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Use of Medical Care and Suicide Among Veterans

Wyatt Edward Meriwether
Walden University

Walden University

College of Health Sciences

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Wyatt Edward Meriwether

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Dr. James Rohrer, Committee Chairperson, Public Health Faculty
Dr. Howell Sasser, Committee Member, Public Health Faculty
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Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
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Abstract

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MHRM, Keller Graduate School of Management, 2013

MBA, Keller Graduate School of Management, 2012

BA, University of Kansas, 2010

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health - Epidemiology

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Abstract

Due to rising veteran suicide rates, the veteran population has become a focus of practitioners, research scientists, and policymakers. Although researchers have studied the relationship between suicidality and the environment, more research is required to evaluate how suicidal behavior, suicidal ideation, and suicide risk are associated with a veteran's use of medical care services within the Veterans Health Administration (VHA). Therefore, this study focused on environmental variables (medical care usage and rurality), and their relationship with suicidal behavior (Manuscript 1), suicidal ideation (Manuscript 2), and suicide risk (Manuscript 3). The social ecological model was used to better understand the interaction between the environmental factors discussed and veteran suicidality. Use of primary care services was found to be significantly associated (negative association at all levels in comparison to the reference level of high use) with each dependent variable: suicidal behavior ($p < .001$, OR = .074 - .529), suicidal ideation ($p < .001$, OR = .170 - .490), and suicide risk ($p < .001$, OR = .154 - .656). Finally, rurality was found to be significantly associated with suicidal behavior and suicidal ideation. A positive association was found between suicidal behavior ($p < .05$, OR = 8.099) and suicidal ideation ($p < .05$, OR = 1.892) and urban residence (in comparison to the reference level of highly rural). This study can promote social change by providing insights on how environmental factors influence veterans' propensity to suicide and by leading VHA researchers into further exploring the impact of veterans' use of services on the suicidality of the population.

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Dedication

This dissertation is dedicated to Robert Paul Schmidt Jr., and all veterans who have lost their lives to suicide. Their struggle was too great to bear, but they are nonetheless honored for their service and dedication to the United States of America.

Acknowledgments

I would like to express my deepest gratitude to my best friend, my partner, and my wife, Courtney Lynn Meriwether. Without her support this study would not have been possible. I would also like to acknowledge my academic mentor and dissertation chair, Dr. James Rohrer. Dr. Rohrer has been the leader I have needed to guide my path through this process. I would like to also thank Dr. Howell Sasser and Vasileios Margaritis as my committee member and University Research Reviewer. Their guidance has been instrumental in my dissertation journey. Additionally, I would like to acknowledge Dr. Olurinde Oni who was instrumental in assisting me with orientation to the VINCI database. Also, I would like to thank my professional colleagues and friends Dr. Cassi Franklin and Dr. Charlotte McCloskey. They dedicated their time to assist in revision of my dissertation, and that time must be acknowledged. Finally, I would like to thank my father, Donald L. Meriwether. He believed in me even when I had lost belief in myself.

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Part 1: Overview

Introduction

The modern epidemiological study of suicide dates to the mid-20th century. Suicide completion has been tracked by the World Health Organization (WHO) since the 1950s (Bertolote & Fleischmann, 2015). Several facts have been established regarding the rate of suicide across the globe. The WHO has reported that a pattern of increasing suicide completion has emerged among men and older adults (Bertolote & Fleischmann, 2015). This increase has been witnessed since the 1950s with a sharp increase among adults ages 65 and older (Bertolote & Fleischmann, 2015). Although the WHO has reported an increase in deaths due to suicide in men, artificial inflation of the overall suicide deaths may have occurred due to the separation of the Union of Soviet Socialist Republics (USSR) into smaller reporting countries (Bertolote & Fleischmann, 2015). The countries that previously comprised the USSR are now able to individually report suicide completion rates, which may have led to an artificial inflation since the 1990s (Bertolote & Fleischmann, 2015). It is also important to note that although suicide rates among the elderly are higher than the rest of the population, more young people are completing suicide than the elderly (Bertolote & Fleischmann, 2015). As of 2002, the most suicides were being completed in the 35-44-year age group (Bertolote & Fleischmann, 2015). As of 2017, adults ages 18-25 had the highest prevalence of suicidal ideation and attempt (NIMH, 2019). Differences in suicide rate when comparing the

prevalent religious denomination within countries also emerges (Bertolote & Fleischmann, 2015). However, Bertolote and Fleischmann (2015) reported that although global statistics assist in raising awareness of suicidality, regional and local population characteristics related to suicidality must be explored.

The United States tracks suicide completion through the Web-Based Injury Statistics Query and Reporting System (WISQARS; Shepard, Gurewich, Lwin, Reed, & Silverman, 2016). The Centers for Disease Control and Prevention (CDC) maintain the WISQARS and have reported annual increases in suicide deaths (Shepard et al.,2016). In the United States suicide has become the second leading cause of death among men and women ages 15-24 and 25-34 (Shepard et al., 2016). This statistic is in sharp contrast to the global trend of increased suicide death as age increases (Bertolote & Fleischmann, 2015). In addition to the obvious concerns this statistic illustrates, the annual national cost due to suicide completion and attempt reached $58.4 billion in 2013 (Shepard et al., 2016). Due to these facts, suicide has become a leading public health concern in the United States.

Problem Statement

Since 2011, suicide has been the second leading cause of death among military personnel (Bryan et al., 2015). Gibbons, Brown, and Hur (2012) found that the relative risk for military personnel and veterans ages 17 to 24 was 3.84 times greater than in the general population. Weiner et al. (2011) recognized that suicide is a widespread public

health issue. The high risk of suicide mortality in the veteran population has been clearly demonstrated in public health research (Weiner et al., 2011; Kang et al., 2015).

Factors associated with attempted and completed suicide include a variety of psychiatric diagnoses, comorbidities, and sociodemographic influences (LeardMann et al., 2013). Factors associated with veteran suicidality do not differ from the general population. However, researchers have identified specific attributes related to veteran suicidality. Significant correlates to veteran suicidality include gender, diagnoses of major-depressive/manic-depressive disorders, alcohol and substance use disorder, and Post-Traumatic Stress Disorder (LeardMann et al., 2013 Weiner et al., 2011). The only notable difference between veteran suicidality and that of the general population is the correlation with PTSD (Weiner et al., 2011). Suicidality has been defined as a propensity for suicidal ideation and/or suicide attempt (Klonsky & May, 2015). As previously noted a variety of psychiatric diagnoses and comorbidities are associated with suicidal behavior and suicidal ideation (Ferrari et al., 2014). Furthermore, researchers have illustrated that up to two-thirds of all suicides are completed by individuals diagnosed with a mood disorder (Isometsä, 2014). More specifically, the risk for completing suicide may be higher for those individuals diagnosed with major depressive disorder (Fisher, Overholser, Ridley, Braden, & Rosoff, 2015; Isometsä, 2014). However, Khazem and Anestis (2016) found that there was no significant difference in depression between individuals exhibiting suicidal ideation versus suicidal behavior. Also, many individuals who complete suicide do not have any previous attempts (Isometsä & Lönnqvist, 1998).

Deficiencies in care at key emergency and preventative care access points may contribute to veteran suicide (Hoge & Castro, 2012). Denneson et al. (2016) found that veterans have continued to complete suicide even after receiving care at a Veterans Health Administration (VHA) facility. The relationship between acute care access points (primary care and emergency care) and suicidal behavior and suicidal ideation is not clear.

