SUBSTANCE USE DISORDERS AND MENTAL HEALTH ILLNESSES AMONG
U.S. VETERANS: A MULTI-METHOD STUDY USING QUANTITATIVE AND
QUALITATIVE RESEARCH METHODS

by

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A Dissertation
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of
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DEDICATION

       This dissertation work is dedicated to the three most important people in my life, my wife, son, and daughter. My wife and best friend of over 25 years has been there for me since high school and has been a constant source of encouragement and strength throughout my entire adult life. When times were difficult, she was always there to remind me who is ultimately in control, our God almighty. I started taking my first college classes after both of our kids were born. Our children have always seen me as a student and have nothing else to compare this experience to. What they need to know is that this and every one of my accomplishments are for them, not for me. I am no one without God and my family.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Classification and Regression Trees ....CART

Confidence Interval..CI

Healthy Lifestyle Behaviors ....HLB

Home and Urban Development VA Supportive Housing ....HUD-VASH

Institutional Review Board ....IRB

Major Depressive Episode ....MDE

Maryland Center for Veterans Education and Training..MCVET

Medication Assisted Treatment ....MAT

Mental Health Residential Recovery Treatment Program ....MHRRTP

National Survey on Drug Use and Health..NSDUH

Odds Ratio ....OR

Post-Traumatic Stress Disorder ....PTSD

Principal Investigator ....PI

Receiver Operating Characteristic ....ROC

Social Determinants of Health ....SDOH

Social-Ecological Model..SEM

Substance Abuse and Mental Health and Services Administration.......................SAMHSA

Substance Use Disorders..SUD

Treatment Episode Data Set – Discharge .... TEDS-D

Veteran Service Organizations ....VSO

Veterans Affairs...VA

Veterans Health Administration ....VHA

ABSTRACT

SUBSTANCE USE DISORDERS AND MENTAL HEALTH ILLNESSES AMONG U.S. VETERANS: A MULTI-METHOD STUDY USING QUANTITATIVE AND QUALITATIVE RESEARCH METHODS

Christian A. Betancourt, Ph.D.

George Mason University, 2022

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This manuscript-style dissertation presents three studies highlighting some of the biggest challenges that U.S. veterans face after leaving the military, and explores trends related to their challenges. The most pervasive types of veteran's health care treatment needs are for substance use disorders (SUD), suicidal behaviors (ideation, plan, attempt), and depression. Research evidence shows that among veterans who used the Veterans Health Administration (VHA) health care system, nearly half were diagnosed with at least one SUD. A study on military personnel found that approximately 30% of suicide attempts that resulted in death were preceded by substance use. Veterans who have experienced SUDs and homelessness also have a greater likelihood of struggling with depression and suicidal behaviors. The purpose of the first two studies were (1) to examine risk factors that contribute to SUD relapse upon completion of SUD treatment, (2) to estimate the prevalence of suicidal behaviors and prescription opioid misuse among veterans, and (3) to identify associations between suicidal behaviors and misuse of prescription opioids as well as other sociodemographic and behavioral determinants of health using data from

large nationally representative datasets that are not affiliated with the VHA system. The

third study used semi-structured interviews to conduct a phenomenological study in

exploring the perspectives of homeless veterans living with SUDs and assess how social-

ecological factors impact their recovery. This multi-method study provides a robust

analysis of the veteran population using nationally representative data and veterans'

lived-experiences through collection of data from semi-structured interviews. All three

studies used non-VHA data, thus, producing an alternate assessment of all veterans, not

just those who receive care from the VHA. The first study found that approximately 94%

of veterans relapsed upon discharge from outpatient or residential SUD treatment. It also

showed that veterans with homelessness, unemployment, or arrests upon discharge had a

higher likelihood of relapse after SUD treatment completion. The second study revealed

that approximately 3.7% of veterans experienced suicidal behaviors and nearly 3.0%

reported prescription opioid misuse. This study also determined that 16.3% of veterans

who misused prescription opioids also demonstrated suicidal behaviors; these results

showed a much higher prevalence of suicidal behaviors than those with prescription

opioid use without misuse (4.8%) and those with no prescription opioid use (2.5%) in the

last year. The third study established that veteran homelessness and substance use are

strongly associated with trauma suffered while on active duty and personal adverse life

events. These experiences varied from grieving the death of a family member to being

the victims of physical and sexual assault. Our findings suggest that a more focused

approach to address substance use and mental health illness, along with permanent

housing must be placed on veterans who recently separate from the military.

CHAPTER ONE:

Substance Use Relapse Among Veterans at Termination of Treatment for Substance Use Disorders[a]

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ABSTRACT

Introduction: Military veterans continue to struggle with addiction even after receiving treatment for substance use disorders (SUD). Identifying factors that may influence SUD relapse upon receiving treatment in veteran populations is crucial for intervention and prevention efforts. The purpose of this study was to examine risk factors that contribute to SUD relapse upon treatment completion in a sample of U.S. veterans using logistic regression and classification tree analysis.

Methods: Data from the 2017 Treatment Episode Data Set – Discharge (TEDS-D) included 40,909 veteran episode observations. Descriptive statistics and multivariable logistic regression analysis were conducted to determine factors associated with SUD relapse after treatment discharge. Classification trees were constructed to identify high-risk subgroups for substance use after discharge from treatment for SUDs.

Results: Approximately 94% of the veterans relapsed upon discharge from outpatient or residential SUD treatment. Veterans aged 18-34 years old were significantly less likely to relapse than the 35-64 age group (OR 0.73, 95% CI: 0.66, 0.82), while males were more likely than females to relapse (OR 1.55, 95% CI: 1.34, 1.79). Unemployed veterans (OR 1.92, 95% CI: 1.67, 2.22), or veterans not in the labor force (OR 1.29, 95% CI: 1.13, 1.47) were more likely to relapse than employed veterans. Homeless vs. independently housed veterans had 3.26 (95% CI: 2.55, 4.17) higher odds of relapse after treatment. Veterans with one arrest vs. none were more likely to relapse (OR 1.52, 95% CI: 1.19,

1.95). Treatment completion was critical to maintain sobriety, as every other type of discharge led to more than double the odds of relapse. Veterans who received care at 24-hour detox facilities were 1.49 (95% CI: 1.23, 1.80) times more likely to relapse than those at rehabilitative/residential treatment facilities. Classification tree analysis indicated that homelessness upon discharge was the most important predictor in SUD relapse among veterans.

Conclusion: Aside from numerous challenges that veterans face after leaving military service, SUD relapse is intensified by risk factors such as homelessness, unemployment, and insufficient SUD treatment. As treatment and preventive care for SUD relapse is an active field of study, further research on SUD relapse among homeless veterans is necessary to better understand the epidemiology of substance addiction among this vulnerable population. The findings of this study can inform healthcare policy and practices targeting veteran-tailored treatment programs to improve SUD treatment completion and lower substance use after treatment.

INTRODUCTION

Veterans have an increasing need for mental health care and services for substance use disorders (SUD).[1] Veterans have higher rates of SUD than nonveterans, with estimates ranging from 17.1 to 32.9%, depending on polysubstance use.[2] Research evidence indicates that 11% of veterans who sought care within the Veterans Health Administration (VHA) met the criteria for a SUD diagnosis.[3] This problem is further exacerbated by multiple physical and mental health challenges[4] substance users face in completing SUD treatment programs, thus resulting in high relapse rates and return to treatment programs.[5] Recent estimates show that 76% of veterans experience SUD relapse after receiving treatment.[6] SUD relapse constitutes a serious problem not only for the veterans themselves but also presents an economic burden to the society. Over a decade ago, nearly a third of all VHA costs ($12 billion) was attributed to providing veterans with services for treatment related to substance use and mental health conditions.[7] Factors that influence SUD relapse upon receiving treatment services and follow-up care must be closely monitored to ensure that effective targeted intervention and prevention programs are being adequately deployed and utilized.

A number of studies have examined factors that may influence SUD relapse in veterans within the VHA. Research evidence indicates that Healthy Lifestyle Behaviors (HLBs), including recreational, social, coping/spiritual, and substance recovery activities, have been associated with lower relapse rates in veterans.[8] Follow-up on SUD care is as important as residential treatment itself. A 2016 study found a positive significant association between inpatient hospitalizations and SUDs in the year immediately

following residential treatment.[9] This study shows the importance of enforcing continued

and focused SUD relapse prevention behaviors following residential treatment. In

addition, research evidence indicates that homeless veterans have greater difficulty

accessing and receiving adequate treatment for SUD.[10] Lack of resources for this

population is associated with disproportionate hospitalization and emergency services

utilization rates across the country.[11] Other factors associated with SUD relapse in

veterans include involvement with the justice system.[12,13] Veterans represent a

significant proportions of the correctional population,[14] and upon release from

incarceration, they may face homelessness and SUD relapse.[12] Many of these individual

factors can impede a veteran's SUD recovery; however, several of these elements

combined (e.g., homelessness and incarceration) can present a formidable impact on

relapse.

Identifying factors that may influence SUD relapse upon receiving treatment in

veteran populations is crucial for intervention and prevention efforts. Limited research,

however, has been conducted on SUD relapse predictors after treatment, especially from

data collected outside of the VHA. The VHA maintains robust veteran datasets along

with comprehensive health-related and demographic data; however, the VHA is not the

only agency that captures data involving veteran demographics, health information, and

treatment. Organizations such as the Substance Abuse and Mental Health and Services

Administration (SAMHSA) record and maintain rich substance use data that report both

veteran and nonveteran populations. SAMHSA coordinates the collection of Treatment

Episode Dataset-Discharge (TEDS-D) data that provides a unique opportunity to study

SUD relapse upon treatment in veteran populations.

The purpose of this study was to examine risk factors that contribute to SUD

relapse in U.S. veterans upon completion of treatment using TEDS-D data. In addition,

this study uses both traditional statistical methods of data analysis (e.g., parametric

regression) and classification trees. The use of machine learning algorithms such as

classification and regression trees (CART), which constitutes a relatively novel technique

in the field of SUD, reinforces research findings by uncovering clusters of risk factors of

SUD relapse.

METHODS

Data Source

Data were used from the 1,661,207 treatment discharges reported in the 2017

TEDS-D public use files within the SAMHSA data repository. TEDS-D data are

reported from 47 states, Washington DC, and Puerto Rico. Georgia, Oregon, and West

Virginia did not report sufficient discharge data for 2017 to be included in this study.[15]

TEDS-D, which is reported annually by the SAMHSA, is publicly available and provides

demographic and characteristics of substance use treatment discharges among people 12

years and older based on state-licensed or certified substance abuse treatment centers that

receive federal public funding.[16] TEDS-D represents a compilation of data collected

through the individual data collection systems of the state agencies for substance use

treatment. More information about data collection procedures are provided in the TEDS

State Instruction Manual.[17]

Sample

A subsample of the TEDS-D, 2017, was created to analyze only the veteran

sample (n=44,296). TEDS-D identified veterans with a "yes/no" question asking the

participants if they had served in the U.S. uniformed services. Discharges ages 12–17 (n

= 178) were excluded from the study as individuals under the age of 17 cannot join the

military.[18] SUD relapse upon treatment discharge had 7.27% missing data (n = 3,209),

which was excluded from the total subsample. The final analytic sample consisted of

40,909 records. Missing data for demographic variables ranged from 0% to 2.6%. Three

measures, including employment status at discharge (15.1% missing), living

arrangements at discharge (15.6% missing), and arrests (<30 days prior to admission)

(12.6% missing), had a large percent of missing data that were either missing completely,

reported as unknown, not collected, or invalid. The data included a mixture of outpatient

and inpatient residential treatment episodes.

Measures

The outcome variable of this study was substance use at the point of discharge

(relapse). The original field response in the survey was intended to "identify the client's

primary substance use at admission and discharge" and provided 19 response options

including "none," and 18 other types of substances. This variable was converted into a

binary variable identifying discharges that reported either "no relapse," or "relapse."

This study uses Wesson's et al definition of relapse[19] as "a discrete event, which occurs at

the moment a person resumes drug use or as a process which occurs over time."

Wesson's definition is appropriate given how SUD relapse has been measured in TEDS-D outlined above.

Factors that may influence SUD relapse were selected based on previous research that assessed interrelationships among different treatment stages and their effects on the outcome of alcoholic patients.[20] In the present study, 10 variables were categorized into two sets separating sociodemographic from treatment-related variables. Sociodemographic variables included age, gender, race/ethnicity (veteran's race and specific Hispanic or Latino origin), employment status (full-time, part-time, unemployed, not in labor force), education (no high school, high school, college), living arrangements upon discharge (homeless, dependent living, independent living), and number of arrests a veteran had 30 days preceding the date of admission to treatment services (none, one, two or more), or in the event that the client was in treatment fewer than 30 days, this item refers to number of arrests during the treatment period only. Treatment-specific variables were used in this study such as reason for discharge. Options for this variable included treatment completed, dropped out of treatment, transferred to another facility, or "other" (terminated from treatment, incarcerated, death, or other). Service setting at discharge provides an option to report what type of service was provided for treatment, such as detox facilities, rehabilitative or residential facility, or ambulatory care facilities. Length of stay was measured by duration of treatment in days; time frames ranged between one day (outpatient stay), 2-30 days, 31-90 days, 91-180 days, 181-365 days, and more than 365 days. Stays longer than 365 days may be due to veterans receiving medication

assisted treatment (MAT) for their addictions. MAT, such as methadone treatment, presents the most benefit to its users when it is administered longer than 12 months.[21]

Data Analysis

Descriptive statistics were used to describe the sample characteristics. Bivariate analysis with the Pearson's chi-squared test was used to test for significant associations between the dependent variable (drug/alcohol use upon treatment discharge, i.e., relapse versus no relapse) and each of the independent variables, including all sociodemographic and treatment-related variables. A multivariable logistic regression model was conducted to determine associations between all independent variables and SUD relapse after treatment discharge. Robust standard errors were computed to adjust for potential departures from assumptions of the logistic regression model. The statistical analyses were conducted using STATA, version 16.[22]

Classification trees were constructed for this sample to identify subgroups of veterans who are at high-risk for substance use after being discharged from treatment for SUD. CART is a non-parametric technique and it does not require assumptions about the distribution of the data.[23] This analytic method can process large datasets with a high number of variables, and it is not affected by collinearities. Although logistic regression estimates the associations between risk factors and SUD relapse, it does not clearly demonstrate how multiple risk factors interact in creating clusters that predict the dependent variable and identify high-risk subgroups. CART, however, can uncover multipart variable associations and categorize high-risk subgroups based on a set of predictor variables.[23] This methodology has been used in various health-related fields to

not only assist researchers in developing treatment strategies [24], but also as an alternative method of mimicking actual thinking processes.[25] In this study, the classification tree was constructed based on 70% of the observations in the sample, and the remaining 30% of the sample was used to test the accuracy of the classification tree. The CART analysis was conducted using Minitab 19 computer software.[26]

RESULTS

Descriptive statistics and bivariate associations

Table 1 provides descriptive statistics of the sample discharges along with bivariate analysis between SUD relapse and sample characteristics based on veteran treatment discharges for the year 2017. Most veterans with SUD discharges were White non-Hispanic (65%), male (89%), and aged 35-64-years-old (67%). The vast majority of all discharged veterans reported being unemployed or not in the labor force upon discharge (71%). Most veterans had at least a high school education (57%) or had attended some college (41%). Nearly two-thirds (64%) of all veteran discharges were recorded as living independently upon discharge from treatment. In terms of involvement with the justice system, 7% of veterans were arrested at least once within 30 days prior to admission.

Bivariate analysis demonstrates statistically significant associations between all sociodemographic variables and SUD relapse in veterans (p-value < 0.001) upon discharge. Approximately 6% of all veteran discharges abstained from using drugs/alcohol, with the majority of veterans relapsing (94%). More than two-thirds

(68%) of all veteran discharge episodes in the 35-64 age group experienced SUD relapse upon discharge. White non-Hispanic (65%) and males (90%) represented the vast majority of episodes that resulted in SUD relapse upon discharge. Approximately, 44% of veteran discharges that did not report having relapsed, left treatment with some level of employment, while more than two-thirds (71%) of those who relapsed, reported being either unemployed or not in the labor force. Among those discharges that reported an education level of at least a high school education, more than half (57%) relapsed after a treatment discharge. Homelessness was associated with a significantly higher proportion of SUD relapse (18%) than those who did not relapse upon discharge from treatment (5%). Discharges that involved any veteran arrests within the last 30 days prior to admission to treatment demonstrated a slightly higher proportion of SUD relapse (7%) than those that had no arrests (6%).

Descriptive statistics and associations between SUD relapse and other treatment-related predictor variables are also displayed in **Table 1.** About half of all reported treatment discharges resulted in completed treatment (48%). A large portion of veterans (58%) were seen at ambulatory facilities followed by rehab/residential facilities (24%) after discharging from SUD treatment. About half the treatment episodes lasted more than one day, but no more than 30 days (51%). Of the veteran treatment episodes that resulted in SUD relapse, more than half (58%) received treatment in an ambulatory setting after discharge. Of the veteran treatment episodes that resulted in relapse, 60% had treatment periods of 2-90 days, 14% stayed in treatment between 91-180 days, and 8% for treatment 180-365 days.

Table 1. Sample Characteristics and Associations of Sociodemographic and Treatment-Related Factors, and Relapse among Veterans upon Discharge from Treatment

Sociodemographic Variables	Entire Sample n = 40,909 n (%)	SUD relapse upon discharge n (%) 38,381 (93.8%)	No SUD relapse upon discharge n (%) 2,528 (6.2%)	P-value
Age	**40,909**			0.000
18-34	11,314 (27.7)	10,474 (27.3)	840 (33.2)	
35-64	27,447 (67.1)	25,904 (67.5)	1,543 (61)	
≥ 65	2,148 (5.2)	2,003 (5.2)	145 (5.7)	
Gender	**40,905**			0.000
Male	36,501 (89.2)	34,344 (89.5)	2,157 (85.3)	
Female	4,404 (10.8)	4,033 (10.5)	371 (14.7)	
Race/ethnicity	**39,839**			0.000
White non-Hispanic	25,737 (64.6)	24,079 (64.5)	1,658 (66.2)	
Black non-Hispanic	7,831 (19.8)	7,96 (19.8)	495 (19.8)	
Hispanic	3,769 (9.5)	3,494 (9.4)	275 (11)	
Other [a]	2,442 (6.1)	2,367 (6.3)	75 (3)	
Employment status (at discharge)	**36,942**			0.000
Full-time	8,472 (22.9)	7,779 (22.2)	693 (36.6)	
Part-time	2,418 (6.6)	2,276 (6.5)	142 (7.5)	
Unemployed	12,415 (33.6)	11,987 (34.2)	428 (22.6)	
Not in labor force	13,637 (36.9)	13,006 (37.1)	631 (33.3)	
Education	**40,006**			0.000
No High School	740 (1.8)	701 (1.9)	39 (1.6)	
High School	22,783 (57)	21,237 (56.6)	1,546 (62)	
College	16,483 (41.2)	15,577 (41.5)	906 (36.4)	
Living arrangements (at discharge)	**36,677**			0.000
Homeless	6,176 (16.8)	6,083 (17.5)	93 (4.9)	
Dependent Living	6,926 (18.9)	6,566 (18.9)	360 (19)	
Independent Living	23,575 (64.3)	22,135 (63.6)	1,440 (76.1)	
Arrests (<30 days prior to admission)	**37,768**			0.000
None	35,218 (93.2)	32,878 (93.2)	2,340 (94.4)	
One	2,172 (5.8)	2,063 (5.8)	109 (4.4)	
Two or more	378 (1)	348 (1)	30 (1.2)	
Reason for discharge	**40,909**			0.000
Treatment completed	19,672 (48.1)	18,319 (47.7)	1,353 (53.5)	
Dropped out of treatment	8,628 (21.1)	7,916 (20.6)	712 (28.2)	
Transferred to another facility	8,932 (21.8)	8,614 (22.4)	31 (12.6)	
Other [b]	3,677 (9)	3,532 (9.2)	145 (5.7)	
Service setting (discharge)	**40,909**			0.000
Detox	7,365 (18)	6,983 (18.1)	382 (15.1)	
Rehab/Residential facility	9,855 (24.1)	9,276 (24.2)	579 (22.9)	
Ambulatory	23,689 (57.9)	22,122 (57.6)	1,567 (62)	
Length of stay	**40,909**			0.000
Outpatient stay (One day)	5,117 (12.5)	4,919 (12.8)	198 (7.8)	
2-30 days	15,909 (38.9)	14,902 (38.8)	1,007 (39.8)	
31-90 days	8,566 (20.9)	8,090 (21.1)	476 (18.8)	
91-180 days	5,808 (14.2)	5,303 (13.8)	505 (20)	
181-365 days	3,326 (8.1)	3,143 (8.2)	183 (7.2)	
>365 days	2,183 (5.3)	2,024 (5.3)	159 (6.3)	

[a] Non-Hispanic: Alaska Native/American Indian, Asian/Native Hawaiian/Pacific Islander, other single race, or two or more races; [b] Terminated from treatment, incarcerated, death, or other

Logistic Regression Analysis: Sociodemographic and treatment-related predictors

Table 2 presents the results of the multivariable logistic regression. The area under the receiver operating characteristic (ROC) was 0.713 and the overall rate of correct classification was about 94%. Younger veterans between 18-34 years old were 27% less likely to relapse than those who were 35-64 years old (OR 0.73, 95% CI: 0.66, 0.82). Male veteran discharge episodes were associated with 1.55 (95% CI: 1.34, 1.79) higher odds of SUD relapse upon discharge than their female counterparts. "Other" race/ethnicity (e.g. Alaska Native/American Indian, etc.) were 2.31 times more likely (95% CI: 1.43, 2.34) to relapse than White non-Hispanics. All discharge episodes of veterans who did not have full-time employment upon discharge were more likely to relapse that those who were fully employed (part-time (OR 1.27, 95% CI: 1.05, 1.54), unemployed (OR 1.92, 95% CI: 1.67, 2.22), not in labor force (OR 1.29, 95% CI: 1.13, 1.47)). College-educated veterans were 43% more likely to relapse after discharge from treatment than those who only possessed a high school education (OR 1.43, 95% CI: 1.29, 1.59). Homeless veteran episodes were more than three times more likely to relapse after treatment discharge compared to those living independently (OR: 3.26, 95% CI: 2.55, 4.17). Veteran discharges that had at least one arrest prior to admission were 52% more likely to relapse than those who were never arrested (OR 1.52, 95% CI: 1.19, 1.95).

