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Short communication

## Decreased depression in marijuana users

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Over 4400 adult internet users completed The Center for Epidemiologic Studies Depression scale and measures of marijuana use. We employed an internet survey in an effort to recruit the most depressed and marijuana-involved participants, including those who might prove unwilling to travel to the laboratory or discuss drug use on the phone or in person. We compared those who consumed marijuana daily, once a week or less, or never in their lives. Despite comparable ranges of scores on all depression subscales, those who used once per week or less had less depressed mood, more positive affect, and fewer somatic complaints than non-users. Daily users reported less depressed mood and more positive affect than non-users. The three groups did not differ on interpersonal symptoms. Separate analyses for medical vs. recreational users demonstrated that medical users reported more depressed mood and more somatic complaints than recreational users, suggesting that medical conditions clearly contribute to depression scores and should be considered in studies of marijuana and depression. These data suggest that adults apparently do not increase their risk for depression by using marijuana.

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The media continues to report links between marijuana and depression. In a recent review, Degenhardt, Hall, and Lynskey (2003) identified a modest relationship only among problematic users. Many studies show no link between cannabis and depression despite appropriate statistical power, measurement, and design (Fergusson & Horwood, 1997; Fergusson, Lynskey, & Horwood, 1996; Green & Ritter, 2000; Kouri, Pope, Yurgelun-Todd, & Gruber, 1995; McGee, Williams, Poulton, & Moffitt, 2000; Musty & Kaback, 1995; Rowe, Fleming, Barry, Manwell, & Kropp, 1995). One neglected source

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of depression among marijuana users may stem from medical use. Those who use the plant to battle symptoms of illness may be depressed because of illness, not marijuana. With over 4400 participants, our study is the largest investigation of marijuana and depression to date. We use robust statistical methods specifically designed to maximize power with non-normal data, as drug use and depression are rarely normally distributed. Our study also contains a control group of both males and females who reported never using marijuana, which some other studies lack. We also assessed medical use, which other studies have not done.

## 1. Method

### 1.1. Participants

Approximately 9000 people replied to an email request sent to drug policy organizations, in an effort to target a range of cannabis users. The 4494 people who used daily, once a week or less, or never (2834 men (63%), 1660 women (37%), mean age=32.19, SD=12.92 years) had a median education of some college without a degree, and a median income of \$20,000 to \$40,000 per year. Respondents were primarily Caucasian (87%), but included African Americans (1%), Native Americans (3%), Asians (3%), Latinos (4%), and people of mixed race (2%). Those who used cannabis began at a mean age of 16.8 (SD=4.3).

### 1.2. Procedure

#### 1.2.1. Cannabis use

The daily users (DU) reported using 7 days/week ( $n=3323$ ). Those who reported using less than or equal to 1 day/week but had used within the last 30 days comprised the group who used once per week or less (WU;  $n=861$ ). Only those who had never used in their lifetimes were included in the group who had never used (NU;  $n=310$ ).

#### 1.2.2. Medical use

Medical users identified themselves and listed their ailments. The most common conditions were nausea, vomiting, cancer, attention deficit, and poor appetite.

#### 1.2.3. Depression

The Center for Epidemiologic Studies Depression scale (CES-D) contains 4 factors: depressed affect, positive affect, somatic and retarded activity, and interpersonal symptoms, each with good to excellent psychometric properties (Radloff, 1977).

## 2. Results

### 2.1. Comparing user groups by gender

Internal consistency ( $\alpha$ ) was 0.90 for the Total Score (TS), but ranged for subscales: Depressed Affect (DA; 0.84), Positive Affect (PA; 0.78), Somatic and Retarded Activity (SR; 0.61) and

Interpersonal Symptoms (IS; 0.63). Two (gender)  $\times$  3 (user group) ANOVAs were conducted, with subsequent post hoc bootstrap linear contrasts on the 20% trimmed means. This approach allows for maximum power given these deviant distributions (Wilcox, 2003). TS revealed a significant main effect for user group,  $F_t=8.83$ ,  $p<0.05$ . NUs had higher levels of depression than WUs,  $\psi=4.39$ ,  $p<0.001$ , and DUs,  $\psi=3.90$ ,  $p<0.001$ , who did not differ from each other,  $\psi=-1.51$ ,  $p=0.13$ . A robust effect size estimate (Wilcox, 2003) revealed that user group accounted for 16% of the winsorized variance in TS.

