



Depression and marijuana use disorder symptoms among current marijuana users



Lisa Dierker^{a,*}, Arielle Selya^b, Stephanie Lanza^c, Runze Li^c, Jennifer Rose^a

^a Psychology Department, Wesleyan University, United States

^b Department of Population Health, University of North Dakota, United States

^c The Methodology Center, Penn State University, United States

HIGHLIGHTS

- Depression was positively associated with 8 National Household Survey of Drug Use and Health marijuana use disorder symptoms.
- Marijuana users with depression were consistently more likely to experience most marijuana use disorder symptoms.
- The relationship was consistent across all levels of marijuana use frequency from 1 day in the past month to daily use.

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ABSTRACT

Background: Depression is one of the most consistent risk factors implicated in both the course of escalating substance use behaviors and in the development of substance dependence symptoms, including those associated with marijuana use. In the present study, we evaluate if depression is associated with marijuana use disorder symptoms across the continuum of marijuana use frequency.

Methods: Data were drawn from six annual surveys of the National Survey of Drug Use and Health to include adults who reported using marijuana at least once in the past 30 days (N = 28,557).

Results: After statistical control for sociodemographic characteristics and substance use behaviors including marijuana use, alcohol use, smoking, and use of illicit substances other than marijuana, depression was positively and significantly associated with each of the marijuana use disorder symptoms as well as the symptom total score. Adult marijuana users with depression were consistently more likely to experience marijuana use disorder symptoms and a larger number of symptoms, with the magnitude and direction of the relationship generally consistent across all levels of marijuana use frequency from 1 day used in the past month to daily marijuana use.

Conclusions: Depression is a consistent risk factor for marijuana use disorder symptoms over and above exposure to marijuana suggesting that depressed individuals may represent an important subgroup in need of targeted substance use intervention.

1. Introduction

Depression is one of the most consistent risk factors implicated in both the course of escalating substance use behavior and in the development of dependence symptoms and chronic and/or heavy use. With recreational marijuana having recently been legalized in a growing number of U.S. states, an understanding of the relationship between depression, marijuana use and marijuana use disorders will assist in guiding both education and policy. Though often viewed as less addictive than other licit and illicit substances (Nutt, King, Saulsbury, & Blakemore, 2007), a diagnosis of marijuana abuse has

been estimated at approximately 4% among U.S. adults ages 24–28 years (Haberstick et al., 2014), and among those who have ever used marijuana, nearly one in ten develop dependence (Wagner & Anthony, 2002).

Evidence for the association between marijuana use and depression comes from cross-sectional and longitudinal investigations in which both depression symptoms (Crane, Langenecker, & Mermelstein, 2015; Hayatbakhsh et al., 2007; Horwood et al., 2012; Stapinski, Montgomery, & Araya, 2016; Troup, Andrzejewski, Braunwalder, & Torrence, 2016) and a diagnosis of major depression (Fairman & Anthony, 2012; Gage et al., 2015) have been shown to be

* Corresponding author at: Wesleyan University, Department of Psychology, 207 High Street, Middletown, CT 06459, United States.
E-mail address: ldierker@wesleyan.edu (L. Dierker).

associated with marijuana use, particularly heavy use (Rasic, Weerasinghe, Asbridge, & Langille, 2013), marijuana dependence (Mathews, Hall, & Gartner, 2011) and a decreased likelihood of successful quitting (Cornelius, Chung, Martin, Wood, & Clark, 2008; Shi, 2014). Though support for the order of onset between depression and marijuana use has been mixed with evidence for marijuana use being a risk factor for later depression (Lev-Ran et al., 2014), and depression a risk factor for later marijuana use (Stapinski et al., 2016), their co-occurrence has been consistently established. Based on a nationally representative sample of U.S. adults, individuals meeting criteria for marijuana use disorders within the past year had 6.4 times the odds of meeting criteria for major depression than those without a marijuana use disorder (Grant, 1995). Similarly, findings from the National Comorbidity Survey have shown greater frequency of marijuana use to be associated with a higher risk of having experienced a major depressive episode; with lifetime marijuana dependence associated with a 3.4 times increased risk of major depression (Chen, Wagner, & Anthony, 2002).

A discussion of the mechanism that may explain the association between depression and substance use disorder symptoms has often focused on the role of depression in elevating one's probability of use (i.e. increasing the likelihood of initiation, promoting earlier onset, and/or influencing the amount or persistence of use). Thus, the association is explained by the resulting physiological adaptations to the substance that directly lead to substance use disorder symptoms (Ouzir & Errami, 2016; Pomerleau, 1995). For example, the relationship between depression and substance use behavior has often been hypothesized to result from increased exposure to substances from the need to medicate the negative affective experiences associated with depression (Mirin & Weiss, 1991; Preisig, Fenton, Stevens, & Merikangas, 2001; Swendsen et al., 2000).