Researchers have identified a potential need for expanded suicide screening in a primary care setting (Lish et al., 1996). Also, researchers have evaluated the relationship between usage of VHA services and suicide mortality (Blow et al., 2012). Veterans enrolled and utilizing VHA services were found to have a higher suicide mortality than the general population (Blow et al., 2012). In addition, researchers have studied the types and frequency of health care contacts before completed suicide. Luoma, Martin, and Pearson (2002) analyzed primary care usage prior to completed suicide and found differences between gender and age. Specifically, they found that older adults and women had a higher contact rate with a primary care provider prior to suicide (Luoma et al., 2002). In the year prior to suicide approximately 77% of all older adults were in contact with a primary care provider, and 100% of women were in contact with a primary care provider (Luoma et al., 2002). Ahmedani et al. (2014) discovered a positive correlation between health care contacts within the VHA and completed suicide. However, veteran population studies have not informed researchers of the relationship between health care usage and suicidal behavior, ideation, and risk. The relationship

between access to medical care as a rural veteran and suicidality must also be addressed. In previous research, rural residence was found to be correlated with suicide in the veteran population (McCarthy et al., 2012). However, research in this area is minimal. Therefore, a gap exists in understanding the relationship between all aspects of veteran access to health care (primary care use, emergency care use, specialty care use, and rurality/residence), and suicidality.

Purpose of the Study

Researchers have conducted a significant amount of public health research to address potential deficiencies in mental health services within the VHA (Katz, 2012). Public health research has also informed intervention strategies in emergency care services (Knox et al., 2011). However, there is a gap in research in evaluating the relationship between frequency of use of services within emergency care and primary care, and suicidality. Furthermore, public health research has shown that rural residence may be a suicide risk factor while controlling for access and usage of mental health services (McCarthy et al., 2012). However, little is known regarding the relationship between geographic residence (rurality) and suicide as the relationship pertains to use of health care services. I developed this study to better understand the association between veterans' use of medical services in the VHA, their type of residence (urban, rural, highly rural), and suicide.

Framework

The social ecological model (SEM) served as the framework I used to understand the relationship between the independent and dependent variables, and covariate interaction. The SEM uses four levels to evaluate violence and the effects of approaches to prevention (Krugg, Dahlberg, Mercy, Zwi, & Lozano, 2002). The four levels include the individual, relational, community, and societal (Krugg et al., 2002). Cramer and Kapusta (2017) suggested that suicide risk assessment may be augmented through a suicide risk assessment algorithm that encompasses all levels of the SEM and addresses risk factors throughout the SEM levels. Cramer and Kapusta (2017) specifically noted that relational and community levels of the SEM are correlated to applicable health care environments including outpatient treatment areas (e.g., emergency and primary care settings). Furthermore, research has been conducted to evaluate suicide risk using the levels of the SEM levels (Langhinrichsen-Rohling, Snarr, Slep, Heyman, & Foran, 2011). My application of the SEM assisted in understanding the relationship between medical care usage within the VHA and veteran suicidality.

Social Impact

In this study, my intent was to fill the gap in clinical understanding of medical care usage as a potentially predictive factor of suicidal ideation and behavior. The research was unique because it addressed the relationship between the use of various medical care settings and suicidality. My goal was that the results of the study would inform VHA policy makers of potential areas for increased risk and the specific areas to

consider for increased suicide prevention strategies outside of traditional mental health care (outpatient mental health services and inpatient psychiatry/residential rehabilitation programs).

Current VHA research and policy revisions are focused on increased prevention within mental health programs, and the known psychological and psychiatric risk factors associated with higher suicide risk (substance use disorders, PTSD, and mood disorders; Bagalman, 2016). Therefore, my intent was to provide policy makers with a unique perspective on suicidal behavior/ideation correlation for future study, and to inform future prevention strategy creation and implementation.

Background

Historical Findings

Research has indicated that suicide mortality among the veteran population is an ongoing concern. Weiner et al. (2011) found that the 10-year (1993-1998, $N = 10{,}163$) risk for suicide mortality for veterans with a previous suicide attempt was three-times higher than the general U.S. population. As of 2016, the suicide rate (adjusted for age and gender) of veterans reached 30.5 per 100,000 in comparison 16.4 per 100,000 for non-veteran adults (OMHSP, 2018). Since the 1990s, standard mortality ratios (SMRs) have been compared between veterans and nonveterans. Hoffmire, Kemp, and Bossarte (2015) discovered that the observed suicide mortality ratio was higher than the nonveteran population and increased over the course of the early 2000s to a 60% higher number of observed suicides in the veteran population. As previously noted, although the

overall veteran suicide mortality rate has increased, Hoffmire et al. found that the suicide mortality rate of veterans utilizing VHA services decreased from 2000 to 2010. Also, the suicide rate of veterans ages 35-75+ did not increase from 2015 to 2016 (OMHSP, 2018). However, the suicide rate of veterans 18-34 increased to 45 per 100,000—a substantially higher rate than the non-veteran population (OMHSP, 2018).

Physical and Psychiatric Risk Factors of Veteran Suicidality

Researchers have confirmed that suicide risk among the veteran population is higher in comparison to the general population (Kang et al., 2015; Hoffmire et al., 2015; Weiner et al., 2011). Suicide in the veteran population is considered a public health issue because of this increased risk to the population (Weiner et al., 2011). Researchers have focused on identifying psychiatric diagnoses that are positively correlated with suicidality in the veteran population. Those diagnoses include PTSD, major depressive disorder and other mood disorders, and substance use disorders (Ashrafioun, Pigeon, Conner, Leong, & Oslin, 2016; Ilgen et al., 2012).

Ashrafioun et al. (2016) conducted a screening survey for depression, substance use disorder, and PTSD (Ashrafioun et al., 2016). They screened 3,004 veterans within one VA Medical Center (Philadelphia) who were contacted by clinicians within the Behavioral Health Laboratory (BHL) as part of the facility's Primary Care/Mental Health Integration (PC/MHI) Department (Ashrafioun et al., 2016)). The researchers used the Paykel Suicide Scale (PSS) to assess severity of suicidality, the Patient Health Questionnaire-9 (PHQ-9) to evaluate depression, and the PTSD Checklist-Civilian (PCL-

C) to assess PTSD (Ashrafioun et al., 2016). Additionally, they used a structured interview format (Mini-International Neuropsychiatric Interview (MINI) to elucidate any symptoms of other psychiatric disorders and used the 7-day timeline follow-back procedure to assess heavy alcohol consumption (Ashrafioun et al., 2016). Multinomial regression analyses were conducted, and several psychiatric disorders were found to be significantly associated with a higher severity of suicidal ideation (Ashrafioun et al., 2016). A significant association between suicidal ideation and depression, PTSD, generalized anxiety disorder, mania, and psychosis was revealed ($OR = 1.3$, $p < 0.05$; Ashrafioun et al., 2016). Illicit drug use was found to be significantly associated with suicide attempt *(*$OR = 3.04$, $p < 0.05$; Ashrafioun et al., 2016). However, no other psychiatric disorder was found to be significantly associated with suicide attempt (Ashrafioun et al., 2016). The results of this study were consistent with those in similar studies (Ashrafioun et al., 2016). However, the study's investigators involved a convenience sample of individuals who were already utilizing PC/MHI resources and may not be a comprehensive analysis of the entire population enrolled within the VHA (Ashrafioun et al., 2016).