Discharges involving veterans who either dropped out of treatment (OR 2.87, 95% CI: 2.44, 3.39), were transferred to another facility (OR: 2.50, 95% CI: 2.16, 2.90), or left for other reasons (terminated from treatment, incarcerated, death), (OR: 2.64, 95%

Table 2 *Multivariable Logistic Regression Model (Odds Ratios (OR) and 95% Confidence Intervals (CI)) for the Association between Sociodemographic and Treatment-Related Factors, and Relapse among Veterans*

	Relapse Odds Ratios (95% CI)	P-value
Age		
35-64	Reference	
18-34	0.73 (0.66, 0.82)	0.000
≥ 65	0.95 (0.75, 1.20)	0.655
Gender		
Female	Reference	
Male	1.55 (1.34, 1.79)	0.000
Race/Ethnicity		
White non-Hispanic	Reference	
Black non-Hispanic	0.89 (0.79, 1.01)	0.077
Hispanic	1.17 (0.98, 1.41)	0.084
Other [a]	2.31 (1.71, 3.13)	0.000
Employment Status (discharge)		
Full-time	Reference	
Part-time	1.27 (1.05, 1.54)	0.016
Unemployed	1.92 (1.67, 2.22)	0.000
Not in labor force	1.29 (1.13, 1.47)	0.000
Education		
High school	Reference	
No high school	1.29 (0.86, 1.93)	0.219
College	1.43 (1.29, 1.59)	0.000
Living Arrangements (discharge)		
Independent living	Reference	
Homeless	3.26 (2.55, 4.17)	0.000
Dependent living	0.99 (0.87, 1.12)	0.834
Arrests		
None	Reference	
One	1.52 (1.19, 1.95)	0.007
Two or more	0.72 (0.45, 1.14)	0.160
Reason for Discharge		
Treatment completed	Reference	
Dropped out of treatment	2.87 (2.44, 3.39)	0.000
Transferred to another facility	2.50 (2.16, 2.90)	0.000
Other [b]	2.64 (2.15, 3.24)	0.000
Service setting (discharge)		
Rehab/Residential facility	Reference	
Detox	1.49 (1.23, 1.80)	0.000
Ambulatory	0.73 (0.63, 0.83)	0.000
Length of stay		
2-30 days	Reference	
Outpatient stay (One day)	1.13 (0.94, 1.37)	0.191
31-90 days	1.49 (1.30, 1.72)	0.000
91-180 days	1.00 (0.87, 1.16)	0.991
181-365 days	1.78 (1.46, 2.17)	0.000
>365 days	1.81 (1.39, 2.36)	0.000

[a] Non-Hispanic: Alaska Native/American Indian, Asian/Native Hawaiian/Pacific Islander, other single race, or two or more races; [b] Terminated from treatment, incarcerated, death, or other.

CI: 2.15, 3.24) all had a higher likelihood of SUD relapse upon treatment discharge than those who successfully completed treatment. Participants who received treatment at a 24-hour detox facility were more likely to relapse than those who received care at a rehabilitative/residential treatment facility (OR 1.49, 95% CI: 1.23, 1.80); however, veterans at ambulatory healthcare facilities fared better than those at rehabilitative/residential treatment facilities in terms of treatment outcome. Statistically significant findings in duration of treatment (days) revealed that veterans who received treatment 31-90 days (OR: 1.49, 95% CI: 1.30, 1.72), 181-365 days (OR: 1.78, 95% CI: 1.46, 2.17), and greater than 365 days (OR: 1.81, 95% CI: 1.39, 2.36) all had higher odds of SUD relapse upon discharge, compared to treatment of 2-30 days.

Classification and regression tree (CART) Analysis

CART analysis originally produced a 59-terminal node tree (terminal nodes are made of a group of cases that share similar characteristics and cannot be further split); however, for purposes of clarity, a 6-terminal-node tree was created (Figure 1). This tree yielded a sensitivity of 57% and a specificity of nearly 68% with an area under the ROC of 65%. Figure 1 shows the variable splits that represent six terminal nodes. Every node displayed on the tree includes the number of veteran discharge episodes and the percentage of each outcome after discharge (None indicates no drug use at discharge versus Substance Use which indicates substance use at discharge). The CART analysis for veterans suffering from SUDs revealed that homelessness upon discharge from treatment increased the percent of relapse among this population to almost 99% (terminal node 6) from about 94% (root node) and showed to be the most important predictor
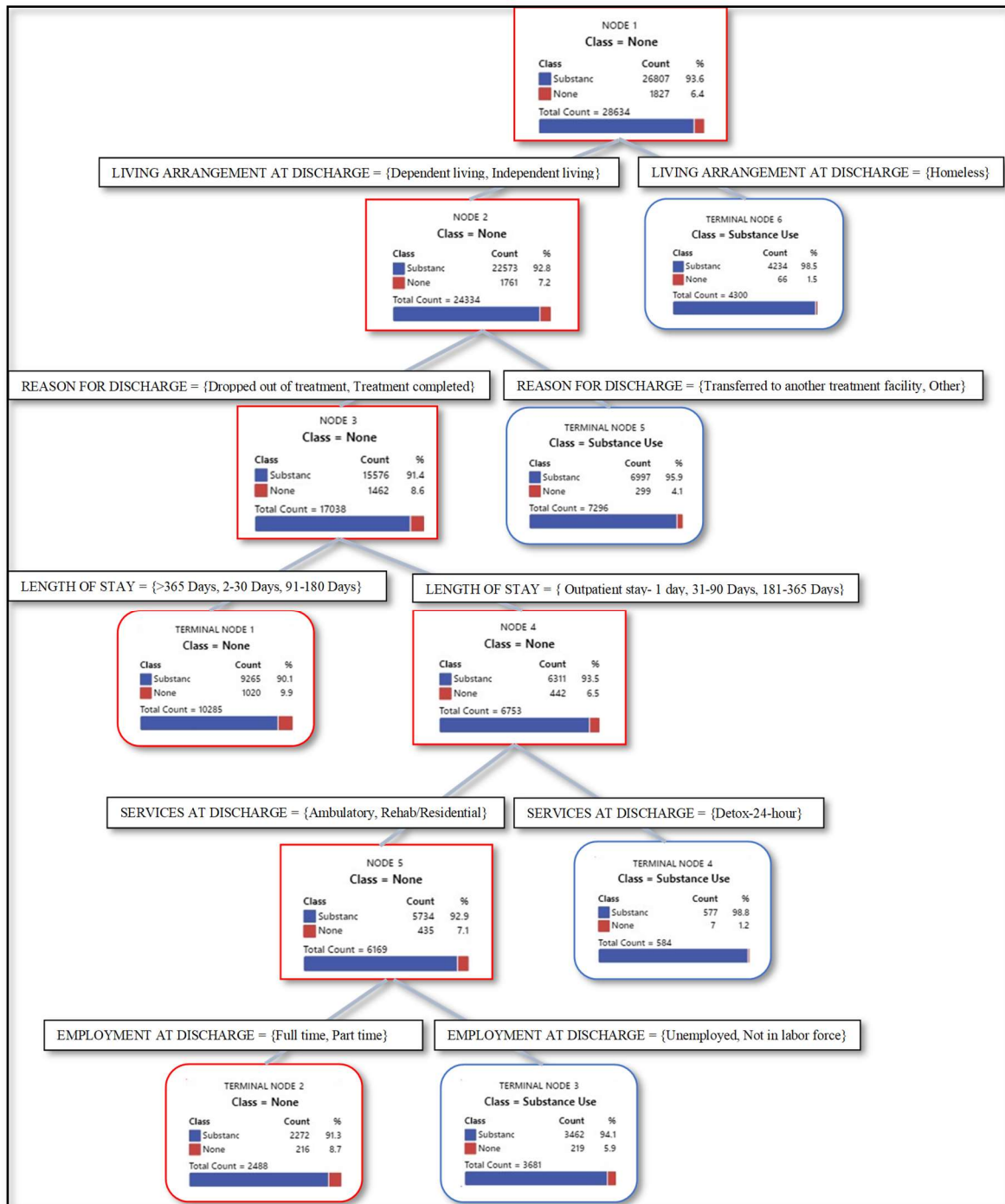
Figure 1. Classification tree for veterans suffering from SUDs where each node includes estimates (%) for no substance use (None) upon discharge from treatment and substance use upon discharge from treatment

among all other independent variables (Figure 1 and 2). Among those veterans who were not homeless (lived independently or dependently), veterans who were transferred to another facility to continue treatment or were discharged for "Other" reasons, nearly 96% of them relapsed at discharge (terminal node 5). However, 99% of the veterans who were not homeless, dropped out of treatment or completed it with a length of stay ranging from 1 day, 31-90 days or 181-365 days, and received treatment at a 24-hour detoxification facility upon discharge experienced a relapse (terminal node 4). Receiving ambulatory or rehabilitative/residential SUD treatment upon discharge from initial treatment and being unemployed or not being in the labor force, was also associated with relapse to substance use upon discharge (94%) (terminal node 3). Among the same subgroup of veterans receiving similar care, a slightly lower percentage of employed veterans relapsed upon discharge from treatment (91%) (terminal node 2). The group with the lowest rate of relapse (90%) was comprised of veterans who were stably housed, completed treatment or dropped out of treatment voluntarily, and spent 2-30 days, 3-6 months, or more than a year in treatment (terminal node 1).

In summary, the most important features as predictors of SUD relapse generated from the classification tree analysis are shown in the *Relative Variable Importance* chart (Figure 2). Relative importance is defined as a percentage (%) improvement to the top predictor. In this CART model, the most important variable in predicting relapse is the veteran's living arrangement upon discharge from treatment (100%). Relative to "living arrangements," the second-most important variable in predicting relapse was a veteran's "reason for discharge" (61%) from treatment.
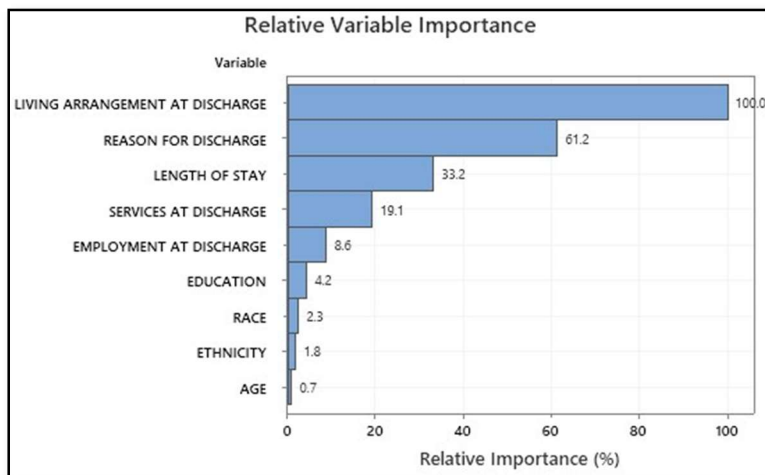
Figure 2. Relative feature/measure importance based on the classification tree analysis of veteran relapse after discharge from treatment

DISCUSSION

The findings of this study indicate that almost 94% of the veterans had an SUD relapse upon treatment discharge. This estimate is higher compared to estimates generated from longitudinal studies that show a 76% SUD relapse rate in veterans after receiving treatment.[6] Most importantly, this study identified risk factors associated with SUD relapse in this population using both traditional statistical methods and classification trees. Classification tree analysis revealed high risk subgroups for SUD relapse that further confirmed the importance of a veteran's living arrangements and service setting after SUD treatment discharge. Simply being homeless indicated the highest likelihood of relapsing after treatment. Although the number of homeless veterans have decreased over the last decade,[27] this does not negate the increasing proportion of homeless veterans who live in a perpetual recovery-relapse cycle. Chronically homeless veterans tend to experience a broad variety of physical and mental

illnesses[10,28] which can contribute significantly to their ability to successfully complete SUD treatment programs and remain sober upon discharge. It is crucial that treatment programs incorporate HLBs which have been associated with lower relapse rates,[8] provide resources that can lead to stable housing, and follow-up treatment to prevent SUD relapse in this population.

Classification tree analysis also revealed a high likelihood of SUD relapse among veterans who were not homeless; however, they either dropped out of treatment or completed treatment ranging from one day, 1-3 months, or 6-12 months, and received treatment at a 24-hour detox facility after discharge. Research evidence shows that those veterans who dropped out of SUD treatment early were more likely to relapse six months after treatment than those who finished all treatment sessions.[29] Length of treatment and type of treatment facilities along with the treatment plans may need further examination in identifying factors that increase the likelihood of SUD relapse in veterans.

The findings of this study also show that veteran discharges which were either prematurely terminated, or were transferred to another treatment location, were at a higher risk of relapse. Treatment completion is vital to reducing relapse after discharge; research evidence shows that those who complete substance use treatment have fewer relapses and are more likely to maintain abstinence after completing treatment.[30] Transfers from detox treatment facilities typically occur when patients have exceeded their level of treatment at that location, thus, requiring follow-on residential care in longer-term SUD treatment facilities. Once a patient discharges from detox, they are at high risk of relapse and therefore vulnerable to treatment incompletion and failure.[31]

Studies that used VHA patient record data found that veterans who completed treatment had a lower SUD relapse prevalence (30% vs. 54%) than in publicly available data such as TEDS-D.[6] However, VHA studies concur with the high risk of relapse during the early stages of recovery.[32] In general, studies performed with VHA data are longitudinal studies, therefore, they tend to represent findings that are captured over an extended period of time.[33,34] Since this is a cross-sectional study, relapse figures are only indicative for the year they were reported (2017).

This study also demonstrates that unemployment plays a significant role in relapse. Logistic regression and classification tree analyses demonstrated a high likelihood of relapse among unemployed veterans after receiving treatment for SUD. Research evidence shows that individuals who are suddenly unemployed may return to substance use simply by having more spare time that comes with job loss or by surrounding themselves with people who are also chronically unemployed.[35]

Veterans who are involved with the criminal justice system represent a particularly vulnerable population who experience high rates of both posttraumatic stress disorder (PTSD) and SUDs.[36] The findings of this study show that veterans with at least one arrest within the last 30 days prior to admission have a greater likelihood of SUD relapse. This indicates that treatment services may need to be tailored to specific populations such as those with prior involvement with the justice system.

Limitations

There are several limitations in this study. First, the facilities reporting TEDS data receive state drug/alcohol agency funds for the provision of drug/alcohol treatment

services, and no data are reported on facilities operated by federal agencies, including the Bureau of Prisons, the Department of Defense, and the Department of Veterans Affairs. However, some facilities operated by the Indian Health Service are included. Another limitation is that, in many states, TEDS-D data may include multiple discharges for the same patient. This in turn makes it challenging to adjust the statistical analyses for potential dependencies in the data. In addition, the data in this study represent admissions and not patients. Due to the small sample sizes for racial/ethnic groups in the "Other" category for race/ethnicity, we were not able to conduct meaningful analyses, and therefore did not examine these groups separately related to SUD relapse. Also, most of the substance use and living arrangement data collected by facilities are self-reported by persons admitted for treatment, thus, social desirability bias may have affected participant responses. This study also utilized cross-sectional data and thus causality cannot be inferred. Regardless of these limitations, this study offers a unique perspective of correlates associated with veteran relapse after discharge from SUD treatment using classification trees and a national-level sample.

Implications

This study profiles SUD relapse among the veteran population in community-based treatment programs. The findings highlighted several risk factors that clinicians and hospital administrators can focus on to identify veterans with a high likelihood of relapse. These factors include homelessness and unemployment upon discharge, arrest history, the use of a 24-hour detox facility, treatment length of stay, and the reason for discharge. Unemployment and homelessness are two of the most pervasive risk factors

of substance use, even after receiving treatment for SUDs. It is imperative for state and federal funding to focus on treatment programs that incorporate stable housing and employment after discharge from such programs. State programs must continue to focus efforts on housing veterans through programs like the VHA's Housing First initiative. Lastly, treatment centers that provide substance use treatment must also be adequately staffed with job placement or work therapy specialists in addition to substance use clinicians. Future research needs to test whether applying these principles may result in lower SUD relapse among veterans. In addition, qualitative research studies in form of interviews or case studies are needed as they may uncover unobserved obstacles that preclude veterans from maintaining sobriety well beyond treatment completion.

Conclusion

Substance use among veterans is already a public health concern that needs to be addressed. This problem is exacerbated by compounding other risk factors such as homelessness, unemployment, and inadequate length and type of SUD treatment. Further research should be conducted to identify what motivates veterans to stay sober and what triggers substance use after treatment. Studies focusing on the identification of efficient length of stay in rehabilitative treatment based on the patient characteristics would provide valuable information for SUD treatment programs. Findings from this study can be used to promote policies related to the implementation of veteran-specific treatment and prevention programs that can increase relapse prevention efforts. The findings of this study also show the need for healthcare providers who work with the veteran population

to design veteran-specific treatment plans that are specifically geared to improve SUD

treatment completion rates and lower substance use after treatment.

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CHAPTER TWO:

Prescription Opioid Misuse and Suicidal Behaviors Among U.S. Veterans: Findings from the 2015-2019 National Survey on Drug Use and Health

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ABSTRACT

Introduction: Suicide continues to be a serious public health issue for the U.S. veteran population as its prevalence has skyrocketed over the last 15 years. Although an abundance of research has been conducted on veteran suicide and substance abuse using Veterans Health Administration (VHA) data, to our knowledge, no studies have analyzed publicly available and nationally representative data in addressing suicidal behaviors and prescription opioid misuse among veterans. Research evidence shows that prescription opioid misuse is significantly associated with suicidal behaviors in the non-veteran population. The purpose of this study was to estimate the prevalence of suicidal behaviors and prescription opioid misuse among veterans, identify associations between suicidal behaviors and misuse of prescription opioids, and identify the sociodemographic and behavioral determinants of health in this population using data from a large nationally representative sample not connected with the VHA system.

Methods: The prevalence of suicidal behaviors and prescription opioid misuse in veterans was estimated using data from the 2015-2019 National Survey on Drug Use and Health (NSDUH), which included 11,875 veterans. Associations between suicidal behaviors (ideation, planning, attempt), and prescription opioid use, sociodemographic, health-related history, and other substance misuse variables were assessed using the Pearson's chi-squared test and multivariable logistic regression models.