If however, depression is independently linked to substance use disorder symptoms, over and above level of exposure, this would support an alternate hypothesis that recognizes depression as a possible predisposing factor for the development of substance use disorder symptoms across a potentially wide range of substance use exposure (Dierker & Donny, 2008). First, symptoms and depression may involve overlapping neurobiological underpinnings. Evidence for this comes from research with adult animals and humans (for review see (Rao, 2006) that have implicated for example, the mesostriatal-mesocorticolimbic dopamine system, a central system in processing rewards, and one that is altered in both depression and substance use disorders. The association between depression and marijuana use disorder symptoms could also reflect latent genetic factors common to both disorders. Previous genetic studies have independently linked the DRD4 gene polymorphism to substance use and to internalizing disorders (Marques, Hutz, & Bau, 2006; Neville, Johnstone, & Walton, 2004). Further, in a study examining the associations between the DRD4 gene 48 bp VNTR polymorphism and comorbidity specifically between marijuana use frequency and depression, showed that risk for comorbidity was greater among individuals the $\geq 7R/\geq 7R$ genotype than those who carry the $< 7R/< 7R$ genotype (Bobadilla, Vaske, & Asberg, 2013).

Alternatively, the clustering of problems in individuals may not be specific to these two syndromes, but rather may be a broad vulnerability associated with risk for any form of psychopathology. That is, based on the Dunedin Multidisciplinary Health and Development Study, lifetime psychiatric disorders were best explained by a general psychopathology dimension with higher scores on this dimension associated with for example, more impairment, worse developmental histories, and more compromised early-life brain function (Caspi et al., 2014). Finally, animal studies have also shown both increases and decreases in responsiveness to substance use as a function of stress in rats possibly suggesting that internalizing symptoms such as depression may influence responses to substance use at consistent levels of exposure. For example, experimentally induced chronic stress (via twice-daily

injections or forced swim) was found to reduce the normal thermic (i.e., core temperature) response to nicotine (Flemmer & Dilsaver, 1989; Peck, Dilsaver, & McGee, 1991), whereas adolescent pre exposure to stress enhanced sensitization to the locomotor effects of nicotine in female rats (McCormick, Robarts, Gleason, & Kelsey, 2004).

To date epidemiological work evaluating the association between depression and substance use disorder symptoms above and beyond substance exposure is scarce. What evidence there is suggests that depression may be associated with substance use above and beyond exposure and across a range of substance use behaviors. Depression, for example, has been found to be associated with nicotine dependence both above and beyond cigarette smoking exposure and across a range of use from non-daily smoking to greater than a pack of cigarettes per day (Dierker & Donny, 2008). To our knowledge, no previous studies have examined these associations in the context of marijuana use. If depression predicts marijuana use disorder symptoms exclusively through increasing exposure to marijuana, intervention might best focus on minimizing use among individuals with depression. If, however, depression predicts marijuana use disorder symptoms regardless of level of exposure to marijuana, it would suggest that reducing exposure may be an insufficient approach. That is, even at low levels of use depression may increase risk for experiencing marijuana use disorder symptoms.

In the present study, we set out to evaluate whether the relationship between depression and marijuana dependence symptoms can be accounted for by marijuana exposure. Specifically, we examine the association between depression and marijuana use disorder symptoms in a nationally representative sample of marijuana users controlling for frequency of marijuana use. We ask: (1) Does depression uniquely predict marijuana use symptoms over and above frequency of use? and (2) Is the direction and strength of the relationship between depression and marijuana use symptoms consistent across levels of marijuana use frequency? We hypothesize that while frequency of marijuana use will be a significant predictor of marijuana use disorders symptoms, major depression will also be independently associated with individual marijuana use disorder symptoms and with the total number symptoms reported. With respect to the strength of the association between depression and marijuana use disorder symptoms across the continuum of marijuana use frequency from 1 day per month to daily use, we hypothesize that depression will be significantly associated with marijuana use disorder symptoms even among those reporting infrequent use. This would be evidence that the development of marijuana use dependence symptoms in the context of depression is not exclusively driven by heavy use.

2. Methods

2.1. Participants

Drawn from six annual NSDUH surveys from 2009 to 2014, the sample consisted of $N = 28,557$ individuals who (1) reported using marijuana at least once in the past month, and (2) were administered the adult depression module (i.e. participants age 18 and older). The NSDUH utilized multistage area probability methods to select a representative sample of the noninstitutionalized U.S. civilian population aged 12 or older. Persons living in households, military personnel living off bases, and residents of non-institutional group quarters including college dormitories, group homes, civilians dwellings on military installations, as well as persons with no permanent residence are included.

2.2. Measures

2.2.1. Depression

The NSDUH includes measurement of a major depressive episode (MDE) as defined by the Diagnostics Statistical Manual-5 (APA, 2013).

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