Chakravorty, Grandner, Mavandadi, Perlis, Sturgis, and Oslin (2014) used a similar patient population screened at the Philadelphia VA Medical Center. Although similar, Chakravorty et al. (2014) were evaluating the relationship between suicidal ideation and insomnia. They also included psychiatric conditions as covariates and used similar testing protocols Ashrafioun et al. (2016; PSS, PHQ-9, MINI, and 7-day timeline

follow-back). The researchers used an ordinal regression model (the polytomous universal model [PLUM]) to evaluate the relationship between suicidal ideation, insomnia, and psychiatric covariates (Chakravorty et al.,2014). Presence of a psychiatric disorder, mania, PTSD, anxiety, and illicit drug use in the past year were all significantly associated with a higher severity of suicidal ideation ($p < 0.05$; Chakravorty et al., 2014, 2014). The strength of the relationship related to higher suicidal ideation severity was strongest among those who experienced psychiatric diagnoses (91%) and illicit drug use in the past year (83%). Although the researchers reported statistical significance related to high suicide ideation severity and mania, PTSD, and anxiety, the strengths of those relationships were minimal (26%, 47%, and 56% respectively; Chakravorty et al., 2014).

Traumatic brain injury (TBI) has also been studied as a potential correlate of suicidality. However, researchers have had conflicting results. Fonda Fredman, Brogly, Mcglinchey, Milberg, and Gradus (2016) concluded that Operation Iraqi Freedom veterans who suffered a deployment related TBI and received care at a VHA facility were at a higher risk for attempted suicide. Their sample population comprised a cohort of veterans who deployed in support of Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF), and who received care at a VHA facility between 2007 and 2012 (N = 273,591) (Fonda et al., 2016). Proportional hazards ratios were calculated, and the veterans with TBI were found to have near four times the risk of attempted suicide in comparison to those without a TBI (unadjusted hazard ratio = 3.92; Fonda et al., 2016).

Barnes, Walter, and Chard (2012) did not find a statistically significant correlation between a history of TBI and increased risk of suicide in patients suffering from PTSD. Barnes et al. (2012) analyzed the relationship between suicidality and moderate TBI and PTSD. The sample population included 92 male veterans who received care at a VHA facility in the midwestern United States (Barnes et al.,2012). Barnes, Walter, and Chard (2012) reported sufficient power for medium effects using *t* tests (0.8, $d = 0.59$), and medium effects using chi-square tests (0.29). However, the authors also admitted that the effect of suicide on a population is low, discounting the sufficiency of the power of their population size (Barnes et al., 2012). The researchers evaluated the continuous suicidality variables via independent samples *t* tests, and the categorical suicide risk variables via chi-square tests (Barnes et al., 2012). Effects were found to be small ($\delta < 0.3$) and none of the results were found to be significant ($p > 0.05$; (Barnes et al., 2012). Current evidence indicates that more research is needed to fully assess the moderating relationship between psychiatric comorbidities and instances of TBI on suicidality (Barnes et al., 2012; Fonda et al., 2016).

Environmental Risk Factors of Veteran Suicidality

Researchers have also found that some environmental factors are positively associated with veteran suicidality. The environmental factors associated with suicidality include access to mental health, primary care, and specialty care resources, and veterans' rurality (Ahmedani et al., 2014; Bernet, 2013; Denneson, Kovas, Britton, Kaplan, McFarland, & Dobscha, 2016; McCarthy, Blow, Ignacio, Ilgen, Austin, & Valenstein,

2012; Hoffmire et al., 2015). Health care contacts among veterans have been studied to ascertain the relationship with suicidality (Ahmedani et al., 2014). Ahmedani et al. (2014) completed a longitudinal study over a 10-year period using a sample population that spanned eleven states and over 11 million individual patients. Descriptive statistics and chi-square analyses were completed (Ahmedani et al., 2014). Over five-thousand completed suicides were identified during the period (N = 5,894), and the majority of those who completed suicide were found to be male and between the ages of 40 and 64 (Ahmedani et al., 2014). Almost 50% of the sample made a health care visit within a month of suicide completion (Ahmedani et al., 2014). Medical specialty (25%) and primary care visits (21%) were the most prevalent types of utilization prior to suicide completion (Ahmedani et al., 2014). However, it should be noted that the studied sample was not compared to non-suicidal death, and therefore is unable to appropriately demonstrate differences in relationship of healthcare utilization between those groups.

Of the research that has been completed regarding health care utilization and suicidality in the veteran population, researchers have focused on understanding the relationship between health care utilization (inpatient and outpatient encounters) and suicide mortality (completion; Hoffmire et al., 2015). Hoffmire et al. (2015) conducted a cross-sectional study of over 100,000 suicide decedents across 23 states over a 10-year period. Standardized mortality rates (SMR) and crude suicide rates were computed (Hoffmire et al., 2015). The researchers found that beginning in the year 2000 the adjusted SMR for veterans utilizing VHA medical services (34.5/100,000) was greater

than those veterans who did not use VHA services (27.6/100,000; Hoffmire et al., 2015). However, the SMR for VHA-utilizing veterans declined over the subsequent 3 years (Hoffmire et al., 2015).

Researchers have conducted studies to specifically address the relationship between mental health outpatient encounters and readmission rates among veterans with a high risk for suicide. Bernet (2013) discovered that readmission to an inpatient psychiatric setting was reduced by 70% when the veteran attended an outpatient mental health appointment post inpatient discharge. Bernet (2013) conducted a cohort study at the Tennessee Valley VA Healthcare System (n = 124). Logistic regression analyses were completed to evaluate the chance of inpatient psychiatric readmission within 12 months in relationship to the frequency of outpatient mental health visits (Bernet, 2013). The odds ratio of readmission was reduced by 70% for those individuals who completed one post-discharge appointment, in comparison to those who did not attend a post-discharge mental health appointment (OR = 0.308, $p < 0.05$; Bernet, 2013).

In contrast, Denneson et al. (2013) found that approximately 50% of veterans were seen in a mental health setting at least 6 months prior to death by suicide. The majority were found to be assessed for suicidal ideation within 6 months of suicide completion (Denneson, Kovas, Britton, Kaplan et al., 2016). This study's findings were limited due to the lack of a comparison group, and subsequently the researchers' inability to ascertain if there are significant differences between health care utilization among suicide decedents and non-suicide decedents.

Kang, Bullman, Smolenski, Skopp, Gahm, and Reger (2015) studied veteran suicide mortality between 2001 and 2007, which included 1,282,074 combat and non-combat veterans. They discovered a lower suicide risk among deployed veterans (HR, 0.84) controlling for age, sex, race, marital status, and military branch and rank (Kang et al., 2015). Although both nondeployed and deployed veterans' overall mortality risk was lower than the general population (SMR, 0.76), suicide risk among both groups of veterans was higher than the national population (SMR, 1.61).

