



Published in final edited form as:

*J Psychiatr Res.* 2017 June ; 89: 1–5. doi:10.1016/j.jpsychires.2017.01.002.

## Cannabis Use Disorder and Suicide Attempts in Iraq/ Afghanistan-Era Veterans

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### Abstract

The objective of the present research was to examine the association between lifetime cannabis use disorder (CUD), current suicidal ideation, and lifetime history of suicide attempts in a large and diverse sample of Iraq/Afghanistan-era veterans ( $N = 3,233$ ) using a battery of well-validated instruments. As expected, CUD was associated with both current suicidal ideation ( $OR = 1.683$ ,  $p = 0.008$ ) and lifetime suicide attempts ( $OR = 2.306$ ,  $p < 0.0001$ ), even after accounting for the effects of sex, posttraumatic stress disorder, depression, alcohol use disorder, non-cannabis drug use disorder, history of childhood sexual abuse, and combat exposure. Thus, the findings from the present study suggest that CUD may be a unique predictor of suicide attempts among Iraq/Afghanistan-era veterans; however, a significant limitation of the present study was its cross-sectional design. Prospective research aimed at understanding the complex relationship between CUD, mental health problems, and suicidal behavior among veterans is clearly needed at the present time.

### Keywords

suicide; suicide attempts; suicidal ideation; cannabis; marijuana; substance abuse; depression; posttraumatic stress disorder

### Introduction

It is estimated that between 125 and 227 million people use cannabis worldwide, making it the most widely used illicit drug in the world (United Nations, 2014; Hoch et al., 2015).

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Indeed, nearly 20 million Americans report that they have used cannabis in the past month (i.e., 7.5% of Americans 12 years or older; SAMHSA, 2014). Moreover, heavy cannabis use (i.e., cannabis use on 20 or more days during the past month) increased by nearly 60% in the U.S. from 2007 to 2013 (SAMHSA, 2014). Such findings are important because cannabis use has been associated with a wide range of health problems (e.g., Goldman et al., 2010; Joshi et al., 2014). To date, however, there has been only limited attention paid to the relationship between cannabis use and suicidal behavior.

A recent review and meta-analysis (Borges et al., 2016) on cannabis use and suicidal behavior (i.e., suicidal ideation and attempts) identified five studies examining the association between suicidal ideation and heavy cannabis use and six studies examining the association between suicide attempts and heavy cannabis use. Meta-analysis indicated that heavy cannabis use was likely to be associated with both suicidal ideation ( $OR = 2.53$ , 95% CI: 1.00 – 6.39) and suicide attempts ( $OR = 3.20$ , 95% CI: 1.72 – 5.94); however, the authors of this review noted the limited number of studies examined as well as several key issues to be addressed in future research, such as inclusion of more diverse samples, inclusion of patients with and without comorbid mental disorders, and use of clinical interviews to diagnose cannabis use disorders (CUD). Borges et al. (2016) also noted the importance of accounting for the effects of key risk factors (e.g., depression, other drug use problems, and alcohol misuse) that are likely to be associated with both cannabis use and suicidal behavior in statistical analyses.

### **Cannabis Use and Suicidal Behavior in Veterans**

Death by suicide and suicidal behavior are major concerns among veterans at the present time [Bullman and Kang, 1994; DeBeer et al., 2014; Kang and Bullman, 2008; Kaplan, Huguet, McFarland, & Newsom, 2007; Kimbrel et al., 2014, 2015, 2016a, 2016b; U.S. Department of Veterans Affairs (VA), 2016]. Indeed, the most recent statistics available from the Department of Veterans Affairs (2016) suggest that approximately 20 veterans die by suicide each day in the United States. Considerable evidence suggests that veterans with mental health disorders, such as PTSD and depression, are at particularly high risk for suicidal behavior and death by suicide (Bullman and Kang, 1994; DeBeer et al., 2014; Kang and Bullman, 2008; Kaplan et al., 2007; Kimbrel et al., 2014, 2016a; VA, 2016); however, there has been only limited research on the association between CUD and suicidal behavior among veterans to date. In fact, we are aware of only one other study that has examined the association between CUD and suicide attempts in veterans. Specifically, Kimbrel and colleagues (in press) recently reported that CUD was significantly associated with suicide attempts ( $OR=3.10$ ,  $p=0.045$ ) in a sample of 292 Iraq/Afghanistan-era veterans after adjusting for a wide range of covariates, including PTSD, depression, alcohol use disorder, and non-cannabis drug use disorder. This finding is highly consistent with prior research among civilians (e.g., Borges et al., 2016) and suggests that CUD may also increase veterans' risk for self-injurious behavior; however, this finding has not yet been replicated in an independent sample of veterans.