Results: Approximately 3.7% of all veterans in this sample experienced suicidal behaviors while nearly 3.0% reported misusing prescription opioids and approximately 37.0% used prescription opioids without misuse. Veterans who misused prescription opioids had a much higher prevalence of suicidal behaviors (16.3%) than veterans who used prescription opioids without misuse (4.8%) and those who did not use prescription opioids at all (2.5%). When assessing all individual suicidal behaviors, suicidal ideations yielded the highest percentage among veterans who misused prescription opioids (11.9%). Adjusted logistic regression results show that veterans reporting prescription opioid misuse were significantly more likely to have suicidal behaviors (OR 2.24; 95% CI 1.33 – 3.77) than those without a history of prescription opioid use. Younger veterans, 18-34 years old, had higher odds (OR 2.76; 95% CI 1.91 – 3.99) of reporting suicidal behaviors than veterans older than 65 years of age. Interestingly, veterans who reported having a major depressive episode (MDE) in the past year were nearly eight times more likely (OR 7.84; 95% CI: 5.29 – 11.62) to report suicidal behaviors than veterans without an MDE in the last year. Veterans were more likely (OR 3.87; 95% CI 2.62 – 5.72) to have suicidal behaviors if they received mental health treatment in the past year than those who did not receive any treatment. Veterans who reported illicit drug abuse or dependence (OR 2.62; 95% CI 1.53 – 4.50), or alcohol abuse or dependence (OR 1.60; 95% CI 1.05 – 2.45) were more likely to experience suicidal behaviors than those who did not have a history of either substance misuse.

Conclusion: Opioid misuse is strongly associated with suicidal behaviors among veterans. Our findings suggest that immediate substance use and mental health screenings, upon first contact with a health care system, are imperative in preventing and reducing suicide rates within this vulnerable population. Screening for substance abuse related to prescription opioids and early intervention are critical to addressing suicide rates that increasingly plague America's veterans.

Key Words: Veteran, Suicidal Behavior, Prescription Opioid Misuse, Depression, Mental Health, Illicit Drug, Alcohol

INTRODUCTION

Service members face numerous challenges upon discharge from the military.

These challenges include a multitude of mental and physical health stressors that often

result in depression and drug and alcohol abuse, which can ultimately lead to suicidal

behaviors (ideation, plan, attempt).[1–3] Suicidal behaviors continue to be a serious public

health issue for the U.S. veteran population with its prevalence skyrocketing over the last

15 years.[4] According to the Veterans Affairs 2021 annual suicide report, veterans are

averaging 17.2 suicides per day.[5] The daily suicide rate difference between veterans and

non-veterans was 52.3% greater for veterans in 2019.[5] Veterans may be predisposed to

suicidal behavior prior to joining the military due to pre-enlistment mental disorders and

substance use.[6] Both psychiatric distress and a history of substance use have been

associated with chronic suicidal behaviors in veterans.[7] Among a large number of mental

health illnesses, depression is one of the most significant mental health conditions that is

closely related to suicide among veterans.[8] In fact, veterans are more likely than civilians

to report a history of depressive disorder.[9] Of the various medical and mental health

issues a veteran may encounter, several social drivers of health (SDOH), such as

unemployment and lack of education, increase the prevalence of suicidal behaviors and

intensify the deleterious effects of substance abuse and mental illness.[10,11]

A national study on veteran health reported that young veterans, 18-25 years old,

had higher past-year rates of nonmedical use of pain relievers and alcohol use or

dependence than their non-veteran counterparts.[12] Regardless of veteran status or history

of mental health illness, opioid misuse and alcohol abuse have always been significantly

associated with an increased likelihood of suicidal behaviors.[13,14] A 2019 study, conducted at a single facility in the Veterans Health Administration (VHA), found that among veterans, a staggering 82.1% of past-year opioid misusers also had a past-year suicide attempt.[15] Veterans are often prescribed these types of pain management medications to assuage symptoms from service-related injuries.[16] Research evidence in the general population indicates that prescription opioid misuse is significantly associated with a greater likelihood of suicidal behaviors.[17] Another Veterans Affairs (VA) study found that veterans returning from Iraq and Afghanistan were at an increased risk of having suicidal behaviors if they were prescribed opioids.[18] Unfortunately, even if opioids are taken as prescribed, extended periods of prescription opioid use also present a risk of developing addiction that may lead to depression.[19]

Although past research studies on opioid use and suicide among veterans have increased our understanding of this serious public health issue, this type of veteran research has been conducted using VHA health system records because a large number of veterans almost exclusively use health care systems that are specifically designed for veteran care.[20] To our knowledge, no studies have been conducted using non-VHA data to explore opioid misuse and suicidal behaviors among veterans. Organizations such as the Substance Abuse and Mental Health Services (SAMHSA) collect rich data on drug use and mental health for research purposes that report both veteran and civilian populations across the United States. SAMHSA collects data through several sources and surveys such as the National Survey on Drug Use and Health (NSDUH). It is important to explore data related to veteran suicides outside of the VHA health record

system since many veterans do not exclusively receive care from the VHA. Using other

sources of data allows us to capture a true national representation of this population

related to veteran suicides. Broad and continuous surveillance on opioid use and misuse

is critical to the detection and prevention of suicidal behaviors (ideation, plan, attempt),

especially using unrestricted and readily accessible data. The purpose of this study is to

estimate the prevalence of suicidal behaviors and prescription opioid misuse among

veterans and identify associations between misuse of prescription opioids and suicidal

behaviors using data from the 2015-2019 NSDUH. The effects of illicit drug use, alcohol

consumption, depression, and SDOH such as marital status, education, and health

insurance coverage will also be examined in relation to these suicidal behaviors.

Identifying predictors that may influence suicidal behaviors in veteran populations is

crucial for early intervention.

METHODS

Data source

In this study, data were used from the 282,768 observations reported in the 2015-

2019 NSDUH public use files within the SAMHSA data repository. The NSDUH, which

is reported annually from SAMHSA, provides information on substance misuse, abuse,

and dependence, along with various mental health conditions among the U.S.

noninstitutionalized population aged 12 years and older. The NSDUH uses a multistage

area probability sampling design covering all 50 states where participants are interviewed

face-to-face by a professional interviewer in their homes.[21] More information about data

collection procedures are provided elsewhere.[22]

Sample

A sample of veterans (n=11,875) from the 2015-2019 NSDUH was used for

analysis in this study. Respondents were identified as veterans if they responded "yes" to

the question, "Have you ever been in the United States armed forces (e.g., Army, Navy,

Air Force, Coast Guard, Public Health Service Commissioned Corps, Coast Guard and

Geodetic Survey, etc.)?" and also specified that they were "now separated/retired from

reserves/active duty".[21] No observations for respondents aged 12-17 were included in the

study since these individuals are ineligible for military service.[23] Missing data for all

independent variables, with the exception of marital status, ranged from 0% to 1.1%.

Marital status had a large percent of missing data (21%), and was therefore excluded

from the logistic regression; however, it is still presented in the descriptive statistics.

Measures

The dependent and independent variables of this study were selected based on a

conceptual framework for social determinants of veteran's health.[24] This conceptual

framework was developed to illustrate the relationships between SDOH, veteran

experiences, and health outcomes.[24] The dependent variable in this study, suicidal

behaviors, falls under the health outcomes section of the framework. This binary

outcome variable for suicidal behaviors was constructed based on three existing survey

questions which asked the participants "yes" or "no" questions about suicide-related

events. The survey addressed suicidal ideation based on the question: "At any time in

the past 12 months, including today, did you seriously think about trying to kill yourself?" Suicidal planning was assessed using the question: "During the past 12 months, did you make any plans to kill yourself?", and suicidal attempt was ascertained based on the question: "During the past 12 months, did you try to kill yourself?" If the respondents indicated "no" to all three questions, then this constituted the class of "0=no suicidal behaviors" in the dependent variable. If the respondent marked "yes" to any of the three previous questions, the response was assigned "1=suicidal behavior."

The principal independent variable, prescription opioid use, is included in the health behaviors section of the SDOH framework. This variable indicated whether the individual misused, abused, or depended on prescription pain relievers over the last year. Specifically, the three categories of the prescription opioid use variable were "no prescription opioid use," "any prescription opioid use – without misuse (abuse or dependence)," and "prescription opioid misuse (abuse or dependence)." SDOH measures included marital status and education. Health insurance (current) was included in the access to health care section of the SDOH framework. Other sociodemographic characteristics were selected such as age, gender, and race/ethnicity.

Health-related history was assessed using several measures. These included veterans' perception of their overall health (excellent/very good, good, fair/poor), and mental health such as whether or not they had a major depressive episode (MDE) in the last year and whether or not they had received mental health treatment in the last year. Other substance misuse measures besides opioids, included illicit drug abuse or

dependence in the last year (yes, no) and alcohol abuse or dependence in the last year

(yes, no).

Data analysis

Descriptive statistics were used to describe the sample characteristics. Bivariate

analysis with the Pearson's chi-squared test were conducted to test for significant

associations between the dependent variable (suicidal behaviors), each of the individual

suicidal behaviors (ideation, plan, attempt), and independent variables including

prescription opioid use, sociodemographic, health-related history, and other substance

misuse variables. A multivariable logistic regression model was used to assess the effects

(adjusted and unadjusted) of opioid misuse and other independent variables on suicidal

behaviors. The data were weighted due to the NSDUH complex survey design. The

statistical analyses were conducted using STATA, version 16.[25]

RESULTS

Prescription Opioid Use and Suicidal Behaviors among Veterans

In this sample, suicidal behaviors among veterans peaked in 2017 (4.6%)(*Fig. 1)*.

Suicidal behaviors and opioid misuse among veterans showed a slight decline from 2015

to 2016; however, an upward trend reversal can be noted from 2018 to 2019 in both

categories. *Figure 2* displays weighted estimates of suicidal behaviors and prescription

opioid misuse by year. There is a considerable increase in prevalence of suicidal

behaviors among veterans who misused prescription opioids compared to those who

never used prescription opioids or used without misuse across all years. The highest
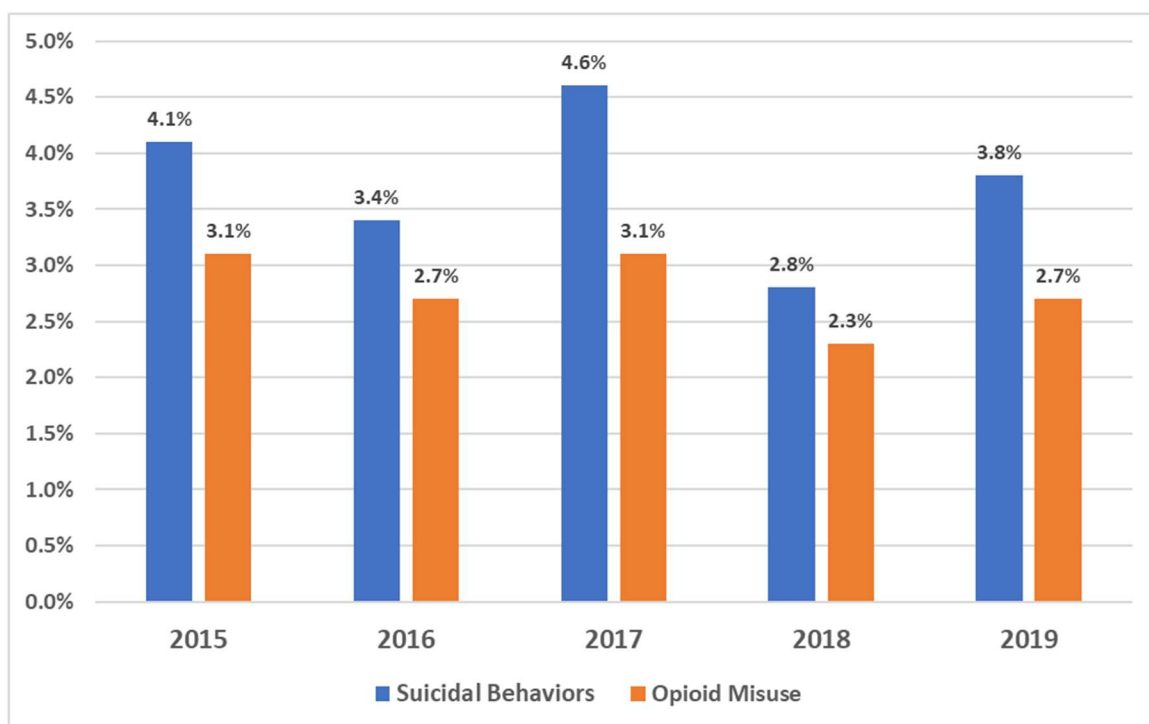
Figure 1. Weighted estimates comparing suicidal behaviors and prescription opioid misuse among veterans, 2015-2019 National Survey of Drug Use and Health

prevalence in suicidal behaviors and prescription opioid misuse was observed in 2017 (20.4%) then sharply dropping in 2018 (7.0%). However, in 2019 we observe a 10% increase in suicidal behaviors among veterans who reported prescription opioid misuse (17.6%). The same trend can be noted from 2018 to 2019 in suicidal behaviors among veterans who used prescription opioids without misuse, an increase from 3.1% to 5.1%.

    Table 1 displays prevalence for suicidal behaviors and prescription opioid use in veterans cumulatively for the 2015-2019 NSDUH. Nearly 3.0% of veterans reported prescription opioid misuse and approximately 37.0% used opioids without misuse. We observe that 3.7% experienced suicidal behaviors. Associations between prescription

opioid use and suicidal behaviors revealed that, overall, veterans who misused

prescription opioids had a significantly higher prevalence of suicidal behaviors (16.3%)
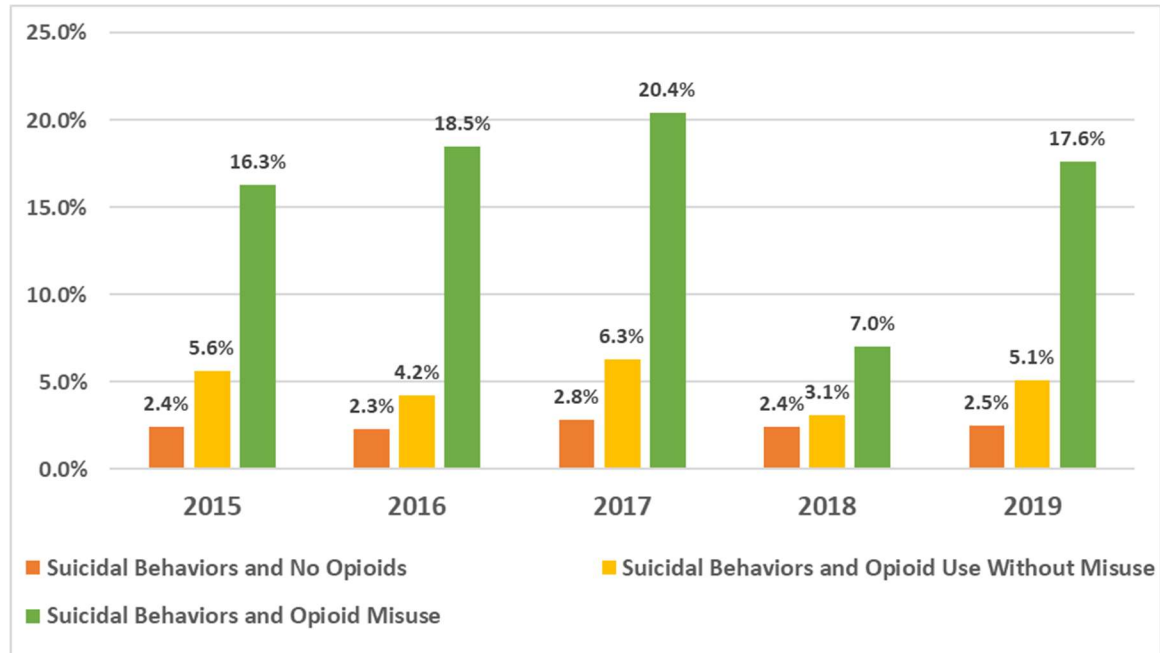
Figure 2. Weighted estimates of suicidal behaviors and no prescription opioid use, prescription opioid use without misuse, and prescription opioid misuse among Veterans, 2015-2019 National Survey of Drug Use and Health

than veterans who used prescription opioids without misuse (4.8%) and those who did not

use prescription opioids at all (2.5%). When assessing individual suicidal behaviors,

suicidal ideations occurred most frequently (11.9%) among veterans who misused

prescription opioids compared to those who used prescription opioids without misuse

(3.3%) or those who did not use prescription opioids (1.8%). Veterans who misused

prescription opioids also were more likely to make a plan to commit suicide (3.2%) than

those who used prescription opioids without misuse (1.2%) and those who never used

prescription opioids (0.4%).

Table 1 *Associations between Prescription Opioid Use and Suicidal Behaviors among Veterans, 2015-2019 National Survey of Drug Use and Health*

	Entire sample	Suicidal behaviors†	No suicidal behaviors†	P-value*	Suicidal Ideation	Suicidal Planning	Suicidal Attempt	P-value*
	Unweighted n= 11,875	Unweighted n= 621 Weighted=3.7%	Unweighted n= 11,181 Weighted=96.3%		Unweighted n= 394 Weighted=2.7%	Unweighted n= 150 Weighted=0.7%	Unweighted n= 77 Weighted=0.3%	
	n (Weighted %)	n (Weighted %)	n (Weighted %)		n (Weighted %)	n (Weighted %)	n (Weighted %)	
Prescription opioid use				<0.001				<0.001
No prescription opioid use	**7,231 (59.9)**	263 (2.5)	6,926 (97.5)		173 (1.8)	55 (0.4)	35 (0.2)	
Any prescription opioid use without misuse	**4,222 (37.3)**	281 (4.8)	3,916 (95.2)		175 (3.3)	74 (1.2)	32 (0.4)	
Prescription opioid misuse**	**422 (2.8)**	77 (16.3)	339 (83.7)		46 (11.9)	21 (3.2)	10 (1.2)	

† Suicidal behaviors include ideation, plan, or attempt
* P-values were calculated based on a chi-squared test for associations between opioid use and suicidal behaviors, and each individual suicidal behavior including no suicidal behavior
** Prescription opioid Misuse includes Use Disorder (Abuse or Dependence)

Suicidal attempts were more prevalent among veterans who misused prescription opioids (1.2%) versus veterans who used

prescription opioids without misuse (0.4%) or no prescription opioid use (0.2%).

Sample Characteristics and Associations with Suicidal Behaviors

Table 2 displays sample characteristics and associations with suicidal behaviors among veterans. Most of the veterans (91.7%) were male, 78.3% were White non-Hispanic, and 50.4% were older than 65 years old. The majority of veterans surveyed were married (63.9%) and had at least high school education (69.6%). Most veterans were covered by some form of health insurance (96.5%). When assessing health-related history, we observe that most veterans reported being in excellent or very good health (48.4%). The majority of veterans reported not having any MDEs in the past year (94.6%), and did not receive any mental health treatment in the last year (86.8%). Alcohol dependence and abuse was particularly high (4.7%), while illicit drug abuse or dependence was present in 1.6% of the veterans.

Bivariate associations show that veterans between the ages of 18-34 and 35-64 years old were significantly more likely to experience suicidal behaviors. A high proportion of female veterans experienced suicidal behaviors (14.7%). Nonmarried veterans (51.5%) and those without health insurance (6.6%) were also more likely to report suicidal behaviors. Nearly a third of veterans who perceived their overall health as fair or poor (31.9%) reported having suicidal behaviors. A considerably large proportion of veterans who reported experiencing suicidal behaviors also reported having an MDE in the past year (46%). More than half of veterans who reported suicidal behaviors also received some type of mental health treatment in the last year (56%). Approximately 10.0% of veterans who reported suicidal behaviors also reported illicit drug abuse or dependence while 15.8% reported alcohol abuse or dependence.