The relationship between rurality and suicide mortality has been minimally studied in the veteran population. McCarthy et al. (2012) evaluated a significant sample veteran population (N = 5,447,257) for the relationship between rurality and suicide mortality. Rural residence was defined by the veterans' zip code and criteria created by the VA Office of Rural Health and using the United States Census Categories (McCarthy et al., 2012). They found that rurality was positively associated with a higher suicide risk in rural populations in two different cohorts. The suicide rate (crude) of rural residence veterans was found to be 38.76/100,000 in comparison to 31.45/100,000 in urban areas in a cohort spanning fiscal years 2004-2005 (McCarthy et al., 2012). In the cohort spanning fiscal years 2007-2008, the crude suicide rate of rural veterans was 39.62/100,000 versus urban veterans at 32.44/100,000 (McCarthy et al., 2012). Race was used as a covariate, and when included for sensitivity analysis the hazard ratio remained consistent for rural residence (HR = 1.06-1.19; McCarthy et al., 2012). Few researchers have evaluated the association between suicidality and rurality. In fact, a recent systematic literature review

of rurality and mental health care in the veteran population resulted in few validated studies exploring the association between rural residence and suicide attempt or ideation (Bumgarner et al., 2017).

Kaplan, McFarland, Huguet, Conner, Caetano, Giesbrecht, and Nolte (2012) discovered a positive association between increased acute alcohol intoxication and rural residence and suicide completion. Specifically, Alaska's prevalence rate of suicide decedents with a blood-alcohol level greater than 0.08 exceeded 40% (Kaplan et al.,2012). Veteran suicide decedents were also found to have a higher adjusted odds ratio of being intoxicated (BAC > 0.08) than non-veterans (AOR = 1.12; Kaplan et al., 2012).

Overview of the Manuscripts

The three studies that follow addressed the relationship between veteran suicidality (as three separate components) and medical care usage within the VHA. Suicidality was divided into three aspects to more comprehensively evaluate the predictive relationship VHA medical care usage has with veteran suicide. The three aspects of suicidality were (a) suicidal behavior as defined by clinical identification and coding of self-harm with the intent to complete suicide and suicide attempt, (b) suicidal ideation as defined by clinical identification and coding of thoughts of completing suicide with or without a definitive plan, and (c) suicide risk as defined by the coding of self-harm with unknown intent. Although suicidal behavior, ideation, and risk are interrelated, the use of three separate studies were used to clarify each aspect's relationship with veterans' use of VHA outpatient medical care. I classified the three dependent variables (suicidal behavior,

ideation, and risk) using International Statistical Classification of Diseases and Related Health Problems (ICD-9) codes. The ICD-9 was replaced by ICD-10 in 2015. However, the VHA did not adopt the new ICD-10 codes system-wide until the beginning of fiscal year 2017. Therefore, ICD-9 codes were used to more comprehensively measure the dependent variables. The intent of the three studies was to analyze the relationship between the use of outpatient services and each component of suicidality, parallel to the other components. **Manuscript 1**

In this quantitative study, I focused on the relationship between the use of outpatient services and suicidal behavior.

Research question. The research question for this study was: What is the relationship between utilization of medical care and suicidal behavior in the veteran population, controlling for rurality, gender, age, and mental health diagnoses associated with suicidal behavior (PTSD, major depressive disorder, and substance disorders)?

Nature of the study. For this study, I used a quantitative approach and data from the VA Informatics and Computing Infrastructure (VINCI; HSR&D, n.d.). All data were collected retrospectively using electronic medical records (EMRs) of patients meeting inclusionary criteria. The VINCI database was accessed to retrieve randomly identified patients who completed a primary care appointment and/or who were seen in a VHA emergency department between January 1, 2008 and December 31, 2018. Please note that predictive modeling of suicidality is a current strategy for quantitatively

understanding the relationship between risk factors and suicidal behavior and ideation (Darvishi, Farhadi, Haghtalab, & Poorolajal, 2015).

Study procedures.

I requested and was granted a waiver for HIPAA authorization for VHA IRB approval. Also, a waiver for informed consent was granted by the Kansas City VAMC IRB. All data, including personally identifiable records, were stored on the secure VINCI environment to which only I had access. There were no paper records associated with this study. Data from this study were not removed from the VINCI (VA protected) environment, unless sanitized (de-identified). No personal health information (PHI) has been reused and/or disclosed to any other person or entity, except as required by law for authorized oversight of the research study, or for other research for which the use of disclosure of the requested information would be permitted by the privacy rule. Confidentiality has been protected by ensuring all PII/PHI was only available to me. No data were stored in temporary files on any non-VINCI hard drive. The data for this protocol were limited-set data with limited PHI. The data stored within the VINCI environment were not considered de-identified. Scrambled SSNs and dates were essential to making accurate data extractions from the corporate data warehouse (CDW). All PII was deleted at the point in which it was analyzed and was no longer needed for data extraction. The following are protected identifiers that were required: SSN/Scrambled SSN, dates of treatment, geographic PSSG enrollee category.

Variables and source of data.

I completed the evaluation of suicidal behavior and veterans' medical care environment by identifying 106,608 veterans who (a) had a residence designation (urban/rural/highly rural), and (b) were seen by a primary care provider or within the emergency department of any VHA medical facility within the previous 10 years (2008-2018). Residence designation was not recoded (urban, rural, and highly rural).

I used clinic stop codes associated with primary care provider primary visits and any emergency department visit, for which a discharge or admission occurred. These codes include primary code and all associated secondary codes of:

1. 323, Primary Care Visit; primary care visits were divided into quintiles.
2. 102, Emergency Department Visit; emergency use was recoded as a binary variable (No visits/one or more visits).

Diagnoses potentially associated with suicidality were correlated to the patient records using ICD-9 codes. These codes included:

1. 296.3, Depression.
2. 309.81, PTSD.
3. 300.X, Substance Abuse.

The ICD-9 code used to capture instances of suicidal behavior is: E95.X, Suicide Attempt/Intentional Self-Harm.

The query resulted in the number of times within the 10-year period the ICD-9 diagnosis code was recorded. I then recoded the variable as binary variables (present/not present). Although at the time of this study ICD-10 codes had been nationally

implemented across the VHA, uniform usage could not be guaranteed, nor could it be queried prior to 2017. Therefore, I did not use ICD-10 codes for this study.

Structured query language was used to develop schema and query results from the CDW working database. This database is the primary repository for all data associated with the electronic medical record, including clinic stop codes, ICD-9/ICD-10 codes, and Planning Systems Support Group (PSSG) codes.

Statistical analysis.

The statistical analyses included descriptive statistics to summarize the sample population data. I calculated frequencies for all categorical variables and means for all continuous variables. Chi-square tests of independence and multinomial logistic regression analyses were completed using the Statistical Package for the Social Sciences (SPSS) to examine the relationship between the dependent, independent, and control variables.

Power analysis.

I found a target sample size range using an *a priori* power analysis in *G*Power.* The power analysis was completed assuming the following: two-tailed, alpha of 0.05, power of 0.80 and 0.95, and effect (odds ratio) of 1.12. The odds ratio of 1.12 was used based upon literature examples. This odds ratio is smaller than other odds ratios in previously conducted examples of associations between suicide risk factors and suicidality (Kaplan et al., 2012). The sample size required, depending on power (0.80-0.95), was calculated as at least 3828 participants. I also completed a post hoc power

analysis using *G*Power*. Odds ratio range (OR =.074-8.099), alpha of 0.05, and the total sample size of 106,608 resulted in an observed power equal to 1.0 (100%).

Manuscript 2

In this quantitative study, I focused on the relationship between the use of outpatient services and suicidal ideation.

Research question.

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For this study I used a quantitative approach and data from the VA Informatics and Computing Infrastructure (VINCI; HSR&D, n.d.). All data were collected retrospectively using electronic medical records (EMRs) of patients meeting inclusionary criteria. The VINCI database was accessed to retrieve randomly identified patients who completed a primary care appointment and/or who were seen in a VHA emergency department between January 1, 2008 and December 31, 2018. Please note that predictive modeling of suicidality is a current strategy for quantitatively understanding the relationship between risk factors and suicidal behavior and ideation (Darvishi et al.,2015).