## Study Objective and Hypothesis

The objective of the present study was to attempt to replicate Kimbrel and colleagues' (in press) recent finding that lifetime CUD is associated with increased risk for suicidal behavior in a large and diverse sample of Iraq/Afghanistan-era veterans. Consistent with the findings of Borges et al. (2016) and Kimbrel et al. (in press), we hypothesized that CUD would be significantly associated with both current suicidal ideation and lifetime history of suicide attempts in this sample of Iraq/Afghanistan-era veterans, even after accounting for established predictors of suicidal behavior among veterans, including sex, PTSD, depression, alcohol use disorder, non-cannabis drug use disorder, history of childhood sexual abuse, and combat exposure (Ashrafioun et al., 2016; Kimbrel et al., 2014, 2015, 2016a, 2016b, in press; Maguen et al., 2015).

## Materials and Methods

### Participants and Procedures

Participants included 3,233 Iraq/Afghanistan-era veterans who took part in a cross-sectional, multi-site study conducted by the Department of Veterans Affairs' (VA) VISN 6 Mid-Atlantic Mental Illness, Research, Education and Clinic Center (MIRECC). Procedures for this study have been fully described elsewhere (Ashley-Koch et al., 2015; Calhoun et al., 2008; Guerra et al., 2011; Kimbrel et al., 2014). To be eligible for the study, participants had to have served in the United States military after September 11, 2001. Recruitment for this study began in 2005 and is ongoing. Most (78.7%;  $n = 2,544$ ), but not all, participants reported deployments to one or more warzones. The most common warzone participants had been deployed to was Iraq (59.3%;  $n = 1918$ ). On average, participants had been deployed 1.5 ( $SD = 1.3$ ) times during their military service. The vast majority of participants (~90%) were enrolled at one of the four VA Medical Centers. The study protocol was approved by the local institutional review boards at each participating site. All participants provided written informed consent prior to enrollment. Study procedures primarily involved completion of a clinical interview and a battery of self-report questionnaires. Sample characteristics are provided in Table 1.

### Measures

The Structured Clinical Interview for DSM-IV Disorders (SCID; First et al., 1994) was used to diagnose lifetime psychiatric disorders based on DSM-IV criteria. The present analyses focused on lifetime psychiatric diagnoses because of our interest in lifetime history of suicide attempts. All study interviewers received extensive training as well as on-going supervision from experienced clinicians. Reliability was excellent (Fleiss' kappa = 0.95) among study interviewers when scoring a series of seven SCID-based training videos. Substance dependence and abuse diagnoses were combined into a single substance use disorder variable for each substance. Thus, participants who met criteria for either cannabis dependence or cannabis abuse were coded as "1," whereas participants who had never met criteria for either disorder were categorized as "0." Alcohol and non-cannabis drug use disorders were coded similarly. History of childhood sexual abuse was assessed with the Traumatic Life Events Questionnaire (TLEQ; Kubany et al., 2000). Combat exposure was assessed with the Combat Exposure Scale (CES; Keane et al., 1989). Current suicidal

ideation and lifetime history of suicide attempts were assessed with the Beck Scale for Suicide Ideation (BSS; Beck & Steer, 1991), which has demonstrated reliability and validity in previous research (Brown et al., 2000), including studies of suicidal behavior in Iraq/Afghanistan-era veterans (DeBeer et al., 2014; Guerra et al., 2011; Kimbrel et al., 2014). Scores of 3 or higher on the BSS have been prospectively associated with increased risk for death by suicide (Brown et al., 2000). Therefore, scores of 3 or more on the BSS were operationalized as a clinically significant level of current suicidal ideation and were scored as “1”, whereas scores of 0-2 were scored as “0”, reflecting an absence of clinically significant ideation at the time of the assessment. Suicide attempts were also dichotomized such that a lifetime history of 1 or more suicide attempts was coded as “1”, whereas no lifetime history of suicide attempts was coded as “0”.

### Data Analysis Plan

Chi-square tests were used to examine bivariate associations between CUD and suicidal behavior (i.e., current suicidal ideation and lifetime suicide attempts). Logistic regression was used to assess the relationship between lifetime history of CUD and suicidal behavior. Both adjusted and unadjusted models were conducted. Sex (male=0; female=1), lifetime PTSD (not present = 0; present = 1), lifetime depression (not present = 0; present = 1), lifetime alcohol use disorder (not present = 0; present = 1), lifetime non-cannabis drug use disorder (not present = 0; present = 1), history of childhood sexual abuse (not present = 0; present = 1), and combat exposure (continuous) were included in the adjusted models based on prior research demonstrating significant associations between these variables and suicidal behavior in veterans (e.g., Ashrafioun et al., 2016; Kimbrel et al., 2014, 2015, 2016a, 2016b; Maguen et al., 2015).