Table 2. *Associations between Suicidal Behaviors and Sociodemographic, Health Related History, and Other Substance Misuse Variables among Veterans, 2015-2019 National Survey of Drug Use and Health*

	Entire sample Unweighted n = 11,875	*No Suicidal Behaviors[†] Unweighted n= 11,181*	*Suicidal Behaviors[†] Unweighted n= 621*	*P-value**
	n (Weighted %)	n (Weighted %)	n (Weighted %)	
Sociodemographic				
Age				<0.001
18-34	2,299 (8.0)	2,039 (7.6)	242 (19.0)	
35-64	5,419 (41.6)	5,094 (41.0)	296 (53.8)	
≥ 65	4,157 (50.4)	4,048 (51.3)	83 (27.2)	
Gender				<0.001
Male	10,377 (91.7)	9,824 (92.0)	486 (85.3)	
Female	1,498 (8.3)	1,357 (8.0)	135 (14.7)	
Race/ethnicity				0.529
White non-Hispanic	8,828 (78.3)	8,332 (78.4)	447 (76)	
Black non-Hispanic	1,390 (11.0)	1,312 (10.9)	66 (11.1)	
Hispanic	855 (6.9)	797 (6.8)	53 (7.6)	
Other non-Hispanic [a]	802 (6.9)	740 (3.8)	55 (5.3)	
Marital Status				<0.001
Married	5,533 (63.9)	5,310 (64.6)	197 (48.5)	
Not Married	3,853 (36.1)	3,537 (35.4)	285 (51.5)	
Education				0.188
High School or less	8,649 (69.6)	8,098 (69.5)	490 (73.0)	
College and above	3,226 (30.4)	3,083 (30.5)	131 (27.0)	
Health insurance				<0.001
Yes	11,269 (96.5)	10,639 (96.6)	572 (93.4)	
No	576 (3.5)	525 (3.4)	47 (6.6)	
Health-related history				
Perceived overall health				<0.001
Excellent/Very Good	6,082 (48.4)	5,820 (49.0)	234 (34.7)	
Good	3,842 (33.0)	3,596 (33.0)	220 (33.4)	
Fair/Poor	1,948 (18.5)	1,762 (18.0)	167 (31.9)	
Major Depressive Episode (MDE) in Past Year				<0.001
Yes	856 (5.4)	541 (3.8)	312 (46.0)	
No	10,893 (94.6)	10,582 (96.2)	299 (54.0)	
Mental Health Treatment in last year				<0.001
Yes	1,834 (13.2)	1,476 (11.5)	344 (56.0)	
No	9,982 (86.8)	9,683 (88.5)	276 (44.0)	
Other substance misuse				
Illicit drug abuse or dependence				<0.001
Yes	262 (1.6)	187 (1.3)	69 (10.2)	
No	11,613 (98.4)	10,994 (98.7)	552 (89.8)	
Alcohol abuse or dependence				<0.001
Yes	731 (4.7)	605 (4.3)	118 (15.8)	
No	11,144 (95.3)	10,576 (95.7)	503 (84.2)	

[a] Non-Hispanic: Alaska Native/American Indian, Asian/Native Hawaiian/Pacific Islander, other single race, or two or more races

[†] Suicidal behaviors include ideation, plan, or attempt

* P-values were calculated based on a chi-squared test for associations between suicidal behaviors and sociodemographic, health related history, and other substance misuse variables

Results from unadjusted and adjusted multivariable logistic regression models are presented in *Table 3*. Unadjusted logistic regression analysis revealed that veterans using any prescription opioids without misuse were approximately twice as likely (OR 2.01; 95% CI 1.47 – 2.73) to have suicidal behaviors than those without any prescription opioid use. Those who reported prescription opioid misuse (OR 7.71; 95% CI 5.59 – 10.63) were nearly eight times more likely to report suicidal behaviors than those with no history of prescription opioid use. After adjusting for potential confounders, veterans reporting prescription opioid misuse remained significantly more likely to have suicidal behaviors (OR 2.24; 95% CI 1.33 – 3.77).

Younger veterans, 18-34 years old, had higher odds (OR 2.76; 95% CI 1.91 – 3.99) of reporting suicidal behaviors than veterans older than 65 years old. Veterans who reported having an MDE in the past year were nearly eight times more likely (OR 7.84; 95% CI: 5.29 – 11.62) to report suicidal behaviors than veterans without an MDE in the last year. Veterans were more likely (OR 3.87; 95% CI 2.62 – 5.72) to have suicidal behaviors if they received mental health treatment in the past year than those who did not receive any treatment. In addition, those who reported illicit drug abuse or dependence were twice as likely (OR 2.62; 95% CI 1.53 – 4.50) to experience suicidal behaviors than those who did not have illicit drug use. Veterans with a presence of alcohol abuse or dependence in the previous year were also more likely to have suicidal behaviors than those without a history of alcohol abuse or dependence (OR 1.60; 95% CI 1.05 – 2.45).

Table 3. *Adjusted and Unadjusted Multivariable Logistic Regression Models (Odds Ratios (OR) and 95% Confidence Intervals (CI)) for Suicidal Behaviors Among Veterans: 2015-2019 National Survey of Drug Use and Health*

	Veterans' Suicidal behaviors[†] Odds Ratios (95% CI)
	Model 1 (Unadjusted OR, 95% CI)
Prescription opioid use	
No prescription opioid use	*Reference*
Any prescription opioid use without misuse	**2.01 (1.47 - 2.73)**
Prescription opioid misuse[**]	**7.71 (5.59 - 10.63)**
	Model 2 (Adjusted OR, 95% CI)
Prescription opioid use	
No prescription opioid use	*Reference*
Any prescription opioid use without misuse	1.34 (0.96 - 1.85)
Prescription opioid misuse[**]	**2.24 (1.33 - 3.77)**
Sociodemographic	
Age	
≥ 65	*Reference*
18-34	**2.76 (1.91 - 3.99)**
35-64	1.41 (0.99 - 2.00)
Gender	
Female	*Reference*
Male	1.29 (0.93 - 1.79)
Race/ethnicity	
White non-Hispanic	*Reference*
Black non-Hispanic	0.91 (0.63 - 1.31)
Hispanic	0.86 (0.54 - 1.38)
Other non-Hispanic [a]	1.35 (0.66 - 2.79)
Education	
College and above	*Reference*
High School or less	0.90 (0.63 - 1.23)
Health insurance	
Yes	*Reference*
No	1.49 (0.83 - 2.69)
Health-related history	
Perceived overall health	
Excellent/Very Good	*Reference*
Good	1.10 (0.76 - 1.58)
Fair/Poor	1.41 (0.97 - 2.05)
Major Depressive Episode (MDE) in Past Year	
No	*Reference*
Yes	**7.84 (5.29 – 11.62)**
Mental Health Treatment in last year	
No	*Reference*
Yes	**3.87 (2.62 - 5.72)**
Other substance misuse	
Illicit drug abuse or dependence	
No	*Reference*
Yes	**2.62 (1.53 - 4.50)**
Alcohol abuse or dependence	
No	*Reference*
Yes	**1.60 (1.05 - 2.45)**

Note: Figures in **bold** indicate the results are significant at p-value <0.05
[a] Non-Hispanic: Alaska Native/American Indian, Asian/Native Hawaiian/Pacific Islander, other single race, or two or more races
† Suicidal behaviors include ideation, plan, or attempt
** Prescription opioid misuse includes Use Disorder (Abuse or Dependence)

DISCUSSION

The present study explored the prevalence and association of prescription opioid use/misuse and suicidal behaviors using a sample of veterans from the NSDUH, a dataset not affiliated with the VHA. It is critical to examine suicidal behaviors in veterans using non-VHA data, since many veterans do not use the VHA for healthcare services. Some veterans use other not-for-profit entities such as homeless shelters and veteran service organizations to receive their care. The results of the present study are inconsistent with recent studies which used VHA data, and show a much higher prevalence of suicidal ideation (11.6%)[27] and suicide attempt (4.9%).[26] Our study shows 2.7% and 0.3%, respectively. Other studies have reported veteran past-year prescription opioid misuse/disorder between 0.8% - 1.0%;[13,26] while the findings of the present study show nearly three times the prevalence at 2.8% of veterans having misused prescription opioids in the last year. Although providers are not prescribing opioids to veterans at the same rate as they have in the past,[27] this study reveals that prescription opioid misuse is still a problem that needs to be addressed, especially since veterans continue suffering from chronic pain that may have originated from their military service.[28]

Findings from this study also show that veterans with past-year prescription opioid misuse were more likely to have reported suicidal behaviors relative to those without prescription opioid misuse. Previous research shows that prescription opioid misuse alone and in combination with other medications can further increase risk of suicide or unintentional overdose.[13,29,30] As veterans are prescribed opioids for pain management, prolonged use may lead to depression[19,31] which we found is associated

with a greater likelihood of suicidal behaviors. Previous veteran studies using VHA data

have also found that individuals with a history of depression have a much higher

likelihood of suicidal behaviors than those not experiencing depressive symptoms.[32,33]

While it is important to focus on depression as a dominant predictor of suicidality, further

research is needed to identify other mental health illnesses associated with suicidal

behaviors. Depression is often a good predictor of suicidal ideation,[34] but not the driver

behind suicidal planning and attempt.[35] Our findings indicate that veterans are more than

twice as likely to display suicidal behaviors if they have a history of illicit drug use or

dependence. A study using VHA data found that more than a third of veterans who

reported a suicide attempt used illicit drugs such as cocaine.[36] Our findings are consistent

with the current literature indicating that illicit drug use and dependence have been

significantly associated with suicidal behaviors.[37] Alcohol abuse and dependence was

also found to be positively correlated with suicidal behaviors among veterans. Overall,

suicidal behaviors and alcohol abuse and dependence, along with PTSD, are strongly

associated with intentional self-harm (suicidal behaviors) among veterans.[38]

In addition, study findings indicate that veterans 18-34 years old were nearly three

times as likely to experience suicidal behaviors than veterans older than 65 years old.

This finding is consistent with other nationally representative studies that show younger

individuals in the general population to have a higher likelihood of suicidal ideation than

older people.[39,40] Young servicemembers are often expected to mature faster than the

general population because of their exposure to traumatic events; however, the study

findings indicate that these same young veterans are still greatly being affected with suicidal behaviors after separation from active duty.

This study has several limitations. First, our study uses cross-sectional data, and thus, causality cannot be implied. Next, sensitive topics such as suicidal behaviors are limited to the last 12 months and may be underreported by participants. Therefore, suicidal ideations and plans that happened greater than 12 months ago would not be reported in the survey, and subsequently and attempt would be reported if it happened within the last 12 months. This is important as other research has shown a difference between those who attempt suicide without a plan than those with a plan.[35] Consistent with other large-scale drug and health surveys, participants may have underreported risky behaviors such as illicit drug, alcohol, and prescription opioid misuse, or dependence. Lastly, the NSDUH, however, conducts participant interviews through computer-assisted self-administered methods that have been proven in other studies to help minimize underreporting.[41]

Currently, many VHA programs that address substance use disorders in veterans and mental health illness, which we find may decrease mental health illness in the veteran population.[42] Our study results highlight prescription opioid and illicit drug misuse as significant factors associated with an increased likelihood of suicidal behaviors among veterans. Health care providers who prescribe opioids to veterans as part of a pain management treatment plan must have a heightened awareness of the consequences associated with prolonged prescription opioid use and its strong correlation to suicidal behaviors. Frequent prescription evaluations should be considered to monitor the

medication's efficacy over a long period of time. Considering the findings of this study that show younger veterans to have a higher propensity for suicidal behaviors, stronger efforts to assess mental health must be focused on servicemembers who have recently separated from the military. A dynamic clinical approach to prevent and treat suicidal behaviors, especially for veterans who have already been exposed to substance use and depression, must be at the forefront of every healthcare facility that exclusively provides care to veterans. Moreover, healthcare providers must increase their focus on a veteran's mental health and apply an equal level of importance as they do on their physical health upon separation from military service. Not all veterans receive their medical care from the VHA; therefore, non-VHA health care programs must also have specialized healthcare providers that are proficient in veterans' health care needs.

Conclusion

Opioid misuse, younger age, a history of illicit drug or alcohol misuse, or having a major depressive episode are strongly associated with suicidal behaviors among veterans. These findings suggest that immediate substance use and mental health screenings, upon first contact with a health care system, are imperative in preventing and reducing suicide rates within this vulnerable population. Although prescription opioid misuse has continued to fall over the last several years, it continues to be a significant contributor toward veteran suicidal behaviors. Screening for substance abuse related to prescription opioids and early intervention are critical to addressing suicide rates that increasingly plague America's veterans.

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CHAPTER THREE:

**Perspectives of homeless veterans living with substance use disorders (SUD) and
mental illness**

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ABSTRACT

Introduction: As America's veterans return to the civilian world from the military, some find themselves facing difficult challenges such as homelessness and substance use disorders (SUD). Numerous studies have shown strong correlations between homelessness and substance use, especially among veterans who are already struggling with other mental health illnesses. Veterans who have experienced SUDs and homelessness also have a greater likelihood of struggling with depression and suicidal behaviors. The purpose of this study was to understand homeless veterans' lived experiences, through their eyes, of their everyday life and social interactions.

Methods: We used semi-structured interviews to conduct a phenomenological study on 14 homeless veterans with known SUDs. Veterans were recruited from two homeless organizations in the Washington D.C.-Baltimore Metropolitan area. A Social-Ecological Model (SEM) was used to create themes, *a priori*, then used open coding analytic methods to identify emerging themes from the respondents' data.

Results: Most homeless veterans were male (92.9%), African-American (64.3%), and 35-64 years old (64.3%). More than two-thirds used illicit drugs or abused alcohol (78.6%) and nearly all veterans reported having a history of depression or anxiety (92.9%). Suicidal behaviors (ideation, plan, attempt) were present in 35.7% of all veterans. Themes that resulted from using the SEM codes were substance use/addiction and suicidal behaviors (*Individual*), military traumatic events (*Relationships*),

homelessness (*Community*), and veterans' perception of the Veterans Affairs health system (*Societal*). Themes that openly emerged were substance use to cope with death, social influence of substance use in high-risk communities, and violence and crime in homelessness.

Conclusion: We found that veteran homelessness and substance use are strongly associated with trauma suffered while on active duty. Consequently, once homeless, the communities that veterans live in generally encourage and exacerbate addiction and impede a path toward sobriety. Homeless veterans who have already struggled with SUDs in the past, and later experience a death in their family, often relapse to drug and alcohol use. Further qualitative research on homeless veterans suffering from SUDs must be conducted to expand initial findings from this study. Deeply exploring a veteran's personal relationships with family, friends, and their immediate community, may reveal opportunities to address these issues using healthcare and community interventions.

Key Words: Veteran, Homeless, Substance Use, Suicide, Social-Ecological Model, Qualitative, Mental Illness

INTRODUCTION

Many of America's veterans struggle upon returning to civilian life. Two of the most impactful challenges include substance use disorders (SUD) and homelessness.[1,2] A 2017 study found that more than 25% of homeless veterans diagnosed with a mental illness were also diagnosed with opioid dependence.[3] A large proportion of veterans diagnosed with SUDs, and who are considered to be chronically homeless, will likely continue to struggle with poor health and unstable housing despite high utilization of Veterans Affairs (VA) health services.[4] The National Survey on Drug Use and Health (NSDUH) is commonly used to conduct research on people suffering from SUDs.[5,6] One study using NSDUH data found that nearly a quarter of all veteran respondents reported binge drinking and about 4% of veterans reported using some type of illicit drug in the past month.[7] Another study reported that the prevalence of untreated SUDs among veterans (16%) was twice as high as other untreated serious psychological distress (8%).[5]

Homelessness is considered to be one of the most common social determinants of substance use among veterans.[8] Veterans lacking stable housing generally have poor SUD treatment compliance.[9] More focused and effective interventions are necessary to reduce homelessness among veterans entering substance abuse treatment.[10] Research evidence shows that nearly 60% of homeless veterans in the Home and Urban Development VA Supportive Housing (HUD-VASH) program had an SUD with the majority of those having both an alcohol use disorder and a drug use disorder.[11] Furthermore, veterans may be more likely to become homeless due to addiction and mental health issues and more than half of those homeless veterans are arriving at

hospital emergency rooms seeking help.[2] Previous studies have confirmed the strong relationship between substance abuse and homelessness, and support the notion that homeless veterans with SUDs would have worse housing status before entering any housing program.[11]

Another mental health concern that veterans with SUDs often experience is the presence of suicidal behaviors. Prior to joining the military, veterans may have been already susceptible to suicidal behaviors due to pre-existing mental illness and substance use[12], or a history of incarceration.[13] In fact, both psychiatric illness and a history of substance abuse are strongly associated with chronic suicidal behaviors.[14] Since veterans are often prescribed pain management medications to assuage symptoms from service-related injuries,[15] they may become addicted to the medication over time. One recent study found that prescription opioid misuse was significantly associated with suicidal behaviors compared to participants reporting no prescription opioid misuse.[16]

In terms of relapse, several factors are known to affect a person's desire to return to substance use. A 2008 study evaluated the association between Healthy Lifestyle Behaviors (HLBs) and relapse rates in a homeless residential rehabilitation program.[17] They found that of the 97 veterans who participated in the study, those who practiced several HLBs such as recreational, social, coping/spiritual, and substance recovery activities, showed lower relapse rates.[17] A team of researchers aimed to find predictors of inpatient admissions of veterans who recently completed SUD residential treatment. They found a significant association between inpatient hospitalizations and SUDs in the year immediately following residential treatment.[18] This study represented the

importance of enforcing continued and focused SUD relapse prevention behaviors following residential treatment. Furthermore, a longitudinal study of 207 veterans who completed a Mental Health Residential Recovery Treatment Program (MHRRTP) throughout a one-year period, and continued monitoring over the next five years, found that a total of 76% of veterans relapsed during the study.[19] Those who did not complete treatment had a noticeably higher relapse rate in the first year compared to those who completed treatment, 68% and 33%, respectively. Over the course of the entire five-year observation period, nearly all veterans (98%) who did not complete their treatment program relapsed.[19] Treatment completion is vital to reducing substance use incidences after discharge, and those who complete substance use treatment have fewer relapses and are more likely to maintain abstinent after completing treatment.[20]

Although various research methods have been used to investigate veteran's struggles with substance use and mental health after their military service, a qualitative research design provides a more comprehensive picture of a veteran's life. Qualitative research is necessary to explore nuanced individual experiences lived by veterans that would otherwise be impossible to capture using quantitative research methods. While complicated health issues can be quantified, describing the complexity and subtlety of homelessness and mental illness is better distilled and managed using qualitative analytic methods.

Study Objectives

This study investigates major barriers and facilitators in maintaining sobriety upon completion or termination of SUD residential treatment in the Washington D.C. and

surrounding metropolitan areas among homeless veterans. To guide this study, we used

the Social Ecological Model (SEM) that was originally designed to comprehend human

development and examine the roots of violence[21] (*Fig. 1*). We used this this model not

only as a framework to construct our study, but also to develop all interview questions

used in this study (Appendix B). We adapted this model to help us understand how a

veteran's health is affected by the interaction of their individual characteristics,

relationships, community, and societal environments. The specific objectives of this

qualitative research study were to: 1) Understand how individual characteristics increase

the likelihood of SUD relapse (Individual); 2) Explore how cultural norms and personal

relationships influence SUD relapse (Relationship); 3) Discover how living conditions

(homelessness) influence substance use and abuse or suicidal behaviors (if any)

(Community); 4) Examine how societal networks and access to basic needs influence
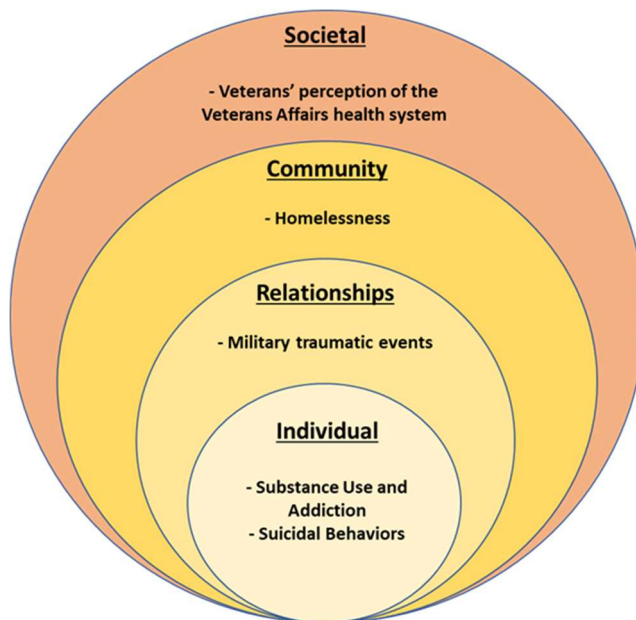
substance use and abuse (Societal).

Figure 1. Social-Ecological Model (SEM) used for coding themes derived from homeless veteran's interview responses. This model was adapted to fit this study's SEM themes at each of the four levels.

METHODS

Design

The goal of this study was to understand veterans' lived experiences with homelessness, SUDs, and other mental illnesses by exploring, through their eyes, their everyday life and social interactions. We conducted a phenomenological study, which allowed for the development of a complete, accurate, clear and articulate description and understanding of a homeless veteran's human experience with an SUD. This method allows for an accurate description of the veteran's lived experiences.[22] This study was approved by George Mason University's Office of Research Integrity and Assurance, Institutional Review Board (IRB) on May 24, 2021. A written consent form was emailed to, and signed by, all respondents. The consent form explained the research procedures, risks, benefits, confidentiality, inclusion and exclusion criteria, and the researchers' contact information (Appendix C). This form also requested their consent to audio-record the phone interview sessions.

