taking tasks after treatment; it is possible that other domains of risk-taking may be more sensitive to treatment effects. These inconsistencies in the literature highlight the need for more robust measures of risk-taking that may be better able to clarify the relationship between risk-taking and substance use. Our results suggest that

neuroeconomic/monetary risk-taking tasks, which are used in the vast majority of risk-taking studies, should be supplemented by assessments of risk-taking domains that are related to drug use specifically, such as health/safety or ethical risk-taking.

As expected, self-reported financial risk-taking in the DOSPERT correlated with behavior on the monetary risk-taking task. More surprisingly, ethical risk scores also correlated with behavior in the risk-taking task. This indicates that monetary risk-taking may not be completely unrelated to other forms of risk-taking. Ethical risk emerged as an interesting construct that not only differentiated the groups, in that marijuana users scored higher than controls in the likelihood of engaging in ethically risky behavior, but also showed distinct relationships with the other risk measures. Ethical risk questions asked participants' about their likelihood of engaging in activities such as cheating on exams, plagiarizing, shoplifting, and illegally downloading software. Presumably, since the sale and purchase of recreational marijuana is still illegal in Massachusetts and federally, people regularly smoking marijuana may be more willing to engage in a range of other illicit or ethically questionable activities. In the current study, ethical risk scores in marijuana participants were related to their likelihood of engaging in health risks (unprotected sex, binge drinking, not wearing a seatbelt, etc.), but were independent of risk-taking scores in other domains, such as social, financial, and recreational risk, indicating that perhaps activities related to drug-taking are independent of other types of risky behaviors. In contrast, among control participants, the likelihood of engaging in ethically risky behaviors was highly related to all other domains of risk-taking. This could indicate that controls tend to make more cohesive choices surrounding risks in various domains, whereas people who use marijuana experience more dissonance between their drug use behavior and other risky choices.

For all risk domains, negative correlations were found between participants' likelihood of engaging in a behavior and the perception of how risky they considered the behavior to be. This finding in particularly intriguing in light of recent data showing that among high school students, as perceived risks of marijuana use have gone down, the amount of use has increased (Johnston, 2014). This finding may also be potentially important in prevention and/or treatment of substance use disorders, as educating individuals about the immediate and long-term risks of substance use may decrease their likelihood of use.

Though we did not detect a difference in financial risk-taking (self-reported or laboratory behavior), there were significant differences between marijuana users and controls in impulsivity scores on the BIS. In contrast to the mixed literature on risk-taking and substance use, literature strongly suggests an association between substance use and greater impulsiveness (see Grant and Chamberlain, 2014; Moeller et al., 2001 for reviews). Though impulsivity and risk-taking may be related, they are also dissociable, as risk-taking may be either impulsive (e.g., rapid, unplanned, lacking thought of potential consequences of the risky behavior), or deliberative (e.g., thought-out rationalizations of the risky behavior). Though the DOSPERT does not separate impulsive from deliberative risk-taking, it is likely that differences detected between groups represent differences in deliberative risk-taking. First, even when controlling for impulsivity, differences between groups in risk-taking remained significant. Second, the negative correlation between perception of risk and likelihood of engaging in the risky behavior suggests that the participants had thought

through potential consequences of the risky behaviors, and made a purposeful decision to engage in those behaviors. However, future studies can more definitively test whether substance use is more associated with either impulsive or deliberative risk-taking.

A primary limitation of this study is that because it is cross-sectional, it is impossible to show cause and effect. There are several plausible relationships between elevated risk-taking and marijuana use. First, it is possible that elevated risk-taking in certain domains was a pre-existing factor that led these individuals to become regular marijuana users. Second, risk-taking behaviors may have increased as these individuals used marijuana with greater frequency and became part of a sub-culture where this behavior was the norm. Third, these behaviors may have increased via a biological/neurochemical effect of cannabis itself on behavior. Longitudinal studies are needed to disentangle the temporal relationship between risk-taking behavior and marijuana use. In addition, with a trend toward legalization of marijuana and increased societal acceptance, it is possible that we will see a shift in the risk-taking behavior of individuals who will become regular users, such that more risk-averse individuals will be increasingly more likely to use marijuana.