DA revealed a main effect for sex,  $F_t=10.38$ ,  $p<0.01$  [women ( $M_t=2.16$ ) reported more depressed mood than men ( $M_t=1.64$ )], and user group,  $F_t=5.20$ ,  $p<0.01$ . NUs reported more depression than WUs,  $\psi=3.20$ ,  $p=0.003$ , and DUs,  $\psi=2.91$ ,  $p<0.003$ , who did not differ  $\psi=-0.99$ ,  $p=0.33$ . User group accounted for 11% of the winsorized variance. PA showed a main effect for user group  $F_t=15.85$ ,  $p<0.001$ . NUs reported less positive affect than WUs,  $\psi=4.58$ ,  $p=0.001$ , and DUs,  $\psi=5.56$ ,  $p<0.001$ , who did not differ  $\psi=1.29$ ,  $p=0.19$ . User group accounted for 25% of the winsorized variance. SR reports showed a main effect for sex,  $F_t=18.22$ ,  $p<0.001$  [women ( $M_t=3.12$ ) had more complaints than men ( $M_t=2.57$ )] and user group  $F_t=6.95$ ,  $p<0.05$ . NUs had higher levels of somatic symptoms than WUs,  $\psi=2.34$ ,  $p=0.03$ , but not DUs,  $\psi=0.17$ ,  $p=0.88$ . DUs reported more somatic complaints than WUs,  $\psi=-3.66$ ,  $p=0.01$ . User group accounted for 5% of the winsorized variance. IS did not vary with use or gender. See Table 1.

## 2.2. Medical marijuana use and depression

A 3 (type of use: never used, medical use, recreational use)  $\times$  2 (gender: male, female) ANOVA on 20% trimmed means with follow-up bootstrap linear contrasts tested the role of medical use. TS revealed a main effect for group ( $F_t=26.62$ ,  $p<0.0001$ ). Medical users reported more depression than recreational users,  $\psi=5.18$ ,  $p<0.01$ . NUs also had more depression than recreational users,  $\psi=5.04$ ,  $p<0.01$ . DA revealed a main effect for group ( $F_t=14.80$ ,  $p=0.001$ ). Medical users scored higher than recreational users,  $\psi=4.34$ ,  $p<0.01$ , as did NUs,  $\psi=3.79$ ,  $p<0.01$ . PA revealed a main effect ( $F_t=18.31$ ,  $p<0.0001$ ), with both medical,  $\psi=4.54$ ,  $p<0.001$ , and recreational users,  $\psi=5.75$ ,  $p<0.001$ , reporting more positive affect than NUs. SR revealed main effects for group ( $F_t=21.20$ ,  $p<0.0001$ ) and gender ( $F_t=23.25$ ,  $p<0.0001$ ) indicating that women reported more somatic complaints than men. These main effects were qualified by an interaction,  $F_t=6.26$ ,  $p<0.05$ . Among men, medical users reported more somatic complaints than recreational users,  $\psi=4.37$ ,  $p<0.001$ . Among women,

Table 1

Trimmed mean CES-D scores and range (in parentheses) as a function of frequency of marijuana use and gender