### Results

CUD was significantly associated with both current suicidal ideation [ $\chi^2(1)=14.695$ ,  $p < 0.001$ ] and lifetime history of suicide attempts [ $\chi^2(1)=45.053$ ,  $p < 0.001$ ] at the bivariate level (Figure 1). Unadjusted logistic regression models revealed that veterans with a lifetime history of CUD had 1.921 times the odds (95% CI: 1.369–2.696) of endorsing current suicidal ideation and 2.831 times the odds (95% CI: 2.065–3.881) of having made a suicide attempt compared to veterans with no lifetime history of CUD. After adjusting for sex, PTSD, depression, alcohol use disorder, non-cannabis drug use disorder, history of childhood sexual abuse, and combat exposure (Table 1), CUD continued to be significantly associated with current suicidal ideation ( $OR = 1.683$ , 95% CI: 1.149–2.464,  $p = 0.008$ ) and lifetime suicide attempts ( $OR = 2.306$ , 95% CI: 1.591–3.343,  $p < 0.0001$ ).

### Discussion

According to Bonn-Miller and colleagues (2012), rates of CUD diagnoses have increased by more than 50% among veterans receiving care from the Veterans Affairs (VA) Health Care System between 2002 and 2009. Such findings are critically important, as the present research provided further evidence that CUD may be a unique predictor of suicide attempts among veterans. Importantly, the present research begins to address some of the limitations in the extant literature by examining a large and diverse group of veterans with a relatively

high rate of current suicidal ideation (9.9%) and lifetime history of suicide attempts (9.0%). An additional strength of the present study was the use of diagnostic interviews to assess CUD as well as relevant comorbid disorders that might also influence veterans' risk for suicidal behavior, including PTSD, depression, alcohol use disorder, and non-cannabis drug use disorders.

As noted by Borges and colleagues (2016), few studies have evaluated the relationship between cannabis abuse/dependence and suicide attempts (e.g., Bovasso, 2001; Beautrais et al., 1999). Moreover, there has been only one previous study of CUD and suicide attempts among veterans (Kimbrel et al., in press), despite the fact that veterans are known to be at elevated risk for suicidal behavior (e.g., U.S. Department of Veterans Affairs, 2016). Consistent with prior research (e.g., Borges et al., 2016; Kimbrel et al., in press), the findings from the present study suggest that CUD may be a unique predictor of suicide attempts among veterans, even after a wide array of relevant covariates are considered.

### Clinical Implications

The present findings have a number of implications for clinicians who work with veterans, as cannabis use is strongly associated with mental health problems within this population (Boden et al., 2013; Cheung et al., 2010; Hall et al., 2004). For example, Boden and colleagues (2013) found that psychiatric symptoms (e.g., PTSD, depression, anxiety, insomnia) were the most common reason that veterans provided for using cannabis. Moreover, medicinal use of cannabis has been legalized in many U.S. states, with multiple states listing PTSD as an approved condition. Paradoxically, the present findings suggest the possibility that chronic cannabis use could actually increase risk for suicidal behavior among veterans with mental health problems, a group known to already be at elevated risk (e.g., Bullman and Kang, 1994; Kimbrel et al., 2014, 2016a; U.S. Department of Veterans Affairs, 2016). Unfortunately, due to the cross-sectional nature of the present findings, we are only able to speculate on this important issue at the present time. Thus, further research is needed to determine if CUD prospectively predicts suicide attempts among veterans above and beyond the risks associated with other types of psychiatric disorders. One particularly interesting approach to collecting this type of data would involve collecting data on suicidal behavior before, during, and after CUD treatment to determine if successfully quitting cannabis leads to clinically meaningful reductions in suicidal ideation and suicide attempts during long-term follow-ups. Additional research aimed at increasing understanding of the potential mechanisms through which CUD might increase veterans' risk for suicidal behavior is also needed at the present time.

### Study Limitations

Although the present sample was relatively large ( $N = 3,233$ ), even larger sample sizes are optimal for research on behaviors as rare as suicide attempts. In addition, because the sample was a convenience sample of Iraq/Afghanistan veterans that was not randomly selected from the larger population, the present findings may not generalize to the larger population of Iraq/Afghanistan-era veterans or to veterans from other eras. Finally, the most significant limitations of the present research were use of a cross-sectional design and failure to assess the specific dates of participants' lifetime suicide attempts. As a result of these study

limitations, we were unable to determine if the onset of CUD temporally preceded veterans' suicide attempts.