Sample

This study included 14 U.S. military veterans. The respondents were selected by using a purposive sampling method from veterans who had experienced both homelessness and substance use. Inclusion criteria required that respondents must reside in or near the Baltimore-Washington D.C. Metropolitan area, and must have experienced homelessness within the last 12 months. The Baltimore-Washington D.C. Metropolitan area is one of the top 19 areas which saw an increase of homeless veterans between 2019

and 2020.[23] Another important inclusion criterion is that all respondents must have been diagnosed with an SUD sometime in the past. Lastly, veterans must have recently participated in some type of SUD treatment (within the last 12 months). The exclusion criteria required that respondents were not currently on active duty in the U.S. Armed Forces or on reserve status. Veterans with current self-disclosed physical/mental health conditions that they consider would have inhibited or delayed the interview process were not included in the study. This study was not intended to treat, diagnose, or provide counseling for any of the respondent's current health conditions.

Recruitment and data generation

The recruitment strategy involved contacting several homeless organizations by phone and in person, which included homeless shelters, Veteran Service Organizations (VSO), and food pantries to identify willing veteran participants. Only one homeless shelter, Project PLASE, People Lacking Ample Shelter and Employment, and a VSO, Maryland Center for Veterans Education and Training (MCVET), agreed to provide veterans' information for recruitment purposes. These organizations have direct contact with veterans outside of the federal healthcare systems such as the Department of Defense and the VA. Official documentation stating the purpose and description of the study was provided to each organization's administration and a copy of the Institutional Review Board (IRB) approval letter. The primary researcher provided the administrative staff the opportunity to attend the interviews, if the respondents consented to it. Neither of the organizations' administration chose to participate in the veteran interviews.

The primary researcher visited both organizations in person and met with the

directors of each facility from July through September, 2021. Each director provided a

brief tour of their facility and offered informational literature such as brochures, facility

map, and business cards. After receiving permission from the organizations' leadership

to start the research, the data collection process commenced by way of phone interviews.

All interviews were conducted by the primary researcher as a complete observer. Initial

contact with the respondent was made by phone to determine if they met the inclusion

and exclusion criteria set forth by the IRB parameters (Appendix C). If the veteran met

the required criteria, a future appointment was scheduled to conduct the interview. Due

to COVID-19 restrictions and precautions, all interviews were conducted by phone. The

study aimed to conduct enough initial screenings to identify at least 20 interview

candidates; however, recruiting veterans who met the study's inclusion criteria was

challenging. Three veterans who initially met the inclusion/exclusion criteria did not

return phone calls or emails once they were identified as potential candidates and some

were incredibly difficult to schedule interviews after the first contact. Although all

veterans were affiliated to one of the two homeless organizations, the organizations were

not responsible for tracking these veterans to participate in this study. Only 14 of 26

veterans who were screened meet the inclusion criteria and completed the interview. The

12 ineligible veterans who were not included in this study were disqualified due to not

having a history of homelessness (2), not having a history of any substance use, including

alcohol (4), disclosing that he or she was not a veteran (1), and not responding to follow-

up meetings after making the initial contact (5). Of the five veterans who did not respond after making initial contact, three had met the inclusion/exclusion criteria.

Veterans who were identified for follow-up individual interviews were formally asked if they were willing and able to participate in a one-on-one semi-structured interview to collect more in-depth information. A semi-structured interview was comprised of several predetermined questions asked in a certain order; however, the questions were relatively open-ended allowing both the researcher and the respondent to build rapport and to create opportunities to expound upon emerging themes and theories.[24,25] A $20 Alcohol/Tobacco/Firearms/Lottery Prohibited Walmart Gift Card was given to every respondent for every interview session that he or she participated in.

Interview questions were constructed *a priori* using the SEM as a framework to guide themes within the four SEM levels. The first several questions focused on basic demographics and military history. The remaining questions were asked using a semi-structured interview approach, affording the respondent the opportunity to provide detailed answers. Some of the topics covered involved their history of homelessness, substance use, depression, and suicidal behaviors. A detailed example of all topics covered and questions asked can be found in Appendix B.

Data analysis process

The unit of analysis for this study was the veteran. Interviews were used to understand the context, constraints, and individual viewpoints of the veteran's lived experiences with SUD, homelessness, and/or suicidal behaviors (if any). Interview questions were structured to address objectives derived from the SEM which is often

used by substance use and mental health researchers.[24,25,26] All phone interviews were audio-recorded and transcribed for data analysis using NVivo 12 software.[29] Theme coding was conducted using two analytic methods, *a priori* and open coding.[30] We used *a priori* techniques to create themes prior to coding using the SEM, and open coding was used to identify emerging themes from respondents after data was collected. To standardize formatting of collected interview data, recorded information from individual interviews were transcribed to Microsoft Office Word documents.

Study Assumptions

The main assumption from this study was that the veterans would answer the interview questions honestly and with a great deal of detail. Another assumption was that the inclusion criteria of the sample were accurate, and that veterans all experienced a similar phenomenon (living homeless with SUDs) of the study. The last assumption was that the interviewed veterans would sincerely want to participate in the study without any other motives such getting additional compensation for a more captivating but insincere story.[31] This study intended to uncover real-life veteran stories that will help illuminate the challenges that homeless veterans living with SUDs face day-to-day.

RESULTS

Characteristics of study respondents

The 14 participating veterans represented a broad range of demographic and military characteristics (*Table 1*). Nearly two-thirds (64.3%) of the veterans were 35-64 years old. Most veterans were male (92.9%), African-American (64.3%), served in the

Army (42.9%), while nearly half (42.9%) of them served during the post-Vietnam era

from 1976-1990 and the other half (42.9%) served during the OEF/OIF era from 2001-

2021. The vast majority of veterans used illicit drugs (78.6%) including heroin, cocaine,

crack-cocaine, Molly (MDMA), Fentanyl, and marijuana. The same percentage of

veterans (78.6%) abused alcohol either as a sole substance without using any other drugs,

or in combination with other mind-altering substances. Veterans were asked if they had

spent any time in jail greater than one night and the majority of veterans

Table 2. *Veterans' Demographics, Substance Use, and Mental Health Illness History*

Characteristics	*N* (%)
Total Sample	14 (100%)
Age	
18-34	3 (21.4)
35-64	9 (64.3)
>65	2 (14.3)
Gender	
Male	13 (92.9)
Female	1 (7.1)
Race	
African-American	9 (64.3)
White	2 (14.3)
Other[*]	2 (14.3)
Military Branch	
Army[†]	6 (42.9)
Navy	3 (21.4)
Marine Corps	2 (14.3)
Air Force	2 (14.3)
Coast Guard	1 (7.1)
Service Eras	
Vietnam 1961-1975	1 (7.1)
Post-Vietnam 1976-1990	6 (42.9)
Gulf War 1990-2000	1 (7.1)
OEF/OIF 2001-2021	6 (42.9)
Illicit Drug Use	11 (78.6)
Alcohol Abuse	11 (78.6)
Arrest History	9 (64.3)
Depression/Anxiety	13 (92.9)

had an arrest history (64.3%) ranging from two nights to six years. Almost all veterans

reported having a history of depression or anxiety (92.9%). Whether they were medically

diagnosed by a healthcare professional or self-diagnosed, all veterans who reported

having depression were adamant in their responses. Lastly, more than a third of all

veterans reported having suicidal behaviors (35.7%). These five veterans reported

suicidal behaviors such as ideation, plan, and attempt. When asked to confirm whether or

not they wanted to report those actions as being suicidal, they responded "no" to having

suicidal behaviors; hence, they were not included in the final figure of those who reported

suicidal behaviors.

All respondents were affiliated to one of the two institutions mentioned in the

methods section. These two locations either assist homeless persons with temporary

housing at their physical location or provide them with resources to find temporary

housing that may lead to permanent housing. Some veterans denied being homeless at

the time of the interview and described their periods of homelessness as happening many

years back. However, since 11 of the 14 veterans were actively connected to one of these

two institutions, the housing they currently have is considered to be transitional or

temporary. The remaining three veterans have already secured permanent housing, but

still had a period of homelessness within the previous 12 months. Two of the 11 veterans

who were identified as homeless initially denied ever having any periods of

homelessness; however, after rephrasing the question regarding their housing status, they rescinded their original response and agreed to having periods of homelessness within the last 12 months. Interviews averaged 47 minutes in duration, shortest was 24 minutes, and longest was 82 minutes.

We noticed that much like other qualitative research studies that focus on substance use, not all themes align neatly with each level of the SEM. Some themes were easily identified to fit one particular level of the model, while other themes openly emerged from the veteran responses. Substance use and addiction and suicidal behaviors aligned best in the *Individual* level. Military traumatic events corresponded well in the *Relationships* level. Homelessness fit best in the *Community* level. Veterans' perception of the Veterans Affairs health system suited the *Societal* level most appropriately. Four additional themes emerged from the interview responses: substance use to cope with death, social influence of substance use in high-risk communities, violence and crime in homelessness, and drug use as a substitute for suicide.

Social-Ecological Model Themes

Substance Use and Addiction - Individual

All levels of the SEM and corresponding themes along with emerging themes and respondent quotes that were found in this study are presented in **Table 2**. Substance use was not found to originate consistently at any particular point in a veteran's life. Some veterans began consuming drugs and alcohol early in their life, while others began using substances after leaving the military. The reasons why they started using drugs in the

first place varied from having a family history of substance use and always being around drugs and alcohol, to using drugs to self-medicate symptoms of their depression and anxiety.

An African-American Marine Corps veteran in his mid-thirties explained how becoming addicted to drugs happened organically. He lacked self-awareness and became chemically dependent without warning. He mentioned, *"I really didn't know what an addictive personality was…"* He talked about chasing the *"euphoria"* that is normally reached the first time a person consumes a drug, then tried maintaining it without question. This was a common theme with several of the respondents. This particular veteran talked about how doing drugs became his job.

> *I didn't understand why I was doing what I was doing. All I knew was that I was doing it because I wanted to, and I was doing what I was doing because I created a lifestyle of habit… This is what I do every day now… it became my job."*

Suicidal Behaviors – Individual

More than a third of the veterans in this study reported having some type of suicidal behavior. While some went beyond ideation and followed through with a plan and attempt, others considered their drug use as a form of a suicidal behavior. One veteran mentioned that he "*…sat there with a gun in my mouth a couple times…"* because he thought another group of homeless people were trying to stab him. A second veteran described her experience with planning her suicide with a razor as a way out of what she was going through and how she did not want to burden anyone else with her problems. Another veteran considered attempting suicide because *"…at that time, I had*

68

nothing…" and contemplated jumping from a bridge until his friend saved his life by talking him off the edge.

A veteran in his late twenties talked about his experience with suicidal behaviors. He began having suicidal ideations after a close friend committed suicide. He mentions that he and his friend came from the same state, went to basic training together, and were stationed together at the same military installation. His friend's suicide came without warning and he still blames himself for not doing more to prevent his death. This veteran described personal challenges of coping with this traumatic event. The tone and pace of his voice varied often throughout his recollection, as if he's visualizing everything that happened on that day. Hearing his story, the way he told it, with numerous pauses and sighs, one can deduce that he was still living in pain from that memory. This same veteran also experienced death in his family while he was in basic training. His older brother was shot and killed less than three weeks after he left to basic training. He wasn't notified of his brother's death until after he finished his training.

> *"…and then losing my oldest brother while in basic training and then turning around and losing a best friend, which I considered a brother... it was like... it took a toll…" "…I mean, I still, I still have the thoughts about this, about umm... 'What if?'... like, I still have the "What ifs", but umm... it's pretty much different from my oldest brother, because it's like... if I was there, I could have stopped it and I pretty much blame myself…"*

Military Traumatic Events – Relationships

While many servicemembers complete their time in the military honorably and without much exposure to traumatic events, many veterans who struggle with substance use often attribute their substance addictions to the mental trauma they acquired while on active duty. Regardless of age, gender, or race, veterans are broadly exposed to a wide array of stressors that often take a negative toll on their mental health. The relationships and cultural norms that are uniquely encountered in the military result in a broad range of lifestyle outcomes. While some veterans have positive experiences that they later use as a foundation to live a fruitful and productive life, others endure very unfortunate events that negatively impact their mental health. A Hispanic-African-American Army veteran explained how some of his military experiences weighed heavily on his mental health. He talked about how some of the pre-deployment videos he watched and the things he saw while on deployment to a toll on him physically and mentally. He explained that age was not a factor in processing these events and how everyone around him was also negatively affected by their experiences.

> *I mean, anybody, not even based off of age, because they say a lot of younger soldiers, it would take a toll on them, but not even based on age... pretty much seeing and hearing some of the stuff that we saw and heard... It messed a lot of us up mentally."*

A female veteran in her mid-sixties still vividly recalls the day she experienced a horrific sexually traumatic event while showering in her barracks. Her anger and frustration shone through the volume and tone of her voice during her recollection of the event. She attributes her depression and anxiety to this event in her life. She explained

her traumatic event in great detail talked about how she can never forget her name and how it made her feel to be violated in that manner while being in such a vulnerable state. She reported the incident to her chain-of-command, but they disregarded her story and said that she was lying.

An Army veteran in his late-twenties, who declined to disclose his race and ethnicity, talked about how his memories from previous war deployments led him to alcohol abuse. He mentioned how he lived in a state of denial after deploying to Afghanistan. He still experiences flashbacks from war and traumatic memories he had to endure. His pride and wanting to feel like there was nothing wrong led him to mask his difficult memories with alcohol.

Homelessness – Community

All respondents had some experience with homelessness ranging from three weeks to ten years. The most unpredictable aspect of veteran homelessness was its timing of origin. While it would be easier to understand and accept that veterans become homeless over time due to difficulties they have encountered over an extended period of time, we found that homelessness can occur immediately after discharge from service.

An African-American Hispanic Army veteran in his late-twenties talked about not having a place to live immediately after separating from the military. He and his wife moved in with his wife's mother temporarily until the mother moved out. They both lived with his mother-in-law until she had to move. It was at this point that they became

homeless and lived on the streets until eventually finding help from a homeless organization.

A young Coast Guard veteran in his twenties talked about not only having a history of homelessness early in his life, but also experienced several homeless episodes after leaving the military. He recalled being homeless at 13 years old when he and his family were evicted from their home resulting from a foreclosure. He and his family moved around from place to place until he joined the military. The military was the only constant and dependable housing he has ever had. Once he separated from the military, he immediately became homeless and has since experienced homelessness on three different occasions.

One veteran talked about how drinking alcohol while he and his family were homeless helped him cope with his emotions and erased the pain by numbing his feelings. He suffered from anxiety and depression and felt that he was letting his family down. He explained how not being able to provide for his family made him feel like less of a man, and he drank alcohol to mask those feelings.

Veterans' Perception of the Veterans Affairs Health System – Societal

While most veterans who received care from the VA had relatively benign experiences, two veterans reported having poor encounters with its health system. This level of the Socio-Ecological Model represents the outermost factor impacting a veteran's environment. As military servicemembers separate from the military and become veterans, the federal government is responsible for caring for these veterans' health

through the VA health system. Of the veterans participating in the study, many reported that they do not receive the care they expected or they or a family member received poor care from the VHA.

An African-American veteran in his late forties blamed the VA for his addiction to opioids. He stated that he would have never gone through all of the negative things he went through while he was addicted had it not been for the VA unscrupulously prescribing him pain medications for over four years. He was originally prescribed Oxycodone to assuage his pain from a surgical procedure on his spine. He mentioned that he was routinely evaluated by his primary care physician for his pain and the answer to his problem was always Oxycodone. He mentioned that once the phone interview was over, they would prescribe him more opioids.

A White Hispanic Coast Guardsman in his mid-twenties talked about not having much faith in the VA. Although he does not receive health care from the VA health system, his opinions of the VA stem from witnessing the type of care his father receives, as his father is a Vietnam veteran. The VA does not recognize this respondent as a veteran because he did not serve his entire four-year contract with the military. He currently receives all of his healthcare from hospital emergency departments and from the homeless organization he is currently affiliated with.

Table 3. *SEM Themes, Other Emerging Themes, and Supporting Respondent Quotes*

SEM	Themes	Respondent quotes
Individual	*Substance use and addiction* –	"…it became not [about] getting high… it just became a daily activity of

	Chasing the euphoria	using just to use. The euphoria... you get the first euphoria, then it wears off and you just doing it, just to do it. Then, after a while, you doing it just do it, but you got to get money to do it too. After a while, the money you get is not going to be legitimate… and if you do get it legitimately, like for me, it wouldn't last long..."
Individual	*Suicidal behaviors* – Ideation	"…some group of like the transient group I was with that was like helping me get by, I thought they were out to get me, you know, but like I was like feeling really paranoid because they found out I cheated on my girlfriend and was doing shitty things in the community... and, you know, they wanted to fight and they wanted to, like, stab me and shit. So, it's like, I wanted to just fucking end it before they did, you know?"
Individual	*Suicidal behaviors* – Remorse	"…I mean, I still, I still kinda have, like, the thoughts of like, umm...like, sometimes I still like ... kind of [have] thoughts of 'what if he didn't do it?'… or what if I could have stopped it, or what… what would be the… what would be a different outcome if I had of talked to him, like, I had of just listened. I still at times catch myself, I still at times catch myself blaming myself because of what happened." "I pretty much still feel like I'm to blame for what happened because I could have, I could have said something..."
Individual	*Suicidal behaviors* – Plan	"I had a razor.... I just wanted…I just wanted to die. You know, I ain't had nothing to live for, you know, and like I wasn't getting nowhere. You know, the thought came, the feeling came and everything else came along with it." "…when you['re] think[ing] about suicide... umm... don't [just] think if you want to kill yourself, just go ahead

		and kill yourself, get it over with. Don't make nobody else miserable with your shit... that's [how] I look at all that…”
Individual	*Suicidal behaviors* – Attempt	“I was on the bridge at one time, and then I looked in the water, I said [to myself], ‘you know you can't swim.’ [Then], this guy I knew came, he was walking by, I was on the bridge or whatever, and he came by [and] he said… get off that bridge!”
Relationships	*Military traumatic events* – Pre-deployment training and deployments	“It takes a toll on you physically and mentally. But I would say it was more so mental than physical because seeing, you know, seeing some of the stuff that I’ve seen, and hearing, like, people tell stories about the stuff that they witnessed or been through on deployment… watching some of the videos that we watched prior to going overseas, and hearing about stuff that could happen to us, or happen to friends of ours that we could witness while overseas... it pretty much, like, not only was an eye-opener for a lot of us, but it also kind of... That's what kind of scared a lot of us...”
Relationships	*Military traumatic events* – Military sexual trauma	“…when I was in the military, I was in Fort Jackson, South Carolina, and in the midst of me going to the bathroom and taking a shower, I was attacked by a Company Commander sergeant in the shower. You know, she tried to.... rape me... and I fought her off and the words she used out her mouth…, ‘You'll never be nothing, you'll never get nowhere... [if] you tell anybody I'm in here...’ and then [when] I think about it, [when] I see a Caucasian female with long weird hair, it messes with me because it happened in the military, in the shower, and it makes you think about somethings… you get

		just depressed, you know, each time you try to manage…”
Relationships	*Military traumatic events* – Deployment to Afghanistan	“… I deployed to Afghanistan… and, you know, I've dealt with a lot of anxiety and depression and 'flashbacks' and, you know, a bunch unwanted feelings and thoughts that I never had prior to my deployment. I had to deal with that once I got out and I was in denial, and I didn't think anything was wrong with me, you know, 'I'm fine'… another pride issue. 'There's nothing wrong with me.' So, this pain… I would run to alcohol...”
Community	*Homelessness* – Along with family members	“At the time, I didn't know where I was going to go as far as when I got out. I didn't know whether I was going to come here to Maryland, or if I was going to return back to my hometown of North Carolina.” “...upon arriving in Maryland, at the time, we were living with her mother, and we pretty much like bounced around from place to place, anywhere we could lay our head. Her mom wound up moving and it pretty much put us out on the street.”
Community	*Homelessness* – Multiple episodes upon discharge from military	“I joined the military around 17 and a half... and I was homeless immediately after my discharge, which was around when I was 21. I was sleeping in a tent over in, you know, central California and trying to figure out how to get my [G.I. Bill] benefits. Went to Towson University and I was homeless again when I was 23…” “…yeah, I was homeless, I was incarcerated… and the most recent time was this year in May [2021].”
Community	*Homelessness* – Alcohol abuse	“… being homeless and me drinking pretty much ran hand in hand…” “It was more so, like, I would drink to, like, ease the pain or the thoughts of me, like, letting my family down. A lot of times I considered myself of