CES-D subscale	Never used		Weekly or less		Daily use	
	Men	Women	Men	Women	Men	Women
Total	10.15 (0–49) <sup>a</sup>	11.49 (0–48) <sup>a</sup>	7.72 (0–42) <sup>b</sup>	8.44 (0–54) <sup>b</sup>	8.35 (0–55) <sup>a,b</sup>	8.83 (0–52) <sup>b</sup>
Depressed affect	2.08 (0–14) <sup>a</sup>	2.62 (0–15) <sup>a</sup>	1.34 (0–14) <sup>b</sup>	1.89 (0–15) <sup>a</sup>	1.50 (0–15) <sup>a,b</sup>	1.97 (0–15) <sup>a</sup>
Positive affect	2.09 (0–12) <sup>a</sup>	2.10 (0–12) <sup>a</sup>	1.99 (0–11) <sup>b</sup>	1.10 (0–12) <sup>b</sup>	1.14 (0–12) <sup>b</sup>	0.91 (0–12) <sup>b</sup>
Somatic activity	2.52 (0–15) <sup>a,b</sup>	3.47 (0–15) <sup>a</sup>	2.42 (0–13) <sup>b,c</sup>	2.73 (0–14) <sup>b</sup>	2.77 (0–15) <sup>a</sup>	3.17 (0–15) <sup>a</sup>
Interpersonal	0.38 (0–6) <sup>a</sup>	0.43 (0–6) <sup>a</sup>	0.36 (0–5) <sup>a</sup>	0.31 (0–6) <sup>a</sup>	0.45 (0–6) <sup>a</sup>	0.41 (0–6) <sup>a</sup>

Within rows and within gender, means with different superscripts are significantly ( $\alpha=0.05$ ) different from each other. Familywise error rate was controlled with Rom's (1990) method.

Table 2

Trimmed mean CES-D scores and range (in parentheses) as a function of gender and type of marijuana use

CES-D subscale	Never used		Medical		Recreational	
	Men	Women	Men	Women	Men	Women
Total	10.28 (0–49) <sup>a</sup>	11.38 (0–48) <sup>a</sup>	9.14 (0–55) <sup>a</sup>	10.25 (0–52) <sup>a</sup>	7.86 (0–51) <sup>b</sup>	8.14 (0–54) <sup>b</sup>
Depressed affect	2.11 (0–14) <sup>a</sup>	2.58 (0–15) <sup>a</sup>	1.74 (0–15) <sup>a</sup>	2.38 (0–15) <sup>a</sup>	1.32 (0–15) <sup>b</sup>	1.78 (0–15) <sup>b</sup>
Positive affect	2.13 (0–12) <sup>a</sup>	2.08 (0–12) <sup>a</sup>	1.23 (0–12) <sup>b</sup>	1.14 (0–12) <sup>b</sup>	1.12 (0–12) <sup>b</sup>	0.88 (0–12) <sup>b</sup>
Somatic activity	2.54 (0–15) <sup>a,b</sup>	3.44 (0–15) <sup>a</sup>	3.09 (0–15) <sup>b</sup>	3.74 (0–14) <sup>a</sup>	2.54 (0–15) <sup>a</sup>	2.78 (0–15) <sup>b</sup>
Interpersonal	0.40 (0–6) <sup>a</sup>	0.43 (0–6) <sup>a</sup>	0.46 (0–6) <sup>a</sup>	0.43 (0–6) <sup>a</sup>	0.42 (0–6) <sup>a</sup>	0.37 (0–6) <sup>a</sup>

Within rows and within gender, means with different superscripts are significantly ( $\alpha=0.05$ ) different from each other. Familywise error rate was controlled with Rom's (1990) method.

both NUs,  $\psi=2.93$ ,  $p<0.01$ , and medical users,  $\psi=5.14$ ,  $p<0.001$ , reported more complaints than recreational users. There were no significant effects on the IS. Data appear in Table 2.

### 3. Discussion

Those who consume marijuana occasionally or even daily have lower levels of depressive symptoms than those who have never tried marijuana. Specifically, weekly users had less depressed mood, more positive affect, and fewer somatic complaints than non-users. Daily users reported less depressed mood and more positive affect than non-users. The groups did not differ on interpersonal symptoms. Our results add to the growing body of literature on depression and marijuana and are generally consistent with a number of studies that have failed to confirm a relationship between the two after controlling for relevant variables.

This study was also the first to our knowledge to separately investigate depression in medical marijuana users relative to recreational users. Medical users reported more depressed mood and more somatic complaints than recreational users, but reported less negative affect and fewer somatic complaints (among women) than those who had never used marijuana. These latter results suggest that our findings should be even more robust among individuals without medical conditions. They also suggest that medical users may contribute to studies that find positive associations between marijuana use and depression. Further investigations on this topic will benefit by assessing medical conditions in addition to marijuana use and depressive symptoms. The potential for medical conditions to contribute to spurious links between marijuana and greater depression requires further investigation.

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