## Conclusions

In sum, the findings from the present study suggest that CUD may be uniquely associated with suicide attempts in veterans, even after a wide array of relevant covariates are considered. This finding is highly significant given the high rate of suicidal behavior observed among veterans with mental health disorders as well as the increasing rate of CUD observed among veterans in recent years. Additional research aimed at understanding the complex relationship between CUD, other mental health problems, and suicidal behavior is needed at the present time.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

### Role of the Funding Source

This project was supported in part by the Department of Veterans Affairs' (VA) Mid-Atlantic Mental Illness Research, Education and Clinical Center (MIRECC) of the VA Office of Mental Health Services, the VA VISN 6 Mid-Atlantic Healthcare Network, and the Research and Development and Mental Health Services of the Durham VA Medical Center. Drs. Kimbrel and Dedert were supported by Career Development Awards #IK2CX000525 and #IK2CX000718, respectively, from the Clinical Science Research and Development (CSR&D) Service of the VA Office of Research and Development (ORD). Drs. Van Voorhees and Naylor were supported by Career Development Awards #5IK2RX001298 and #1IK2RX000908, respectively, from the Rehabilitation Research and Development (RR&D) of the VA Office of Research and Development (ORD). Dr. Beckham was supported by a Research Career Scientist Award (#11S-RCS-009) from CSR&D. VA CSR&D and RR&D played no role in study design, data collection, data analysis, manuscript preparation, or the decision to submit this article for publication. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the VA or the United States government.

The VA Mid-Atlantic Mental Illness Research, Education, and Clinical Center Workgroup includes John A. Fairbank, Kimberly T. Green, Robin A. Hurley, Angela C. Kirby, Jason D. Kilts, Christine E. Marx, Gregory McCarthy, Scott D. McDonald, Marinell Miller-Mumford, Scott D. Moore, Rajendra A. Morey, Treven C. Pickett, Jared Rowland, Jennifer J. Runnals, Cindy Swinkels, Steven T. Szabo, Katherine H. Taber, Larry A. Tupler, Richard D. Weiner, and Ruth Yoash-Gantz.

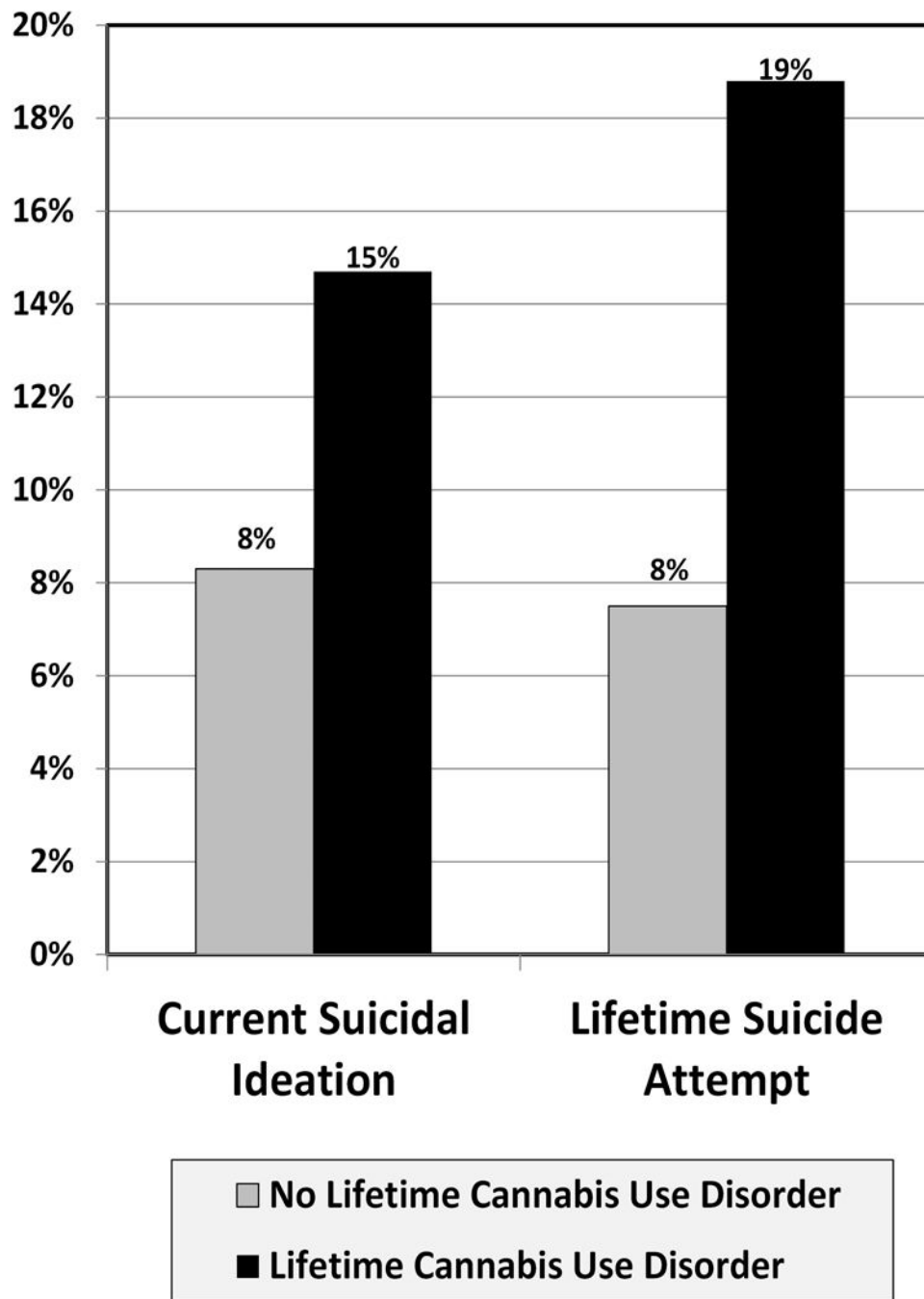
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**Figure 1.**  
 Bivariate Association between Lifetime Cannabis Use Disorder and Current Suicidal Ideation and Lifetime History of Suicide Attempts.