Study procedures.

I requested and was granted a waiver for HIPAA authorization for VHA IRB approval. Also, a waiver for informed consent was requested granted by the Kansas City VAMC IRB. All data, including personally identifiable records, were stored on the secure VINCI environment to which only I had access. There were no paper records associated with this study. Data from this study were not removed from the VINCI (VA protected) environment, unless sanitized (de-identified). No personal health information (PHI) has been reused and/or disclosed to any other person or entity, except as required by law for authorized oversight of the research study, or for other research for which the use of disclosure of the requested information would be permitted by the privacy rule. Confidentiality has been protected by ensuring all PII/PHI was only available to me. No data were stored in temporary files on any non-VINCI hard drive. The data for this protocol were limited-set data with limited PHI. The data stored within the VINCI environment were not considered de-identified. Scrambled SSNs and dates were essential to making accurate data extractions from the corporate data warehouse (CDW). All PII was deleted at the point in which it was analyzed and was no longer needed for data extraction. The following are protected identifiers that were required: SSN/Scrambled SSN, dates of treatment, geographic PSSG enrollee category.

Variables and source of data.

I completed the evaluation of suicidal ideation and veterans' medical care environment by identifying 106,608 veterans who (a) had a residence designation (urban/rural/highly rural), and (b) were seen by a primary care provider or within the

emergency department of any VHA medical facility within the previous 10 years (2008-2018). Residence designation was not recoded (urban, rural, and highly rural).

I used clinic stop codes associated with primary care provider primary visits and any emergency department visit, for which a discharge or admission occurred. These codes include primary code and all associated secondary codes of:

1. 323, Primary Care Visit; primary care visits were divided into quintiles.
2. 102, Emergency Department Visit; emergency use was recoded as a binary variable (No visits/one or more visits).

Diagnoses potentially associated with suicidality were correlated to the patient records using ICD-9 codes. These codes included:

1. 296.3, Depression.
2. 309.81, PTSD.
3. 300.X, Substance Abuse.

The ICD-9 code used to capture instances of suicidal ideation is: V62.84X, Suicidal ideation.

The query resulted in the number of times within the 10-year period the ICD-9 diagnosis code was recorded. I then recoded the variable as binary variables (present/not present). Although at the time of this study ICD-10 codes had been nationally implemented across the VHA, uniform usage could not be guaranteed, nor could it be queried prior to 2017. Therefore, I did not use ICD-10 codes for this study.

Structured query language was used to develop schema and query results from the CDW working database. This database is the primary repository for all data associated with the electronic medical record, including clinic stop codes, ICD-9/ICD-10 codes, and Planning Systems Support Group (PSSG) codes.

Statistical analysis.

The statistical analyses included descriptive statistics to summarize the sample population data. I calculated frequencies for all categorical variables and means for all continuous variables. Chi-square tests of independence and multinomial logistic regression analyses were completed using the Statistical Package for the Social Sciences (SPSS) to examine the relationship between the dependent, independent, and control variables.

Power analysis.

I found a target sample size range using an *a priori* power analysis in *G*Power.* The power analysis was completed assuming the following: two-tailed, alpha of 0.05, power of 0.80 and 0.95, and effect (odds ratio) of 1.12. The odds ratio of 1.12 was used based upon literature examples. This odds ratio is smaller than other odds ratios in previously conducted examples of associations between suicide risk factors and suicidality (Kaplan et al., 2012). The sample size required, depending on power (0.80-0.95), was calculated as at least 3828 participants. I also completed a post hoc power analysis using *G*Power*. Odds ratio range (OR =.170-4.377), alpha of 0.05, and the total sample size of 106,608 resulted in an observed power equal to 1.0 (100%).

Manuscript 3

In this quantitative study I focused on the relationship between the use of outpatient services and suicide risk.

Research question.

The research question for this study was: What is the relationship between utilization of medical care and high suicide risk in the veteran population, controlling for rurality, gender, age, and comorbid mental health diagnoses (PTSD, depression, and substance disorders)?

Nature of the study.

For this study I used a quantitative approach and data from the VA Informatics and Computing Infrastructure (VINCI; HSR&D, n.d.). All data were collected retrospectively using electronic medical records (EMRs) of patients meeting inclusionary criteria. The VINCI database was accessed to retrieve randomly identified patients who completed a primary care appointment, and/or who were seen in a VHA emergency department between January 1, 2008 and December 31, 2018. Please note that predictive modeling of suicidality is a current strategy for quantitatively understanding the relationship between risk factors and suicidal behavior and ideation (Darvishi et al.,2015).

Study procedures.

I requested and was granted a waiver for HIPAA authorization for VHA IRB approval. Also, a waiver for informed consent was requested granted by the Kansas City VAMC IRB. All data, including personally identifiable records, were stored on the secure VINCI environment to which only I had access. There were no paper records associated with this study. Data from this study were not removed from the VINCI (VA protected) environment, unless sanitized (de-identified). No personal health information (PHI) has been reused and/or disclosed to any other person or entity, except as required by law for authorized oversight of the research study, or for other research for which the use of disclosure of the requested information would be permitted by the privacy rule. Confidentiality has been protected by ensuring all PII/PHI was only available to the me. No data were stored in temporary files on any non-VINCI hard drive. The data for this protocol were limited-set data with limited PHI. The data stored within the VINCI environment were not considered de-identified. Scrambled SSNs and dates were essential to making accurate data extractions from the corporate data warehouse (CDW). All PII was deleted at the point in which it was analyzed and was no longer needed for data extraction. The following are protected identifiers that were required: SSN/Scrambled SSN, dates of treatment, geographic PSSG enrollee category.

Variables and source of data.

I completed the evaluation of suicide risk and veterans' medical care environment by identifying 106,608 veterans who (a) had a residence designation (urban/rural/highly

rural), and (b) were seen by a primary care provider or within the emergency department of any VHA medical facility within the previous 10 years (2008-2018). Residence designation was not recoded (urban, rural, and highly rural).

I used clinic stop codes associated with primary care provider primary visits and any emergency department visit, for which a discharge or admission occurred. These codes include primary code and all associated secondary codes of:

1. 323, Primary Care Visit; primary care visits were divided into quintiles.
2. 102, Emergency Department Visit; emergency use was recoded as a binary variable (No visits/one or more visits).

Diagnoses potentially associated with suicidality were correlated to the patient records using ICD-9 codes. These codes included:

1. 296.3, Depression.
2. 309.81, PTSD.
3. 300.X, Substance Abuse.

The ICD-9 code used to capture instances of suicide risk is: E98X, Unknown self-harm.

The query resulted in the number of times within the 10-year period the ICD-9 diagnosis code was recorded. I then recoded the variable as a binary variable (present / not present). Although at the time of this study ICD-10 codes had been nationally implemented across the VHA, uniform usage could not be guaranteed, nor could it be queried prior to 2017. Therefore, I did not use ICD-10 codes for this study.

Structured query language was used to develop schema and query results from the (CDW) working database. This database is the primary repository for all data associated with the electronic medical record, including clinic stop codes, ICD-9/ICD-10 codes, and Planning Systems Support Group (PSSG) codes.

Statistical analysis.