		being, like, less of a man because I couldn't provide... So, the drinking... drinking, it pretty much, like, how can I put it, like masked some of that... some of those emotions, like a numbing-like sensation. I did it to pretty much, like, get away from that world..."
Societal	***Veterans' perception of the Veterans Affairs health system*** – Overprescribed opioids	"… I don't think the VA was supposed to give me those pills so long as they did, and that made a made a big influence on my life." "… doctors aren't supposed to give any one of those... pain pills that long. I mean, for four years, how am I not supposed to be hooked on drugs?" "I had to get interviewed by my home-, by my primary care sometimes just to see what was going on with me..." "they just give me more. I mean, I have the whole script. I mean, I got medical records because I wanted them to have [the records] so they couldn't get rid of proving that I got those pills for four years, for four or so years!"
Societal	***Veterans' perception of the Veterans Affairs health system*** – Witness to family member's care	"My father is a veteran and I've seen how they treat him and they're just being gutted with their budget… and I think that, you know, it's a political thing. They just don't have the funds to keep it going." "…[they're] not capable of taking care of us… and it's not a quality judgment, you know, I'm sure there's a lot of good people in there, but they're just not being funded and managed very well at all."
Other	**Themes**	**Respondent Quotes**
Emerging Themes	***Substance use to cope with death*** – Alcohol abuse due to mother's death	"...I didn't have no help, I didn't have family, no friends, my mom had [died]... I lost my mom during that time, too. I wasn't able to go see her because I was in Texas transitioning from the military." "…that also just

		increased and increased things way more. So, I just really went to a real dark place and I didn't want to eat. I didn't, you know, I didn't want to eat, I would just wake up, you know, I just [didn't] want to feel that. I didn't want to feel it. I [didn't] want to feel like… like how it felt to be me, and to go through what I was going through at the time… so, I ran to alcohol.”
Emerging Themes	*Substance use to cope with death* – Heroin use due to multiple family member's deaths	“I went to Total Healthcare because I had a downfall when.... somebody - my sister, somebody died... sister or brother… one of them died, and I had to bury them… and aunts [died]... everything was like… they were dying, like, back-to-back, months apart and stuff.” “I went to Total Healthcare and I got back on [Suboxone].”
Emerging Themes	*Substance use to cope with death* – Heroin use due to witnessing only son's murder	“I went through a real bad experience with my son being killed. Well, I actually witnessed it… and it was something I had to go through at the time that I was selling drugs… never used, but I was selling… and that day, these guys came in my mom's house...” “When I come out the door, and I'm looking, and I'm like who are these guys with a gun at my son's head?… and when he handed them the 20 dollars, the guy said, 'is that all?'... and he pulled the trigger. So, I actually sat there and witnessed it... but I was, like, stuck and I couldn't move to do anything.” “That picture I dealt with for about... I say nine years my life. I was trying to get this picture out... then, all of a sudden, I just started self-medicating.”
Emerging Themes	*Social influence of substance use in high-risk communities* – Trying to fit in and reduce	“Well, the main thing was that I can't be homeless alone. There's too much things to worry about and to do. So, I usually have to team up with somebody, and you just naturally meet

	stress from being homeless	people… and these people have drugs on them, you know, and Molly is the least of them. So, to kind of fit in, I would do that and also [not to] mention the stress from being homeless. Like if you're on Molly, you're not worried about… you're not even hungry anymore. You're not anything, you know. You're just like in tune with the universe in a kind of way, you know, you just feel euphoric and it really counteracts that like depression of just being dirty and not having anywhere to go.”
Emerging Themes	***Social influence of substance use in high-risk communities*** – Panhandling to support substance use	“Yeah, if I can get it… but I ain't had no money, but if I met somebody who was buying, I was drinking.” “…one thing, you meet, you meet all the homeless people out there, and I don't know if you have ever seen people panhandle, but that's how we did what we did… by panhandling.”
Emerging Themes	***Social influence of substance use in high-risk communities*** – Nightlife lifestyle stimulated substance use	“I tried it to see how the cocaine felt… I liked the experience that I enjoyed [during] that period of time… and [I] went from me indulging in it from every two weeks, then it went from every two weeks to every week, and then it went from every week to every weekend, then from every weekend to every day… then it went from me snorting cocaine to smoking cocaine… and it was stimulated from my loss of purpose, from being out of active duty, from me being in combat. All these emotions and thoughts attributed to me using my substance of choice through stimulation of my mind of what I was feeling. It went from a fun thing to becoming misery down the road.”
Emerging Themes	***Violence and crime in homelessness*** – Violently attacked	“I was waiting outside and these guys... I don't know... these young guys... I didn't do anything to them... and they jumped me. One of them hit me with

	while waiting in line at a food pantry	something. I was sitting outside in broad daylight, 1:00[pm].” “They took $60… and my cigarettes.”
Emerging Themes	***Violence and crime in homelessness*** – Committed crimes to support his addiction while homeless	“… it’s drug-related because of my behavior… and drug-related in a sense because of my addictive behavior that caused me to… led me to the activities that I was doing...” “I never I never took money from hardworking people, it was mostly like stores and stuff like that… doing illegitimate stuff to, you know, to maintain the balance in my lifestyle because it was, it was unstable.” “I didn't think small petty money, I was looking for a large lump sum of money to have it last longer... and so the stuff I was doing provided a large sum of money at a faster pace and faster time.”
Emerging Themes	***Drug use is like suicide*** – Unaware of drug contents	“No, no, I never considered committing suicide. Never been on the table. Only suicide I was committing was, like, each time I went out to go get some drug that does not have any type of ingredients on it… that says it has this and that in it, I feel as though that's slowly committing suicide in an indirect way because the drugs you get out there do not have ingredients on the back of the pack.”
Emerging Themes	***Drug use is like suicide*** – Endlessly chasing the feeling	“…we smoked crack, you know, that first one is always the best one. That first hit... and then, you know, you chasing... chasing that same feeling… and I can remember having crack and I'm just smoking just to be smoking because… I'm not getting any higher. So, I see it as a form of committing suicide ... trying to kill yourself.”
Emerging Themes	***Drug use is like suicide*** – Drugs are dangerous	“ I did a lot of hard drugs while I was homeless too... cocaine and heroin... [I was] just snorting it, but it's very dangerous, you know, it could kill you. “Well, mainly the hard drugs I did

		when I was homeless was kind of suicidal because it's very dangerous, you know? I think it could have been somewhat suicidal, you know, because it's very dangerous to do a lot by yourself and you don't really notice what you're getting into."

Emerging Themes

Substance Use to Cope with Death

One constant theme that emerged from this study was the significant impact that death of a family member had on a veteran's substance use. Even for those who had discontinued substance use, losing a loved one reignited the need for drugs and alcohol to cope with depression and to help them grieve their loss.

One veteran described how his mother's death, along with homelessness, intensified his alcohol abuse. He mentioned that a lack of support from friends and family made him feel like he had nothing. He drank to mask his pain and the sorrows he was feeling during that time. When asked if he thought that homelessness contributed to his alcohol use, he responded:

> *"Yes, most definitely because I felt like I didn't have no options. I didn't have no*
>
> *help. I didn't have nothing.*

A female veteran recalled that after being clean-and-sober over seven years, she relapsed and needed rehabilitative care because several family members died consecutively. She struggled balancing her personal life and having to deal with so much

death in her family. She spoke about having to reach out for help after she relapsed and was put on a medication to treat her opioid use disorder. She considered grieving her family members' deaths as the main reasons she relapsed.

Another male veteran in his late-fifties shared a similar relapse experience after being drug-free over eight years. He mentioned that after completing a 120-day drug rehabilitative program, he relapsed due to the death of his mother and has not been consistently sober since 2015. He recently attended a 30-day drug rehabilitative program at a VA Medical Center in Maryland and confirms that he has been clean-and-sober since completing that program in 2021.

Perhaps the most impactful story leading to substance use as a method to grieve the death of a family member was told by an African-American Army veteran in his late-sixties. Holding back tears, he talked about the day he witnessed his only child get shot in the head after being robbed in his own home. He mentioned that this was the sole reason why he turned to drug use and became addicted to heroin. The pain from his trauma was palpable throughout his story and how he told it. His recollection of this traumatic experience was depicted with a great deal of personal shame and regret for not reacting while this event unfolded. He continued to reference this event throughout the interview regardless of topic. His deceased son was getting ready to be a father himself; however, he was shot and killed three days before his own son was born. Now, this veteran is staying clean-and-sober to be present for his only grandson.

Social Influence of Substance Use in High-Risk Communities

Homeless veterans often find themselves in a perpetual drug use-sobriety-relapse cycle due to the instability of their housing status and the people they surround themselves with. Homeless individuals regularly contend with unstable and transient social relationships related to their uncertain housing situation.[32] Many of these fleeting relationships are forged in homeless communities through substance use. Night life communities are also considered to be of high-risk to addicts looking to recover from substance use.[33] The next few examples display how these high-risk communities influence substance use in the veteran population.

A White Hispanic Coast Guard veteran in his mid-twenties, with a deep family history of substance use and alcohol abuse, talked about becoming homeless after the military. Due to certain requirements for VA benefits' regarding diagnoses documentation in a veteran's medical record, he was not able to receive any medical care from the VA health system upon discharge. At 21-years-old, he found himself homeless and without friends, family, or the government to support him during his transition from the military. One veteran reported that homelessness contributed to his substance use. Although he began experimenting with 'Molly" (MDMA) while he was still in the military, he increased using this drug once he became homeless. He explained how becoming homeless and surrounding himself with other homeless people who were doing drugs increased his drug use. His desire to "fit in" the homeless community and to counteract the feeling of depression stemming from being homeless led to his drug addiction.

An African-American Navy veteran in his late fifties recalls how he maintained his addiction to alcohol while he was homeless. He attributed some of his methods of supporting his addiction to the way the homeless community operates. He mentioned that he would only drink when someone offered him some alcohol and during times when he wasn't able to get alcohol from his friends, he would panhandle to finance his addiction.

One veteran described how he transitioned from being a casual drug user to becoming an addict. Once a Special Forces Marine, a District of Columbia Guardsman, and a federal employee, a government furlough led him to find work where his unique type of skills were required. He became a *"bouncer"* (security) for several *"strip clubs"* in Maryland. He stated that the people and the community that surround that type of business lent themselves to substance abuse. He describes this as the *"turning point"* in his life where he felt that everything began to spiral out of control. What once was a casual night-life-related event, drug use became a painful lifestyle he needed to maintain.

Violence and Crime in Homelessness

Violence is common among the homeless community, particularly if there are drugs involved. Many of the veterans we interviewed talked about some facet of violence in their life. Whether they were crimes they committed themselves or were recipients of a violent act, most veterans experienced some level of violence in their lives.

One veteran participated in the interview while he was still in a hospital's primary care department. He had been the victim of a violent attack while standing in line to

receive food from a local food pantry just the night before the interview. He stated that the assailants were likely homeless as well and were standing in line alongside of him. The location where he was assaulted is a place where homeless people are not only provided food, but it is also a place where they can attend Alcoholics Anonymous or Narcotics Anonymous meetings. He mentioned that this whole event was unprovoked and happened in "*broad daylight*." Although he was offered to continue this interview at another time when he fully recovered from his injuries, he was adamant about finishing it because he felt that this was important information to share.

Another veteran talked about the crimes he had to commit to maintain his addiction and to earn his stay in a communal home shared by other drug addicts engaged in criminal activities. He explained that the reason he was incarcerated so many times was due to his drug addiction. The people he lived with expected him to do the most egregious crimes because of his military experience and took advantage of his drug dependence.

Drug Use is Like Suicide

One interesting theme that emerged from this study was the respondents' self-awareness of their substance use. Although these veterans admitted to not having suicidal behaviors, they equated their chronic substance use as a form of suicide attempt. They mentioned that while their intention was never to kill themselves, having an understanding of what large quantities of drug consumption can do to one's body was like attempting suicide. One of the veterans described chasing the feeling he experienced the first time he smoked crack and never reaching it. As mentioned before, drug addicts

often find themselves chasing the original sensation they felt the first time they consumed drugs. The last veteran talked about his understanding of the dangers of the types of drugs he was consuming and still continued to do it. Most of his *"hard drug"* consumption happened during the times he was homeless.

DISCUSSION

This study of veterans who have experienced homelessness and substance misuse found several themes that may explain why veterans start using illicit drugs and abusing alcohol, and highlights reasons why they may return to substance use after reaching sobriety. The most prevalent themes that emerged from this study reflected each veteran's experiences and how their sobriety, homelessness, and mental health was affected. Examination of these themes within the SEM provided clarity to address and further identify barriers that inhibit recovery from SUDs.

At the individual level of the model, veterans revealed extraordinary stories about their substance use history and how they became addicted. They also talked about how becoming an addict crept into their lives gradually and unsuspectingly and did not originate at any particular point in their life. Recent literature confirms our findings in reporting that some drug users begin to use drugs and alcohol to eliminate unwanted emotions while unknowingly becoming addicted.[34] Another theme that also falls on the individual category is suicidal behaviors. Research evidence has demonstrated that those who have contemplated suicide in the past have either worked in high-risk professions, suffered from financial strain or a traumatic event, or have been victimized.[35] Every

veteran who reported suicidal behaviors reported feelings of hopelessness, persecution, and/or regret. This study provided compelling evidence of these phenomena by depicting several stories of veterans' struggles with addiction and suicidal behaviors.

Relationships also played a significant role in a veteran's recovery from SUDs, particularly on the influence that relationships had on the veterans' mental health and how they managed their traumatic memories from the military. A veteran's relationship with the military is not restricted to the people they meet or work with. In fact, most abiding military relationships are closely connected to unique experiences that are often found during wartime.[36] While some veterans' trauma resulted in depression and anxiety, others sought substance use as a means to forget their past. Our findings are consistent with existing literature reflecting that much of a veteran's stress was derived from deployments and being away from family.[37]

The community that a veteran is a member of and the people who belong to that group can impact the direction of a veteran's sobriety. In fact, most of the emerging themes from this study could fit into the community level in the model. Homelessness, among other social determinants of health, lies at the crux of most substance-use-related issues among the veteran population.[38–40] This study depicted various examples of veterans' homeless episodes and explains why substance use is more prevalent in homeless individuals.[41,42]

At the societal level, our study presented veterans' points of view on the VA health system. Nearly all veterans perceived the VA as a good place to receive health care. Most respondents have service-connected disability benefits that allow them to

receive full medical care at any VA medical center. Two veterans, however, provided

negative feedback regarding the VA health system. One veteran wholly blamed the VA

for his addiction to opioids by being over-prescribed pain killers for over four years.

Although recent research claims a decline in long-term prescription opioid use,[43] opioids

have long been over-prescribed for recovery after surgical procedures.[44] In this veteran's

case, his overuse of VA-prescribed opioids led to heroin and fentanyl addiction.

Arguably some of the most remarkable themes that emerged from this study were

those that did not neatly align with one of the four levels of the Socio-Ecological Model.

For instance, one theme that surfaced from the open analytic methodology was how

veterans coped with a death in their family. Trauma sustained from the death of a family

member or close friend may not always increase the risk of substance use;[17,45] however,

this type of trauma can have a compounding effect on other mental health conditions such

as depression, anxiety, and suicidal behaviors.[46] Secondly, the respondents' communities

that they engaged in enabled their substance use and discouraged sobriety. Veterans

often felt pressured to blend in to be a part of their new community, and to do that, they

participated in high-risk activities that were detrimental to their addiction recovery. One

of the most shocking, yet revealing, stories told by one of the respondents was his

encounter with a violent attacker. Although rare, these random attacks of violence

happen more often to homeless veterans than non-veterans.[47] Unfortunately, homeless

individuals have historically been targeted for violent attacks regardless of

demographics.[48] Not all veterans who experienced suicide-related behaviors had an

intent of self-harm. A recent study investigating poisoning deaths found that nearly one-

third of all poisoning deaths happened without a determined intent.[49] Interestingly, of the decedents who were found to have an undetermined intent as a manner of death, nearly 55% were reported as having substance use problems.[49] This corresponds to our finding in veterans considering their drug use as a form of suicide. Although their intent is not to harm themselves, they could become unintentional victims of suicide.

The findings of this study offer distinct examples of the challenges that veterans are currently facing to recover from substance use addiction and support previous literature. This study has important implications for both health care professionals serving veterans and policy makers who are involved in veteran legislation. Findings from this qualitative investigation of homeless veterans suggest that more focus on housing must be placed and especially those who recently separated from the military. Oftentimes, veterans who leave active duty with a negative discharge may not have a sound housing plan for themselves and their family members.[50] Although there are several pre-separation programs that prepare veterans for the civilian sector, there is no follow-up system that tracks their progress once they leave the military. Veterans who were exposed to either substance use or other mental health conditions while on active duty must be placed on a high-risk surveillance plan in order to monitor them until they are fully recovered or connected to a rehabilitative program. Lastly, special focus should be placed on grief counseling for veterans who experience death of a relative or close relationship, especially if they have a history of substance use or mental health illness.

This study sheds light on experiences that veterans undergo while balancing homelessness and SUDs. This study, however, has several limitations. First, respondents

were recruited during the COVID-19 era, thus, social-distancing restricted face-to -face meetings; non-verbal language cues can often provide the interviewer more information than those conducted over the phone.[51] Second, and possibly one of the biggest difficulties during this study, was recruiting respondents from this vulnerable population. Although all veterans were administratively connected to one of the two participating homeless organizations, homeless veterans were extremely difficult to locate and schedule for interviews. Some veterans did not return calls, others were not available during scheduled times, and some changed their inclusion/exclusion criteria once they started the interview, thus, disqualifying them from the study. Third, the essence of qualitative research requires that investigators scrutinize every individual response to create an understandable conclusion gathered from respondents' responses. Considering that most interviews only lasted an average of approximately 47 minutes, it was challenging to build rapport and gain enough trust from the veterans for them to disclose such sensitive information and share some of their most private stories; therefore, greater detail would have bolstered the quality of the data and analysis. Fourth, since this study recruited veterans from a homeless shelter and a VSO, and not directly from the Veterans Health Administration which solely serves veterans, the sample size was relatively small. Lastly, because all qualitative studies are unique and their data are not publicly accessible, data from these types of studies are difficult to replicate.

Conclusion

Investigating what drives most veterans to experience substance use relapse will likely be an ongoing research topic for a very long time. However, we can attempt to

appreciate the challenges that addiction presents, especially when compounded with additional stressors such as homelessness and mental illness. Veterans endure very unique and traumatic experiences while serving in the military. Some of the effects from these distressing events often linger well after separating from the military and can result in substance abuse. Our research elucidates the roots of these problems by presenting stories told by the veterans themselves through semi-structured interviews. We found that veteran homelessness and substance use are strongly associated with trauma suffered while on active duty and personal adverse life experiences. Consequently, once homeless, the communities that veterans live in generally encourage and exacerbate addiction and impede a path toward sobriety. Homeless veterans who have already struggled with SUDs in the past, and later experience a death in their family, often relapse to drug and alcohol use. Further qualitative research on homeless veterans suffering from SUDs must be conducted to expand initial findings from this study. Exploring a veteran's personal relationships with family, friends, and their immediate community, may reveal opportunities to address these issues using healthcare and community interventions.

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APPENDIX A

Chapter One: Published version of *Substance Use Relapse Among Veterans at Termination of Treatment for Substance Use Disorders* in the journal of Military Medicine.

Substance Use Relapse Among Veterans at Termination of Treatment for Substance Use Disorders

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ABSTRACT

Introduction:
Military veterans continue to struggle with addiction even after receiving treatment for substance use disorders (SUDs). Identifying factors that may influence SUD relapse upon receiving treatment in veteran populations is crucial for intervention and prevention efforts. The purpose of this study was to examine risk factors that contribute to SUD relapse upon treatment completion in a sample of U.S. veterans using logistic regression and classification tree analysis.

Materials and Methods:
Data from the 2017 Treatment Episode Data Set—Discharge (TEDS-D) included 40,909 veteran episode observations. Descriptive statistics and multivariable logistic regression analysis were conducted to determine factors associated with SUD relapse after treatment discharge. Classification trees were constructed to identify high-risk subgroups for substance use after discharge from treatment for SUDs.

Results:
Approximately 94% of the veterans relapsed upon discharge from outpatient or residential SUD treatment. Veterans aged 18-34 years old were significantly less likely to relapse than the 35-64 age group (odds ratio [OR] 0.73, 95% confidence interval [CI]: 0.66, 0.82), while males were more likely than females to relapse (OR 1.55, 95% CI: 1.34, 1.79). Unemployed veterans (OR 1.92, 95% CI: 1.67, 2.22) or veterans not in the labor force (OR 1.29, 95% CI: 1.13, 1.47) were more likely to relapse than employed veterans. Homeless vs. independently housed veterans had 3.26 (95% CI: 2.55, 4.17) higher odds of relapse after treatment. Veterans with one arrest vs. none were more likely to relapse (OR 1.52, 95% CI: 1.19, 1.95). Treatment completion was critical to maintain sobriety, as every other type of discharge led to more than double the odds of relapse. Veterans who received care at 24-hour detox facilities were 1.49 (95% CI: 1.23, 1.80) times more likely to relapse than those at rehabilitative/residential treatment facilities. Classification tree analysis indicated that homelessness upon discharge was the most important predictor in SUD relapse among veterans.