**Table 1**

## Participant Characteristics

		%	N
Gender	Male	79.7%	2,577
	Female	20.3%	655
Race	White	48.7%	1575
	Black	48.3%	1560
	American Indian	2.1%	68
	Asian	1.3%	43
	Pacific Islander	0.5%	17
Ethnicity	Non-Hispanic	93.1%	3011
	Hispanic	5.2%	168
Deployment History	Iraq	59.3%	1918
	Kuwait	29.1%	942
	Afghanistan	17.3%	559
Diagnostic History	Lifetime Depression	37.6%	1215
	Lifetime Alcohol Use Disorder	36.6%	1182
	Lifetime Posttraumatic Stress Disorder	36.4%	1176
	Lifetime Cannabis Use Disorder	9.9%	320
	Lifetime Non-Cannabis Drug Use Disorder	5.8%	186
Suicidal Behavior	Current Suicidal Ideation (BSS = 3)	9.9%	320
	Lifetime Suicide Attempt	9.0%	292

**Table 2**

Summary of the Adjusted Logistic Regression Models Predicting Suicidal Behavior

Variable	<u>Current Suicidal Ideation (n = 320)</u>	
	Odds Ratio	95% Confidence Intervals
Sex	0.88	0.60 – 1.26
Lifetime PTSD	2.08 <sup>***</sup>	1.50 – 2.89
Lifetime Depression	2.80 <sup>***</sup>	2.06 – 3.80
Lifetime Alcohol Use Disorder	1.30	0.98 – 1.73
Lifetime Non-Cannabis Drug Use Disorder	0.95	0.59 – 1.53
Lifetime History of Childhood Sexual Abuse	1.94 <sup>***</sup>	1.35 – 2.78
Lifetime History of Combat Exposure	1.03 <sup>***</sup>	1.02 – 1.04
Lifetime History of Cannabis Use Disorder	1.68 <sup>**</sup>	1.15 – 2.46

Variable	<u>Lifetime Suicide Attempt (n = 292)</u>	
	Odds Ratio	95% Confidence Intervals
Sex	2.15 <sup>***</sup>	1.53 – 3.02
Lifetime PTSD	2.60 <sup>***</sup>	1.87 – 3.61
Lifetime Depression	2.48 <sup>***</sup>	1.82 – 3.38
Lifetime Alcohol Use Disorder	1.45 <sup>*</sup>	1.07 – 1.97
Lifetime Non-Cannabis Drug Use Disorder	2.28 <sup>***</sup>	1.50 – 3.48
Lifetime History of Childhood Sexual Abuse	2.64 <sup>***</sup>	1.90 – 3.67
Lifetime History of Combat Exposure	1.00	0.99 – 1.01
Lifetime History of Cannabis Use Disorder	2.31 <sup>***</sup>	1.59 – 3.34

Note: PTSD = posttraumatic stress disorder. Sex coded as 0 = male, 1 = female.

\*  $p < 0.05$ ;

\*\*  $p < 0.01$ ;

\*\*\*  $p < 0.001$ .