The statistical analyses included descriptive statistics to summarize the sample population data. I calculated frequencies for all categorical variables and means for all continuous variables. Chi-square tests of independence and multinomial logistic regression analyses were completed using the Statistical Package for the Social Sciences (SPSS) to examine the relationship between the dependent, independent, and control variables.

Power analysis.

I found a target sample size range using an *a priori* power analysis in *G*Power.* The power analysis was completed assuming the following: two-tailed, alpha of 0.05, power of 0.80 and 0.95, and effect (odds ratio) of 1.12. The odds ratio of 1.12 was used based upon literature examples. This odds ratio is smaller than other odds ratios in previously conducted examples of associations between suicide risk factors and suicidality (Kaplan et al., 2012). The sample size required, depending on power (0.80-0.95), was calculated as at least 3828 participants. I also completed a post hoc power analysis was also completed using *G*Power*. Odds ratio range (OR =.154-1.566), alpha

of 0.05, and the total sample size of 106,608 resulted in an observed power equal to 1.0 (100%).

Significance

The intent of the three studies was to assist in filling the gap in existing public health research pertaining to the analysis of veteran suicide and use of outpatient medical care within the Veterans Health Administration. I theorized that by dividing suicidality into three components to be studied independently, the resulting perspective would provide future investigators with a broader foundation of analysis to base further suicide research. Additionally, the purpose of the three studies was to assist in understanding the relationship between environmental factors (medical care use and rurality) and suicidality from three outcome perspectives (suicidal behavior, ideation, and risk). The overall purpose of the studies was to provide an outlet for positive social change by augmenting how policymakers and health care professionals perceive the relationship between environmental variables relating to veteran suicidality. Increasing the body of knowledge surrounding suicidal behavior, ideation, and risk has assisted, and will continue to assist in mitigating stigmas that can influence veterans from choosing to seek out mental health care.

Summary

Veteran suicidality as a public health issue required a comprehensive approach to ensure potentially predictive relationships are understood through multiple perspectives. By dividing the issue of suicidality into three distinct components, the relationship with environmental factors could be analyzed in detail. Furthermore, the relationship between the related covariates was more clearly defined for each of the three components of suicidality. Suicidal behavior, ideation, and risk are three aspects of comprehensively defining suicidality. Evaluation of each provided a detailed understanding of the relationship between suicidality and the specified control variables, and the usage of medical care within the Veterans Health Administration.

Part 2: Manuscripts

Use of Medical Care and Attempted Suicide Among Veterans

Wyatt Meriwether

Outlet for Manuscript

Suicide and Life-Threatening Behavior was the target journal for the manuscript. The following was the URL for manuscript submission for the journal: https://onlinelibrary.wiley.com/journal/1943278x. The journal requires APA formatting with a structured abstract. The journal was the first choice for potential publication as the official journal of the American Association of Suicidology.The final decision was provided by the editor, Dr. Thomas Jointer. The following feedback and decision were provided: “Dear Mr. Meriwether: I write to you regarding manuscript # 2019-SLTB-0072 entitled "Use of Medical Care and Suicidal Behavior Among Veterans" which you submitted to Suicide and Life-Threatening Behavior. I have now completed an initial review of your manuscript, and I regret to tell you that we are not able to undertake further consideration of your submission for publication in the journal. The findings are of interest, but studies of this nature are having trouble competing for space with studies with experimental and/or longitudinal features. In light of this, and the current pressure for space in the journal, I am afraid I am unable to prioritize your paper sufficiently to accept it for publication. I am sorry to cause you disappointment. I would add that I am sorry that I was delayed in processing this submission. My apologies. Thank you for the privilege of reviewing your work.”

The manuscript was not submitted to another outlet for publication at the time of dissertation submission.

Abstract

Objective.

Since 2001 an increase in validated veteran suicides has rallied researchers and clinical professionals to further study factors associated with suicidal behavior. Several historical factors have been studied, but conclusions have been disparate among environmental factors. Additional research is required to evaluate how suicide attempts are associated with a veteran's usage of medical care services.

Method.

A nationwide sample of VHA patient records (n = 106,608) who a) had at least one primary care or emergency department visit, and b) had an identified geographic residence designation within the previous ten years were analyzed.

Results.

The results indicate a lower odds ratio ($p < .05$, OR = .074 - .529) at levels of minimal primary care usage and the presence of a suicide attempt. Also, the results indicate a lower odds ratio ($p < .05$, OR = .557) for those individuals with no emergency department visits and the presence of a suicide attempt. Results also suggest that a positive association with urban residence ($p < .05$, OR = 8.099) and an increased risk of suicidal behavior may exist.

Conclusions.

Frequent use of medical care and urban residence may be associated with suicidal behavior in the veteran population.

Introduction

Since 2011, suicide has been the second leading cause of death among military personnel (Bryan et al., 2015). Gibbons, Brown, and Hur (2012) found that the relative risk for military personnel and veterans ages 17 to 24 was 3.84 times greater than in the general population. As of 2016, the Department of Veterans Affairs Office of Mental Health and Suicide Prevention (OMHSP) reported that the suicide rate (adjusted for age and gender) of veterans reached 30.5 per 100,000 in comparison to the rate for non-veteran adults, which was 16.4 per 100,000 (OMHSP, 2018). Also, the suicide rate of veterans ages 18-34 reached 45 per 100,000 (OMHSP, 2018). The high risk of suicide mortality in the veteran population has also been confirmed through public health research (Weiner, Richmond, Conigliaro, & Wiebe, 2011; Kang et al., 2015).

Factors associated with attempted suicide include a variety of psychiatric diagnoses, comorbidities, and sociodemographic influences (LeardMann et al., 2013). Although associated factors with veteran suicidality do not differ from those in the general population, specific attributes related to veteran suicidality have been identified. Significant correlates to veteran suicidality include gender, diagnoses of major-depressive/manic-depressive disorders, alcohol and substance use disorder, and post-traumatic stress disorder (LeardMann et al., 2013; Weiner et al., 2011). The only notable difference between veteran suicidality and that of the general population is the association with PTSD (Weiner et al., 2011). However, Bryan, Sinclair, and Heron

(2016) found that the effect of combat exposure on an acquired capability for suicide, as described by the Interpersonal theory of suicide (IPTS) may not be accurate.

Furthermore, researchers have shown that up to two-thirds of all suicides are completed by individuals diagnosed with a mood disorder (Isometsä, 2014). More specifically, the risk for completing suicide may be higher for those individuals diagnosed with major depressive disorder (Fisher, Overholser, Ridley, Braden, & Rosoff, 2015; Isometsä, 2014). However, Khazem and Anestis (2016) found that there was no significant difference in depression between individuals exhibiting suicidal ideation versus suicidal behavior. Also, many individuals who complete suicide do not have any previous attempts (Isometsä & Lönnqvist, 1998). These findings are evidence of the complexity of suicidal behavior and justify the need to study environmental factors. Deficiencies in care at key emergency and preventative care access points may contribute to veteran suicide (Hoge & Castro, 2012). Denneson et al. (2016) found that some veterans have continued to complete suicide even after receiving care at a Veterans Health Administration facility.