Conclusion:
Aside from numerous challenges that veterans face after leaving military service, SUD relapse is intensified by risk factors such as homelessness, unemployment, and insufficient SUD treatment. As treatment and preventive care for SUD relapse is an active field of study, further research on SUD relapse among homeless veterans is necessary to better understand the epidemiology of substance addiction among this vulnerable population. The findings of this study can inform healthcare policy and practices targeting veteran-tailored treatment programs to improve SUD treatment completion and lower substance use after treatment.

INTRODUCTION

Veterans have an increasing need for mental health care and services for substance use disorders (SUDs).[1] Veterans have higher rates of SUDs than nonveterans, with estimates ranging from 17.1 to 32.9%, depending on polysubstance use.[2] Research evidence indicates that 11% of veterans who sought care within the Veterans Health Administration (VHA) met the criteria for an SUD diagnosis.[3] This problem is further exacerbated by multiple physical and mental health challenges[4] that substance users face in completing SUD treatment programs, thus resulting in higher relapse rates and return to treatment programs.[5] Recent estimates show that 76% of veterans experience SUD relapse after receiving treatment.[6] Substance use disorder relapse constitutes a serious problem not only for the veterans themselves but also presents an economic burden to the society. Over a decade ago, nearly a third of all VHA costs ($12 billion) were attributed to providing veterans with services for treatment related to substance use and mental health conditions.[7] Factors that influence SUD relapse upon receiving treatment services and follow-up care must be closely monitored to ensure that effective targeted intervention and prevention programs are being adequately deployed and utilized.

A number of studies have examined factors that may influence SUD relapse in veterans within the VHA. Research

evidence indicates that Healthy Lifestyle Behaviors, including recreational, social, coping/spiritual, and substance recovery activities, have been associated with lower relapse rates in veterans.[8] Follow-up on SUD care is as important as residential treatment itself. A 2016 study found a positive significant association between inpatient hospitalizations and SUDs in the year immediately following residential treatment.[9] This study shows the importance of enforcing continued and focused SUD relapse prevention behaviors following residential treatment. In addition, research evidence indicates that homeless veterans have a greater difficulty in accessing and receiving adequate treatment for SUD.[10] Lack of resources for this population is associated with disproportionate hospitalization and emergency services utilization rates across the country.[11] Other factors associated with SUD relapse in veterans include involvement with the justice system.[12,13] Veterans represent a significant proportion of the correctional population,[14] and upon release from incarceration, they may face homelessness and SUD relapse.[12] Many of these individual factors can impede a veteran's SUD recovery; however, several of these elements combined (e.g., homelessness and incarceration) can present a formidable impact on relapse.

Identifying factors that may influence SUD relapse upon receiving treatment in veteran populations is crucial for intervention and prevention efforts. Limited research, however, has been conducted on SUD relapse predictors after treatment, especially from data collected outside of the VHA. The VHA maintains robust veteran datasets along with comprehensive health-related and demographic data; however, the VHA is not the only agency that captures data involving veteran demographics, health information, and treatment. Organizations such as the Substance Abuse and Mental Health and Services Administration (SAMHSA) record and maintain rich substance use data that report both veteran and nonveteran populations. The SAMHSA coordinates the collection of Treatment Episode Dataset-Discharge (TEDS-D) data that provide a unique opportunity to study SUD relapse upon treatment in veteran populations.

The purpose of this study was to examine risk factors that contribute to SUD relapse in U.S. veterans upon completion of treatment using TEDS-D data. In addition, this study uses both traditional statistical methods of data analysis (e.g., parametric regression) and classification trees. The use of machine learning algorithms such as classification and regression trees (CART), which constitutes a relatively novel technique in the field of SUD, reinforces research findings by uncovering clusters of risk factors of SUD relapse.

METHODS

Data Source

Data were used from the 1,661,207 treatment discharges reported in the 2017 TEDS-D public use files within the (SAMHSA) data repository. Treatment Episode Dataset-Discharge data are reported from 47 states, Washington DC,

and Puerto Rico. Georgia, Oregon, and West Virginia did not report sufficient discharge data for 2017 to be included in this study.[15] The TEDS-D, which is reported annually by the SAMHSA, is publicly available and provides demographic and characteristics of substance use treatment discharges among people aged 12 years and older based on state-licensed or certified substance abuse treatment centers that receive federal public funding.[16] The TEDS-D represents a compilation of data collected through the individual data collection systems of the state agencies for substance use treatment. More information about data collection procedures are provided in the TEDS State Instruction Manual.[17]

Sample

A subsample of the TEDS-D, 2017, was created to analyze only the veteran sample ($n = 44,296$). The TEDS-D identified veterans with a "yes/no" question asking the participants if they had served in the U.S. uniformed services. Discharges ages 12-17 ($n = 178$) were excluded from the study as individuals under the age of 17 years cannot join the military.[18] Substance use disorder relapse upon treatment discharge had 7.27% missing data ($n = 3,209$), which was excluded from the total subsample. The final analytic sample consisted of 40,909 records. Missing data for demographic variables ranged from 0% to 2.6%. Three measures, including employment status at discharge (15.1% missing), living arrangements at discharge (15.6% missing), and arrests (<30 days before admission) (12.6% missing), had a large percentage of missing data that were either missing completely, reported as unknown, not collected, or invalid. The data included a mixture of outpatient and inpatient residential treatment episodes.

Measures

The outcome variable of this study was substance use at the point of discharge (relapse). The original field response in the survey was intended to "identify the client's primary substance use at admission and discharge" and provided 19 response options including "none" and 18 other types of substances. This variable was converted into a binary variable identifying discharges that reported either "no relapse" or "relapse." This study uses Wesson et al.'s definition of relapse[19] as "a discrete event, which occurs at the moment a person resumes drug use or as a process which occurs over time." Wesson's definition is appropriate given how SUD relapse has been measured in TEDS-D outlined above.

Factors that may influence SUD relapse were selected based on previous research that assessed interrelationships among different treatment stages and their effects on the outcome of alcoholic patients.[20] In the present study, 10 variables were categorized into two sets separating sociodemographic from treatment-related variables. Sociodemographic variables included age, gender, race/ethnicity (veteran's race and

specific Hispanic or Latino origin), employment status (full-time, part-time, unemployed, or not in labor force), education (no high school, high school, or college), living arrangements upon discharge (homeless, dependent living, or independent living), and number of arrests a veteran had 30 days preceding the date of admission to treatment services (none, one, two, or more), or in the event that the client was in treatment fewer than 30 days, this item refers to number of arrests during the treatment period only. Treatment-specific variables were used in this study such as reason for discharge. Options for this variable included treatment completed, dropped out of treatment, transferred to another facility, or "other" (terminated from treatment, incarcerated, death, or other). Service setting at discharge provides an option to report what type of service was provided for treatment, such as detox facilities, rehabilitative or residential facility, or ambulatory care facilities. Length of stay was measured by duration of treatment in days; time frames ranged between 1 day (outpatient stay), 2-30 days, 31-90 days, 91-180 days, 181-365 days, and more than 365 days. Stays longer than 365 days may be because veterans receive medication-assisted treatment for their addictions. Medication-assisted treatment, such as methadone treatment, presents the most benefit to its users when it is administered longer than 12 months.[21]

Data Analysis

Descriptive statistics were used to describe the sample characteristics. Bivariate analysis with the Pearson's chi-squared test was used to test for significant associations between the dependent variable (drug/alcohol use upon treatment discharge, i.e., relapse vs. no relapse) and each of the independent variables, including all sociodemographic and treatment-related variables. A multivariable logistic regression model was conducted to determine associations between all independent variables and SUD relapse after treatment discharge. Robust standard errors were computed to adjust for potential departures from assumptions of the logistic regression model. Statistical analyses were conducted using STATA, version 16.[22]

Classification trees were constructed for this sample to identify subgroups of veterans who are at high risk for substance use after being discharged from treatment for SUD. The CART is a nonparametric technique and does not require assumptions about the distribution of the data.[23] This analytic method can process large datasets with a high number of variables, and it is not affected by collinearities. Although logistic regression estimates the associations between risk factors and SUD relapse, it does not clearly demonstrate how multiple risk factors interact in creating clusters that predict the dependent variable and identify high-risk subgroups. Classification and regression trees, however, can uncover multipart variable associations and categorize high-risk subgroups based on a set of predictor variables.[23] This methodology has been used in

various health-related fields to not only assist researchers in developing treatment strategies,[24] but also as an alternative method of mimicking actual thinking processes.[25] In this study, the classification tree was constructed based on 70% of the observations in the sample, and the remaining 30% of the sample was used to test the accuracy of the classification tree. The CART analysis was conducted using Minitab 19 computer software.[26]

RESULTS

Descriptive Statistics and Bivariate Associations

Table I provides descriptive statistics of the sample discharges along with bivariate analysis between SUD relapse and sample characteristics based on veteran treatment discharges for the year 2017. Most veterans with SUD discharges were White non-Hispanic (65%), male (89%), and aged 35-64 years (67%). The vast majority of all discharged veterans reported being unemployed or not in the labor force upon discharge (71%). Most veterans had at least a high school education (57%) or had attended some college (41%). Nearly two-thirds (64%) of all veteran discharges were recorded as living independently upon discharge from treatment. In terms of involvement with the justice system, 7% of veterans were arrested at least once within 30 days before admission.

Bivariate analysis demonstrates statistically significant associations between all sociodemographic variables and SUD relapse in veterans (P-value $< .001$) upon discharge. Approximately 6% of all veteran discharges abstained from using drugs/alcohol, with the majority of veterans relapsing (94%). More than two-thirds (68%) of all veteran discharge episodes were in the 35-64 age group experienced SUD relapse upon discharge. White non-Hispanic (65%) and males (90%) represented the vast majority of episodes that resulted in SUD relapse upon discharge. Approximately, 44% of veteran discharges that did not report having relapsed, left treatment with some level of employment, while more than two-thirds (71%) of those who relapsed, reported being either unemployed or not in the labor force. Among those discharges that reported an education level of at least a high school education, more than half (57%) relapsed after a treatment discharge. Homelessness was associated with a significantly higher proportion of SUD relapse (18%) than those who did not relapse upon discharge from treatment (5%). Discharges that involved any veteran arrests within the last 30 days before admission to treatment demonstrated a slightly higher proportion of SUD relapse (7%) than those that had no arrests (6%).

Descriptive statistics and associations between SUD relapse and other treatment-related predictor variables are also displayed in Table I. About half of all reported treatment discharges resulted in complete treatment (48%). A large portion of veterans (58%) were seen at ambulatory facilities followed by rehab/residential facilities (24%) after discharging from SUD treatment. About half the treatment episodes lasted more than 1 day, but no more than 30 days (51%). Of the veteran

TABLE I. Sample Characteristics and Associations of Sociodemographic and Treatment-Related Factors, and Relapse among Veterans upon Discharge from Treatment

Sociodemographic variables	Entire sample n = 40,909 n (%)	Substance use disorder relapse upon discharge n (%) 38,381 (93.8%)	No substance use disorder relapse upon discharge n (%) 2,528 (6.2%)	P-value
Age	*40,909*			.000
18-34	11,314 (27.7)	10,474 (27.3)	840 (33.2)	
35-64	27,447 (67.1)	25,904 (67.5)	1,543 (61)	
≥65	2,148 (5.2)	2,003 (5.2)	145 (5.7)	
Gender	*40,905*			.000
Male	36,501 (89.2)	34,344 (89.5)	2,157 (85.3)	
Female	4,404 (10.8)	4,033 (10.5)	371 (14.7)	
Race/ethnicity	*39,839*			.000
White non-Hispanic	25,737 (64.6)	24,079 (64.5)	1,658 (66.2)	
Black non-Hispanic	7,831 (19.8)	7,96 (19.8)	495 (19.8)	
Hispanic	3,769 (9.5)	3,494 (9.4)	275 (11)	
Other[a]	2,442 (6.1)	2,367 (6.3)	75 (3)	
Employment status (at discharge)	*36,942*			.000
Full-time	8,472 (22.9)	7,779 (22.2)	693 (36.6)	
Part-time	2,418 (6.6)	2,276 (6.5)	142 (7.5)	
Unemployed	12,415 (33.6)	11,987 (34.2)	428 (22.6)	
Not in labor force	13,637 (36.9)	13,006 (37.1)	631 (33.3)	
Education	*40,006*			.000
No high school	740 (1.8)	701 (1.9)	39 (1.6)	
High school	22,783 (57)	21,237 (56.6)	1,546 (62)	
College	16,483 (41.2)	15,577 (41.5)	906 (36.4)	
Living arrangements (at discharge)	*36,677*			.000
Homeless	6,176 (16.8)	6,083 (17.5)	93 (4.9)	
Dependent living	6,926 (18.9)	6,566 (18.9)	360 (19)	
Independent living	23,575 (64.3)	22,135 (63.6)	1,440 (76.1)	
Arrests (<30 days before admission)	*37,768*			.000
None	35,218 (93.2)	32,878 (93.2)	2,340 (94.4)	
One	2,172 (5.8)	2,063 (5.8)	109 (4.4)	
Two or more	378 (1)	348 (1)	30 (1.2)	
Reason for discharge	*40,909*			.000
Treatment completed	19,672 (48.1)	18,319 (47.7)	1,353 (53.5)	
Dropped out of treatment	8,628 (21.1)	7,916 (20.6)	712 (28.2)	
Transferred to another facility	8,932 (21.8)	8,614 (22.4)	31 (12.6)	
Other[b]	3,677 (9)	3,532 (9.2)	145 (5.7)	
Service setting (discharge)	*40,909*			.000
Detox	7,365 (18)	6,983 (18.1)	382 (15.1)	
Rehab/Residential facility	9,855 (24.1)	9,276 (24.2)	579 (22.9)	
Ambulatory	23,689 (57.9)	22,122 (57.6)	1,567 (62)	
Length of stay	*40,909*			.000
Outpatient stay (1 day)	5,117 (12.5)	4,919 (12.8)	198 (7.8)	
2-30 days	15,909 (38.9)	14,902 (38.8)	1,007 (39.8)	
31-90 days	8,566 (20.9)	8,090 (21.1)	476 (18.8)	
91-180 days	5,808 (14.2)	5,303 (13.8)	505 (20)	
181-365 days	3,326 (8.1)	3,143 (8.2)	183 (7.2)	
>365 days	2,183 (5.3)	2,024 (5.3)	159 (6.3)	

[a]Non-Hispanic: Alaska Native/American Indian, Asian/Native Hawaiian/Pacific Islander, other single race, or two or more races.
[b]Terminated from treatment, incarcerated, death, or other.

treatment episodes that resulted in SUD relapse, more than half (58%) received treatment in an ambulatory setting after discharge. Of the veteran treatment episodes that resulted in relapse, 60% had treatment periods of 2-90 days, 14% stayed in treatment between 91 and 180 days, and 8% stayed in treatment 180-365 days.

100

TABLE II. Multivariable Logistic Regression Model (Odds Ratios [ORs] and 95% Confidence Intervals [CIs]) for the Association between Sociodemographic and Treatment-Related Factors, and Relapse among Veterans

	Relapse OR (95% CI)	P-value
Age		
35-64	Reference	
18-34	0.73 (0.66, 0.82)	.000
≥65	0.95 (0.75, 1.20)	.655
Gender		
Female	Reference	
Male	1.55 (1.34, 1.79)	.000
Race/Ethnicity		
White non-Hispanic	Reference	
Black non-Hispanic	0.89 (0.79, 1.01)	.077
Hispanic	1.17 (0.98, 1.41)	.084
Other[a]	2.31 (1.71, 3.13)	.000
Employment status (discharge)		
Full-time	Reference	
Part-time	1.27 (1.05, 1.54)	.016
Unemployed	1.92 (1.67, 2.22)	.000
Not in labor force	1.29 (1.13, 1.47)	.000
Education		
High school	Reference	
No high school	1.29 (0.86, 1.93)	.219
College	1.43 (1.29, 1.59)	.000
Living arrangements (discharge)		
Independent living	Reference	
Homeless	3.26 (2.55, 4.17)	.000
Dependent living	0.99 (0.87, 1.12)	.834
Arrests		
None	Reference	
One	1.52 (1.19, 1.95)	.007
Two or more	0.72 (0.45, 1.14)	.160
Reason for discharge		
Treatment completed	Reference	
Dropped out of treatment	2.87 (2.44, 3.39)	.000
Transferred to another facility	2.50 (2.16, 2.90)	.000
Other[b]	2.64 (2.15, 3.24)	.000
Service setting (discharge)		
Rehab/Residential facility	Reference	
Detox	1.49 (1.23, 1.80)	.000
Ambulatory	0.73 (0.63, 0.83)	.000
Length of stay		
2-30 days	Reference	
Outpatient stay (1 day)	1.13 (0.94, 1.37)	.191
31-90 days	1.49 (1.30, 1.72)	.000
91-180 days	1.00 (0.87, 1.16)	.991
181–365 days	1.78 (1.46, 2.17)	.000
>365 days	1.81 (1.39, 2.36)	.000

[a]Non-Hispanic: Alaska Native/American Indian, Asian/Native Hawaiian/Pacific Islander, other single race, or two or more races.
[b]Terminated from treatment, incarcerated, death, or other.

Logistic Regression Analysis: Sociodemographic and Treatment-related Predictors

Table II presents the results of the multivariable logistic regression. The area under the receiver operating characteristic was 0.713 and the overall rate of correct classification was about 94%. Younger veterans between 18 and 34 years old were 27% less likely to relapse than those who were 35-64 years old (odds ratio [OR] 0.73, 95% confidence interval [CI]: 0.66, 0.82). Male veteran discharge episodes were associated with 1.55 (95% CI: 1.34, 1.79) higher odds of SUD relapse upon discharge than their female counterparts. "Other" race/ethnicity (e.g., Alaska Native/American Indian, etc.) were 2.31 times more likely (95% CI: 1.43, 2.34) to relapse than White non-Hispanics. All discharge episodes of veterans who did not have full-time employment upon discharge were more likely to relapse that those who were fully employed (part-time [OR 1.27, 95% CI: 1.05, 1.54], unemployed [OR 1.92, 95% CI: 1.67, 2.22], not in labor force [OR 1.29, 95% CI: 1.13, 1.47]). College-educated veterans were 43% more likely to relapse after discharge from treatment than those who only possessed a high school education (OR 1.43, 95% CI: 1.29, 1.59). Homeless veteran episodes were more than three times more likely to relapse after treatment discharge compared to those living independently (OR: 3.26, 95% CI: 2.55, 4.17). Veteran discharges that had at least one arrest before admission were 52% more likely to relapse than those who were never arrested (OR 1.52, 95% CI: 1.19, 1.95).

Discharges involving veterans who either dropped out of treatment (OR 2.87, 95% CI: 2.44, 3.39), were transferred to another facility (OR: 2.50, 95% CI: 2.16, 2.90), or left for other reasons (terminated from treatment, incarcerated, or death) (OR: 2.64, 95% CI: 2.15, 3.24) all had a higher likelihood of SUD relapse upon treatment discharge than those who successfully completed treatment. Participants who received treatment at a 24-hour detox facility were more likely to relapse than those who received care at a rehabilitative/residential treatment facility (OR 1.49, 95% CI: 1.23, 1.80); however, veterans at ambulatory healthcare facilities fared better than those at rehabilitative/residential treatment facilities in terms of treatment outcome. Statistically significant findings in duration of treatment (days) revealed that veterans who received treatment 31-90 days (OR: 1.49, 95% CI: 1.30, 1.72), 181-365 days (OR: 1.78, 95% CI: 1.46, 2.17), and greater than 365 days (OR: 1.81, 95% CI: 1.39, 2.36) all had higher odds of SUD relapse upon discharge, compared to treatment for 2-30 days.