It should also be noted that unlike most studies that are recruit clinical samples with formal SUD diagnoses, the population in this study was mixed; about a third endorsed SCID criteria for a cannabis use disorder, though all were regular users. In order to determine whether this population was different a clinical SUD population, we conducted additional analyses comparing lighter users (those reporting <5 joints per week) with heavier users (those reporting >10 joints/week), and also compared those with an SUD to those without an SUD. In these analyses, we found no significant differences between groups in either the Lane risk-taking task or the DOSPERT. This indicates that willingness to take risks, particularly social, health/safety, and ethical risks, may be a general characteristic of individuals regularly engaging in illegal drug use, regardless of whether their use is clinically significant. This also indicates that the lack of difference from healthy controls in self-reported financial risk-taking, and lack of difference in the Lane risk-taking task, may characterize both clinical SUD populations and regular users without SUDs.

In conclusion, this study indicates that monetary risk-taking tasks may not adequately capture all aspects of risk-taking, particularly those domains that may be compromised in substance using individuals. In order to more consistently determine whether increased risk-taking is indeed a risk factor for, or a consequence of, substance use, it may be necessary to use both monetary risk-taking tasks and complementary measures of non-monetary-based risk-taking measures.

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Highlights

- We assessed risk-taking in marijuana users using a multi-dimensional risk-taking scale and a monetary task.
- Marijuana users had higher scores than controls on social, health/safety, and ethical risk-taking.
- There were no differences in performance on the monetary risk-taking task.
- Financial risk-taking may be less affected than other risk domains in marijuana users.

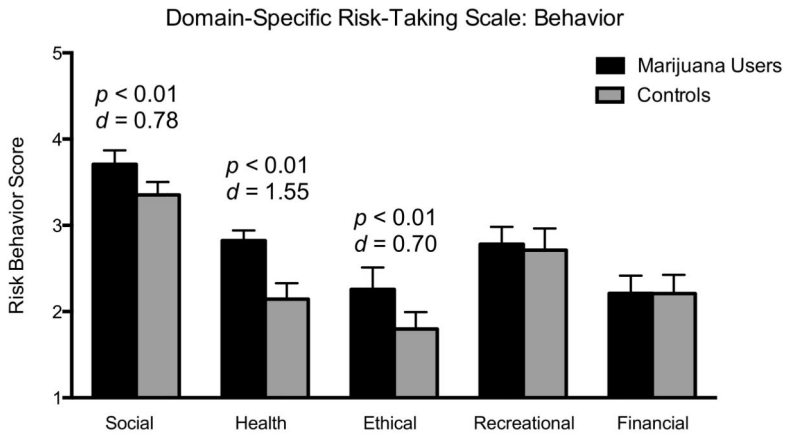

Figure 1.

DOSPERT Questionnaire. Risk scores in each of the five domains were analyzed using between-groups independent t-tests. Marijuana users reported greater likelihood of taking risks than controls in social, health, and ethical risk-taking domains. Bars represent 95% confidence intervals.

Table 1

Demographics of control and marijuana participants.

	Controls (n = 34)	Marijuana users (n = 36)	*p* values
Demographics			
Gender (% male)	39%	64%	0.10
Age	21.6 (2.1)	20.8 (2.2)	0.11
Education (years)	15.4 (1.9)	14.2 (1.7)	0.01*
WTAR	119.7 (5.2)	118.4 (9.1)	0.50
Impulsivity (BIS)			
Attentional	15.6 (4.0)	16.7 (3.7)	0.26
Motor	20.3 (3.5)	22.3 (3.6)	0.02*
Nonplanning	20.6 (4.0)	23.4 (4.1)	0.01*
Substance Use			
Alcohol Use (Drinks/week)	2.3 (1.9)	2.9 (2.4)	0.34
Marijuana Use (Joints/week)	N/A	5.5 (4.8)	N/A
Days since last marijuana use	N/A	3.1 (3.9)	N/A
Age of Onset of marijuana use (years)	N/A	16.6 (1.6)	N/A
Number with marijuana abuse/dependence	N/A	14 (39%)	N/A

*Significant difference between groups. BIS scores reported are raw scores.

Table 2

Pearson's Correlations Among Domains of Risk-Taking in controls and marijuana Participants

	Controls				
	Social	**Recreational**	**Financial**	**Health**	**Ethical**
Social	-	0.12	0.15	0.15	0.42*
Recreational		-	0.31	0.28	0.47**
Financial			-	0.08	0.50**
Health				-	0.48**
Ethical					-
	Marijuana users				
	Social	**Recreational**	**Financial**	**Health**	**Ethical**
Social	-	0.19	−0.26	0.05	0.24
Recreational		-	0.10	0.05	0.24
Financial			-	0.01	0.22
Health				-	0.44**
Ethical					

Values shown are Pearson r from correlations.

* $p < 0.05$,

** $p < 0.01$