Researchers have identified a potential need for expanded suicide screening in a primary care setting (Lish et al., 1996). Also, researchers have evaluated the relationship between usage of VHA services and suicide mortality (Blow et al., 2012). Veterans enrolled and utilizing VHA services were found to have a higher suicide mortality than the general population (Blow et al., 2012). In addition, the types and frequency of health care contacts have been studied before completed suicide. Luoma, Martin, and Pearson

(2002) analyzed primary care usage prior to completed suicide and found differences by gender and age. Specifically, they found that older adults and women had a higher contact rate with a primary care provider than with a mental health provider in the year prior to suicide (Luoma et al., 2002). In the year prior to suicide, approximately 77% of all older adults were in contact with a primary care provider, and 100% of women were in contact with a primary care provider (Luoma et al.,2002). Ahmedani et al. (2014) also discovered that women and older veterans had a higher contact rate (VHA visit) within the year prior to suicide. Also, three-fifths of the individuals had at least one primary care or medical specialty visit without a mental health diagnosis (Ahmedani et al., 2014).

Residence is a secondary environmental factor that has received minimal attention as it relates to veteran suicide within the VHA. The relationship between access to medical care in relation to residence type (urban versus rural) and suicidality must also be addressed. In previous studies, researchers have found that rural residence is correlated with suicide in the veteran population (McCarthy et al., 2012). However, research in this area is minimal. Therefore, a gap exists in understanding the relationship between aspects of veteran access to health care (primary care use, emergency care use, and rurality), and suicidal behavior. The results, discussion, and implications were intended to better understand the association between veterans' use of medical services in the VHA, their type of residence (urban, rural, highly rural), and suicidal behavior.

Methods

The Veterans Informatics and Computing Infrastructure (VINCI) is the internal VHA organization that links researchers with data available within the infrastructure of the electronic medical record (HSR&D, n.d.). I queried databases within the VINCI environment using structured query language protocol for applicable clinic stop coding and ICD-9 diagnoses coding.

Research Question

What is the relationship between utilization of medical care and suicidal behavior in the veteran population, controlling for rurality, gender, age, and mental health diagnoses associated with suicidal behavior (PTSD, major depressive disorder, and substance disorders)?

Variables and Study Procedures

I completed the evaluation of suicidal behavior and veterans' use of medical care by identifying 106,608 veterans who (a) had a residence designation (urban/rural/highly rural), and (b) were seen by a primary care provider or within the emergency department of any VHA medical facility within the previous 10 years (2008-2018). Prior to data collection, I conducted an *a priori* power analysis using *G*Power*. The following were assumed: two-tailed, alpha of 0.05, power of 0.80 and 0.95, and effect (odds ratio) of 1.12. This odds ratio is smaller than the odds ratios in previously conducted examples of associations between suicide risk factors and suicidality (Kaplan et al., 2012). The sample size required, depending on power (0.80-0.95), at least 3828 participants. I also

completed a post hoc power analysis using *G*Power*. Odds ratio range (OR =.074-8.099), alpha of 0.05, and the total sample size of 106,608 resulted in a power equal to 1.0 (100%).

I used clinic stop codes associated with primary care provider primary visits and any emergency department visit, for which a discharge or admission occurred, were used. These codes include primary code and all associated secondary codes of 323: Primary Care Visit, and primary code and all associated secondary codes of 102: Emergency Department Visit. Queries capturing primary care visits and use of emergency care resulted in the number of times within the 10-year period the veteran received treatment in a clinic coded with the respective Decision Support System (DSS) stop code. Emergency use was recoded as a binary variable (No visits/one or more visits). Primary care visits were divided into quintiles. Diagnoses potentially associated with increased suicide attempts were correlated to the patient records using International Statistical Classification of Diseases and Related Health Problems Version 9 (ICD-9) codes. These codes included: 296.3: Depression, 309.81: PTSD, and 300.X: Substance Abuse. The ICD-9 code used to capture instances of suicidal behavior is E95.X: Suicide Attempt/Intentional Self-Harm. These queries resulted in the number of times within the 10-year period the ICD-9 diagnosis code was recorded. I then recoded these as binary variables (diagnosis present/diagnosis not present). Although at the time of this study ICD-10 codes had been nationally implemented across the VHA, uniform usage could

not be guaranteed, nor could it be queried prior to 2017. Therefore, I did not use ICD-10 codes for this study.

I used structured query language to develop schema and query results from the Corporate Data Warehouse (CDW) working database. This database is the primary repository for all data associated with the electronic medical records, including clinic stop codes, ICD-9/ICD-10 codes, and Planning Systems Support Group (PSSG) codes.

I used chi-square and multinomial logistic regression analyses using the Statistical Package for the Social Science (SPSS) to ascertain if an association existed between suicidal behavior and the independent variables. Descriptive statistics were also completed for all variables (see Tables 1 and 2).

Results

Frequencies are illustrated by ordinal level for primary care visits and emergency department visits in Table 1. The sample population consisted of 575 veterans (0.5%) who exhibited suicidal behavior within the 10-year period (2008-2018). Also, 11,790 (11.06%) veterans received emergency care during the 10-year period. A chi-square test of independence was performed to examine the relation between suicidal behavior and the use of primary care and emergency services. The relation between the variables was significant, X^2 (4, N = 106,608) = 555.072, p <.01 and X^2 (1, N = 106,608) = 258.460, p <.01, respectively.

Results of the multinomial logistic regression showed a statistically significant association between suicidal behavior and all covariates except gender. These results

indicated that PTSD ($p < .001$, OR = 2.076), depression ($p < .001$, OR = 3.920), and substance abuse ($p < .001$, OR = 2.815) are independently and significantly associated with suicidal behavior (Table 3). The reference level was the absence of these mental health diagnoses.

Multinomial logistic regression results pertaining to emergency department ($p < .001$, OR = .557) and primary care visits ($p < .001$, OR = .074 - .529) indicated a negative association (at all levels in comparison to the reference level) with suicidal behavior being present (Table 3). The reference levels were the highest quintile of primary care use (>13 visits/year) and one or more emergency department visits. Furthermore, residence at the *urban* level ($p < .05$, OR = 8.099) was positively and significantly associated with suicidal behavior, in comparison to the referent level (*highly rural*; Table 3).

Discussion

The results of the regression and chi-square analyses appear to support the conclusion that the adjusted odds of suicidal behavior is lower at the bottommost level of primary care usage, and the opposite is true at the highest level of primary care use. This could indicate that veterans may be utilizing medical services at a higher rate (> 13 visits/year) as they are more prone to attempt suicide. Also, non-use of emergency care services indicated a lower odds of suicidal behavior. A possible conclusion is that frequent use of emergency services and/or primary care visits may be interpreted as a veteran's attempt to reach out for help, regardless of diagnoses or perceived need to be

seen by a medical provider. Researchers have recently concluded that social isolation (objective or subjective) is associated with aspects of suicidality including attempt (Calati et al., 2018). One possible interpretation of the study results is that veterans at a higher risk of suicidal behavior may attempt to replace levels of the SEM with use of VHA services (subjective isolation). However, my study design does limit any ability to ascertain if veterans using VHA services at a higher frequency are also dealing with chronic physical illness necessitating more frequent primary care visits. Regardless, it is possible that veterans use VHA services to replace social involvement and reduce their subjective isolation to cope with thoughts or feelings leading to suicide attempt. Therefore, it may be beneficial to include frequency of primary care and emergency care services in the development of future algorithms for suicide prevention in the VHA.