Classification and Regression Trees Analysis

The CART analysis originally produced a 59-terminal node tree (terminal nodes are made of a group of cases that share similar characteristics and cannot be further split); however, for the purpose of clarity, a 6-terminal-node tree was created (Fig. 1). This tree yielded a sensitivity of 57% and a specificity of nearly 68% with an area under the receiver operating characteristic of 65%. Figure 1 shows the variable splits that represent six terminal nodes. Every node displayed on the tree includes the number of veteran discharge episodes and the percentage of each outcome after discharge (None indicates no drug use at discharge vs. Substance Use which indicates substance use at discharge). The
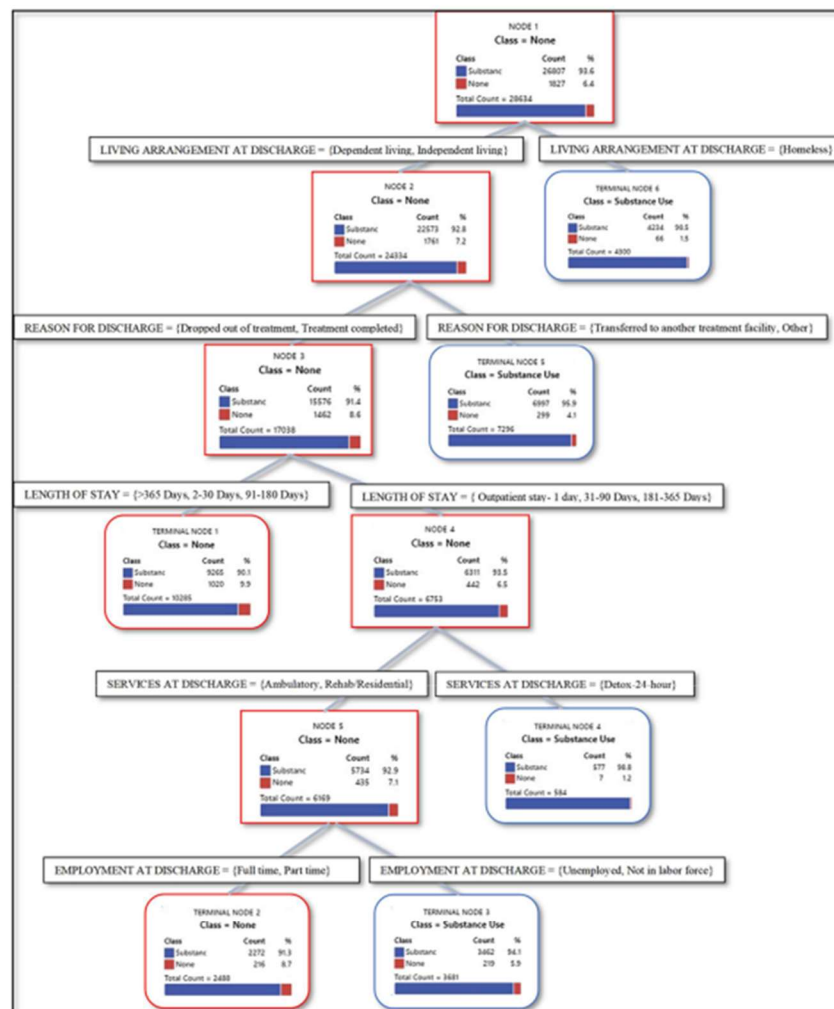
FIGURE 1. Classification tree for veterans suffering from substance use disorders, where each node includes estimates (%) for no substance use (none) upon discharge from treatment and substance use upon discharge from treatment.

CART analysis for veterans suffering from SUDs revealed that homelessness upon discharge from treatment increased the percentage of relapse among this population to almost 99% (terminal node 6) from about 94% (root node) and
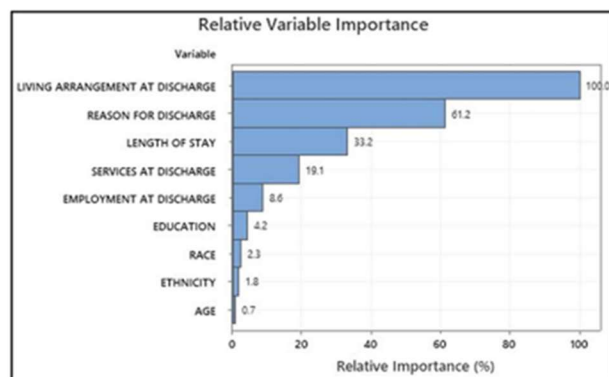
102

FIGURE 2. Relative feature/measure importance based on the classification tree analysis of veteran relapse after discharge from treatment.

showed to be the most important predictor among all other independent variables (Figs. 1 and 2). Among those veterans who were not homeless (lived independently or dependently) or veterans who were transferred to another facility to continue treatment or were discharged for "Other" reasons, nearly 96% of them relapsed at discharge (terminal node 5). However, 99% of the veterans who were not homeless, dropped out of treatment or completed it with a length of stay ranging from 1 day, 31-90 days, to 181-365 days, and received treatment at a 24-hour detoxification facility experienced a relapse upon discharge (terminal node 4). Receiving ambulatory or rehabilitative/residential SUD treatment upon discharge from initial treatment and being unemployed or not being in the labor force was also associated with relapse to substance use upon discharge (94%) (terminal node 3). Among the same subgroup of veterans receiving similar care, a slightly lower percentage of employed veterans relapsed upon discharge from treatment (91%) (terminal node 2). The group with the lowest rate of relapse (90%) comprised veterans who were stably housed, completed treatment or dropped out of treatment voluntarily, and spent 2-30 days, 3-6 months, or more than a year in treatment (terminal node 1).

In summary, the most important features as predictors of SUD relapse generated from the classification tree analysis are shown in the "Relative Variable Importance" chart (Fig. 2). Relative importance is defined as a percentage improvement to the top predictor. In this CART model, the most important variable in predicting relapse is the veteran's living arrangement upon discharge from treatment (100%). Relative to "living arrangements," the second-most important variable in predicting relapse was a veteran's "reason for discharge" (61%) from treatment.

DISCUSSION

The findings of this study indicate that almost 94% of the veterans had an SUD relapse upon treatment discharge. This estimate is higher compared to estimates generated from longitudinal studies that show a 76% SUD relapse rate in veterans after receiving treatment.[6] Most importantly, this study identified risk factors associated with SUD relapse in this population using both traditional statistical methods and classification trees. Classification tree analysis revealed high-risk subgroups for SUD relapse that further confirmed the importance of a veteran's living arrangements and service setting after SUD treatment discharge. Simply being homeless indicated the highest likelihood of relapsing after treatment. Although the number of homeless veterans have decreased over the last decade,[27] this does not negate the increasing proportion of homeless veterans who live in a perpetual recovery–relapse cycle. Chronically homeless veterans tend to experience a broad variety of physical and mental illnesses,[10,28] which can contribute significantly to their ability to successfully complete SUD treatment programs and remain sober upon discharge. It is crucial that treatment programs incorporate Healthy Lifestyle Behaviors which have been associated with lower relapse rates,[8] provide resources that can lead to stable housing, and follow-up treatment to prevent SUD relapse in this population.

Classification tree analysis also revealed a high likelihood of SUD relapse among veterans who were not homeless; however, they either dropped out of treatment or completed treatment ranging from 1 day, 1-3 months, to 6-12 months, and received treatment at a 24-hour detox facility after discharge. Research evidence shows that those veterans who dropped out of SUD treatment early were more likely to

relapse 6 months after treatment than those who finished all treatment sessions.[29] Length of treatment and type of treatment facilities along with the treatment plans may need further examination in identifying factors that increase the likelihood of SUD relapse in veterans.

The findings of this study also show that veteran discharges which were either prematurely terminated, or were transferred to another treatment location, were at a higher risk of relapse. Treatment completion is vital for reducing relapse after discharge; research evidence shows that those who complete substance use treatment have fewer relapses and are more likely to maintain abstinence after completing treatment.[30] Transfers from detox treatment facilities typically occur when patients have exceeded their level of treatment at that location, thus requiring follow-on residential care in longer-term SUD treatment facilities. Once a patient is discharged from detox, they are at high risk of relapse and therefore vulnerable to treatment incompletion and failure.[31] Studies that used VHA patient record data found that veterans who completed treatment had a lower SUD relapse prevalence (30% vs. 54%) than in publicly available data such as TEDS-D.[6] However, VHA studies concur with the high risk of relapse during the early stages of recovery.[32] In general, studies performed with VHA data are longitudinal studies; therefore, they tend to represent findings that are captured over an extended period of time.[33,34] Since this is a cross-sectional study, relapse figures are only indicative of the year they were reported (2017).

This study also demonstrates that unemployment plays a significant role in relapse. Logistic regression and classification tree analyses demonstrated a high likelihood of relapse among unemployed veterans after receiving treatment for SUD. Research evidence shows that individuals who are suddenly unemployed may return to substance use simply by having more spare time that comes with job loss or by surrounding themselves with people who are also chronically unemployed.[35]

Veterans who are involved with the criminal justice system represent a particularly vulnerable population who experience high rates of both posttraumatic stress disorder and SUDs.[36] The findings of this study show that veterans with at least one arrest within the last 30 days before admission have a greater likelihood of SUD relapse. This indicates that treatment services may need to be tailored to specific populations such as those with prior involvement with the justice system.

Limitations

There are several limitations in this study. First, the facilities reporting TEDS data receive state drug/alcohol agency funds for the provision of drug/alcohol treatment services, and no data are reported on facilities operated by federal agencies, including the Bureau of Prisons, the Department of Defense, and the Department of Veterans Affairs. However, some facilities operated by the Indian Health Service are included. Another limitation is that, in many states, TEDS-D data may include multiple discharges for the same patient.

This in turn makes it challenging to adjust the statistical analyses for potential dependencies in the data. In addition, the data in this study represent admissions and not patients. Due to the small sample sizes for racial/ethnic groups in the "Other" category for race/ethnicity, we were not able to conduct meaningful analyses and therefore did not examine these groups separately related to SUD relapse. Also, most of the substance use and living arrangement data collected by facilities are self-reported by persons admitted for treatment; thus, social desirability bias may have affected participant responses. This study also utilized cross-sectional data and thus causality cannot be inferred. Regardless of these limitations, this study offers a unique perspective of correlates associated with veteran relapse after discharge from SUD treatment using classification trees and a national-level sample.

Implications

This study profiles SUD relapse among the veteran population in community-based treatment programs. The findings highlighted several risk factors that clinicians and hospital administrators can focus on to identify veterans with a high likelihood of relapse. These factors include homelessness and unemployment upon discharge, arrest history, the use of a 24-hour detox facility, treatment length of stay, and the reason for discharge. Unemployment and homelessness are two of the most pervasive risk factors of substance use, even after receiving treatment for SUDs. It is imperative for state and federal funding to focus on treatment programs that incorporate stable housing and employment after discharge from such programs. State programs must continue to focus efforts on housing veterans through programs like the VHA's Housing First initiative. Lastly, treatment centers that provide substance use treatment must also be adequately staffed with job placement or work therapy specialists in addition to substance use clinicians. Future research needs to test whether applying these principles may result in lower SUD relapse among veterans. In addition, qualitative research studies in the form of interviews or case studies are needed as they may uncover unobserved obstacles that preclude veterans from maintaining sobriety well beyond treatment completion.

CONCLUSION

Substance use among veterans is already a public health concern that needs to be addressed. This problem is exacerbated by compounding other risk factors such as homelessness, unemployment, and inadequate length and type of SUD treatment. Further research should be conducted to identify what motivates veterans to stay sober and what triggers substance use after treatment. Studies focusing on the identification of efficient length of stay in rehabilitative treatment based on the patient characteristics would provide valuable information for SUD treatment programs. Findings from this study can be used to promote policies related to the implementation of veteran-specific treatment and prevention programs

that can increase relapse prevention efforts. The findings of this study also show the need for healthcare providers who work with the veteran population to design veteran-specific treatment plans that are specifically geared to improve SUD treatment completion rates and lower substance use after treatment.

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106

Veteran Interview Topics and Questions

<u>**Veteran Interview Question Topics**</u>

The following topics will be discussed during the interview. Most questions, with the exception of demographics, will be presented as open-ended questions giving the participant an opportunity to tell his or her story.

- Basic demographics (i.e., name, gender, age, race/ethnicity)
- Military history (branch, war period)
- History of homelessness
- Arrest history
- History of substance misuse, abuse, and/or dependence
- History of depression
- History of suicidal behaviors (thought, plan, and/or attempt)
- Access to food, transportation, and healthcare
- Any other history of physical/mental health conditions

<u>**Veteran Interview Questions**</u>

- Can you please state your name (or nickname), gender, age, race and ethnicity?

    If participant has difficulty understanding the individual parts of the question, options will be offered for each category.

- What branch of the military did you serve in and during which war period?

    If participant does not remember the particular war period, options will be offered for each time period.

- Have you ever considered yourself to be homeless?

a. If so, tell me a little about that period(s) of your life and what it was like.

- Have you ever been arrested for which you had to stay in jail overnight?

    a. If so, talk to me about that experience and how that time has impacted your life.

- I understand that by participating in this interview you indicated that you have a history of substance use. Tell me about your first encounter with substance use.

    a. Did this happen while in the military?

    b. Do you currently – use illicit drugs, misuse prescription drugs, alcohol, or any other mind-altering substance?

    c. Have you ever sought treatment for your addiction(s)? If so, what was the outcome of that treatment?

        i. If the treatment worked, what have you done to remain clean and sober?
        ii. If the treatment did not work, what do you think has caused you to relapse after treatment?

    d. If you experienced homelessness, do you think that being homeless contributed to your substance use?

        i. If so, tell me more about how being homeless prevented you from staying sober.

- Have you ever struggled with depression?

    a. If so, tell me more about that experience and how you think that has affected you substance use.

- Have you ever thought about committing suicide? If so, did you have a plan to carry it out and did you attempt it? How do you feel about it now?

    If participant is currently having thoughts, researcher will recommend that the participant seek immediate help and contact the National Suicide Prevention Lifeline: (800) 273-8255, or seek medical attention immediately. At this point,

this becomes a medical concern for the participant and the interview will stop. Participant may continue the interview after seeking medical/mental help and if they choose to participate.

- Do you currently have access to food, transportation, and adequate healthcare?

    a. Can you explain how having these types of needs met impacts your addiction, recovery, and/or your overall physical/mental health?

- Lastly, are there any other physical or mental health concerns that you believe have contributed to your addiction and other behavioral matters?

    a. If so, tell me how these concerns have impacted your life decisions and substance recovery over the years.

Institutional Review Board Approved Consent Form

Perspectives of Homeless Veterans Living With Substance Use Disorders (SUD): A Qualitative Study Investigating Homeless Veterans' Lived Experiences With SUDs and Other Mental Health Illnesses

INFORMED CONSENT FORM

RESEARCH PROCEDURES
This research is being conducted to understand a veteran's lived experience; that is, get an inside look, through their eyes, of their everyday life and social interactions to fully understand what they experience day-to-day. Interviews will be used to understand the context, constraints, and individual viewpoints of the veteran's lived experiences with SUD, homelessness, and/or suicidal behaviors (if any). If you agree to participate, you will be asked to participate in an interview that will be audio recorded and transcribed for data analysis. These interviews are expected to be 60 to 90 minutes in length. Interview questions will be based on theories and frameworks used by clinical SUD treatment social workers and other mental health specialists who have worked with homeless veterans.

RISKS
There are no foreseeable risks for participating in this research. If any participant has any questions or concerns about suicidal thoughts, please contact the National Suicide Prevention Lifeline at 1-800-273-8255.

BENEFITS
The benefits to you include having an increased self awareness of your current physical, mental, and behavioral health state which may lead you to seek assistance for any existing conditions (if any).

CONFIDENTIALITY
The data in this study will be confidential. Only the principal investigator (PI) and the co-investigator will have access to the private files containing interview transcripts, audio/video recordings, and other collected data. The files will be password protected

and will reside on a computer that is also password protected. Only the PI and the co-investigator will have access to the audio/video files and transcripts. All quantitative data will be aggregated and reported in summary format. Qualitative data, such as quotes, may be reported, however will not be attributed to a specific individual. Names of participants will not be released unless the participant agrees and provides approval for release of information, which is not a requirement of participation.

We will not release your name or identifiable information in reports or publications. Only the name of the individual, age, gender, and pertinent health history pertaining to substance use and other mental health diagnoses will be collected. Only the PI and the co-investigator will have access to this data. Only aggregate quantitative data and deidentified qualitative data such as quotes will be released in reports or further proposals. Quotes may be attributed to an individual's personal experiences, life events, military service, or other demographic information; however, we will not include information that could identify a specific individual. The de-identified data could be used for future research without additional consent from participants. **The PI and co-investigator will delete the audio/video recordings from their computer storage location as soon as they are transcribed to MS-Word documents. Transcripts will be kept for five (5) years after the study ends, then deleted from all computer storage.**

The Institutional Review Board (IRB) committee that monitors research on human subjects may inspect study records during internal auditing procedures and are required to keep all information confidential.

While it is understood that no computer transmission can be perfectly secure, reasonable efforts will be made to protect the confidentiality of your transmission. Participants may review Zoom's website for information about their privacy statement at https://zoom.us/privacy.

PARTICIPATION
Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

Potential participants will be screened for the inclusion/exclusion criteria by gathering preliminary information from the participant at initial contact via phone call, meeting, or email (not the interview). The first contact will happen when the potential participant responds to the recruitment advertisement and shows interest in participating. At this point, the PI or the co-investigator will confirm that the potential participant meets the inclusion/exclusion criteria.

Inclusion criteria: Participants must reside in or near the Washington D.C. Metro area, including Northern Virginia, and must have experienced homelessness within the last 12 months. Another important inclusion criterion is that all participants must have been diagnosed with a substance use disorder sometime in the past. Lastly, veterans must have recently participated in any substance use disorder treatment (within the last 12 months).

Exclusion criteria: Participants may not currently be on active duty in the U.S. Armed Forces or on reserve status. Veterans with known current physical/mental health conditions that will prohibit or delay the interview process may not be included in the study. This study is not intended to treat, diagnose, or provide counseling for any of the participant's current health conditions.

Participants will receive a $20 Walmart gift card for participating in the study. Under the U.S. federal tax law, you may have individual responsibilities for disclosing the dollar value of the incentive received on this study.

CONTACT
This research is being conducted by Christian Alexis Betancourt at George Mason University. He may be reached at cbetanc@gmu.edu or 904-562-8099 for questions or to report a research-related problem. You may also contact Dr. Debora Goetz Goldberg, George Mason University, at dgoldbe4@gmu.edu or 202-495-8441. You may contact the George Mason University Institutional Review Board office at 703-993-4121 or IRB@gmu.edu if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

CONSENT
Please indicate whether you consent to the audio/video recording for interviews by checking the boxes below.

☐   I agree to audio/video taping.

☐   I do not agree to audio/video taping.

I have read this form, all of my questions have been answered by the research staff, and I agree to participate in this study.

_____   _____
Signature   Date of Signature

IRBNet number: 1747549-1

BIOGRAPHY

Christian Betancourt was born in Cali, Colombia, and now lives in Fairfax, VA. He enlisted in the Navy in 1998 as a Hospital Corpsman in Great Lakes, Illinois. He began his enlisted career at 2nd Marine Division, 3rd Battalion 6th Marines, Camp Lejeune, North Carolina, as a Fleet Marine Force corpsman. In 2001, he served as an Emergency Medical Technician and as the Leading Petty Officer for the Acute Care Clinic in Jacksonville, FL. In 2004, Christian was assigned as the Junior Medical Officer Representative on the USS McInerney (FFG-8) based out of Mayport, Florida. LT Betancourt continued his career at the Naval Branch Health Clinic in Mayport, Florida, from 2008 to 2010 as the Leading Petty Officer for the Dental Department.

Christian separated from the Navy in 2010, and in 2011, he graduated with a Masters in Health Services Administration from the University of Central Florida in Orlando, Florida. He worked as a federal employee for the Orlando Veterans Affairs Medical Center as the Administrative Officer for the Mental Health Residential Rehabilitation Treatment Program (MHRRTP).

LT Betancourt was commissioned as a Naval Officer in 2014 and reported to Naval Hospital Yokosuka, Japan. He served in several leadership roles in the Patient Administration, Materiel Management, and Data Quality Departments. LT Betancourt attained the credential as Certified Defense Financial Manager in 2016. He reported to the Navy Professional Development Center, Bethesda, Maryland, in August 2017 as the Comptroller.

He attained his Ph.D. in Health Services Research from George Mason University in Fairfax, VA, in May, 2022. LT Betancourt's military decorations include the Navy and Marine Corps Commendation Medal (two awards), Navy and Marine Corps Achievement Medal (four awards), Enlisted Surface Warfare Specialist and Fleet Marine Force designator devices, as well as multiple unit and service awards. He is married to his wife of 23 years, Angelica, and has two children, Christian (18) and Gabriella (13).