The results also support previous researchers' findings and reinforce the relationship between depression and suicidal behavior (Fisher et al., 2015; Isometsä, 2014). The results show that veterans diagnosed with depression are almost four times more likely to exhibit suicidal behavior ($p < .001$, OR = 3.920). Veterans diagnosed with PTSD or substance abuse were also at a higher relative risk of exhibiting suicidal behavior ($p < .001$, OR = 2.076) and ($p < .001$, OR = 2.815), respectively. These results support past research the same associations (LeardMann et al., 2013; Weiner et al., 2011).

The results of the multinomial regression analysis also showed that urban residence may indicate a higher relative risk of suicidal behavior within the veteran population utilizing VHA services. Implications include monitoring of residence type for

potential prevention strategies. One possible interpretation of these results is that there may be such a reduced sense of community (subjective isolation) at an urban level of residence, as described by the Social-Ecological Model (SEM), that suicidal behavior tendencies persist (Cramer & Kapusta, 2017). It is also possible that individuals who have exhibited suicidal behavior gravitate to urban living, where mental health resources are more readily available.

Some additional limitations to the research should be noted. First, the research is limited by the interpretation and coding of clinical professionals for diagnoses and suicide attempt. The coding of the ICD-9 code for suicidal behavior is subjective and may result in over or underrepresenting the veterans who have attempted suicide. Also, variations in interpretation of the clinical definition of suicidal behavior may impact representation within the sample. Additionally, the research is limited by the possible lack of standardization of DSS stop codes for clinical designation. Also, the clinical efficacy of the visits is unknown, and therefore could be a contributing factor to veterans' increased care utilization. Finally, the data incorporate only those visits and diagnostics within the VHA; utilization occurring outside the VHA is unknown.

Although there are limitations to the collection and support of the data, the implications for future research are evident. The statistical results supported the conclusions of previous researchers who have shown associations between PTSD, depression, and substance use with suicidal behavior (Ashrafioun et al., 2016; Ilgen et al., 2012). It appears that historical conclusions suggest rural residence is associated with

higher incidences of suicide attempt (McCarthy et al., 2012). However, the results of my study conflict with this conclusion, and therefore the relationship between rurality and suicidal behavior requires further analysis and modeling to assert an evidence-based conclusion. Veterans' frequent use of VHA services and increased suicidal behavior requires future research to assess this relationship in detail. Regardless, the findings may have social impact by influencing future policy to implement early identification of suicidal behavior through the monitoring of veterans' use of medical care at primary access points within the VHA.

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Tables

Table 1

All Frequencies

Primary Care Use Frequency		
Minimal use (percent)		22257 (20.9)
Moderately low use (percent)		20309 (19.1)
Moderate use (percent)		21720 (20.4)
Moderately high use (percent)		20989 (19.7)
High use (percent)		21333 (20)
Emergency Department Visits Frequency		
None (percent)		94632 (88.8)
One or more visits (percent)		11976 (11.2)
Rurality Frequencies		
Urban (percent)		69389 (65.1)
Rural (percent)		35764 (33.5)
Highly rural (percent)		1455 (1.4)
Gender Frequencies		
Male		98831 (92.7)
Female		7777 (7.3)
ICD-9 Variable Frequencies	**Not present**	**Present**
Suicide attempt (percent)	106033 (99.5)	575 (.5)
PTSD (percent)	87251 (81.8)	19357 (18.2)
Depression (percent)	96668 (90.7)	9940 (9.3)
Substance abuse (percent)	83922 (78.7)	22686 (21.3)

Table 2

Crosstabs

Primary Care Visits				Suicidal behavior
	not present	present	total	p- value
Minimal use (percent)	22246 (99.5)	11 (.05)	22257	
Moderately low use (percent)	20272 (99.8)	37 (.2)	20309	
Moderate use (percent)	21643 (99.6)	77 (.4)	21720	
Moderately high use (percent)	20866 (99.4)	123 (.6)	20989	
High use (percent)	21006 (98.5)	327 (.5)	21333	
Total (percent)	106033 (99.5)	575 (0.5)	106608	< .001

Emergency department visits				Suicidal behavior
	not present	present	total	p- value
None (percent)	94243 (99.6)	389 (.4)	94632	
1 or more visits (percent)	11790 (98.4)	186 (1.6)	11976	
Total (percent)	106033 (99.5)	575 (.5)	106608	< .001

PTSD				Suicidal behavior
	not present	present	total	p- value
Not diagnosed (percent)	87040 (99.8)	211 (.2)	87251	
Positive diagnosis (percent)	18993 (98.1)	364 (1.9)	19357	
Total (percent)	106033 (99.5)	575 (.5)	106608	< .001

Depression				Suicidal behavior
	not present	present	total	p- value
Not diagnosed (percent)	96416 (99.7)	252 (.3)	96668	
Positive diagnosis (percent)	9617 (96.8)	323 (3.2)	9940	

Total (percent)	106033 (99.5)	575 (.5)	106608	< .001

SUD			Suicidal behavior	
	not present	present	total	p- value
Not diagnosed (percent)	83766 (99.8)	156 (.2)	83922	
Positive diagnosis (percent)	22267 (98.2)	419 (1.8)	22686	
Total (percent)	106033 (99.5)	575 (.5)	106608	< .001

Gender			Suicidal behavior	
	not present	present	total	p- value
Female (percent)	7694 (98.9)	83 (1.1)	7777	
Male (percent)	98339 (99.5)	492 (.5)	98831	
Total (percent)	106033 (99.5)	575 (.5)	106608	< .001

Rurality			Suicidal behavior	
	not present	present	total	p- value
Urban (percent)	68974 (99.4)	415 (.6)	69389	
Rural (percent)	35605 (99.6)	159 (.4)	35764	
Highly rural (percent)	1454 (99.9)	1 (.1)	1455	
Total (percent)	106033 (99.5)	575 (.5)	106608	< .001

Table 3

Multinomial logistic regression

Variable	OR (95% CI)	p
PTSD diagnosis[a]	2.076 (1.72 – 2.50)	< .001
Depression diagnosis[b]	3.920 (3.27 – 4.70)	< .001
Substance Abuse/Substance Use Disorder (SUD) diagnosis[c]	2.815 (2.30 – 3.45)	< .001
Age	.966 (.960 - .972)	< .001
Emergency Department Use		
No recorded visits[d]	.557 (.463 - .670)	< .001
Primary Care Use[e]		
Minimal use	.074 (.040 - .138)	< .001
Moderately low use	.238 (.166 - .340)	< .001
Moderate use	.385 (.296 - .501)	< .001
Moderately high use	.529 (.426 - .656)	< .001
Rurality[f]		
Urban	8.099 (1.13 – 57.98)	.037
Rural	6.098 (.849 – 43.82)	.072
Gender[g]	.922 (.721 – 1.18)	.517

Reference categories: [a] "No PTSD diagnosis"; [b] "No depression diagnosis"; [c] "No substance abuse/substance use disorder diagnosis"; [d] "1 or more emergency department visits"; [e] "High use"; [f] "highly rural"; [g] "male"

Manuscript 2

Use of Medical Care and Suicidal Ideation Among Veterans

Wyatt Meriwether

Outlet for Manuscript

The following was the target journal for the manuscript: *Medical Care: Official Journal of the Medical Care Section, APHA*. The following is the URL for manuscript submission for the journal: https://journals.lww.com/lww-medicalcare/pages/default.aspx. The journal requires AMA formatting with a structured abstract and numbered citations. The journal was an evident choice for potential publication as the official journal of the Medical Care Section of the American Public Health Association (APHA).

The manuscript was initially submitted for review on April 7, 2019. The manuscript underwent two iterations of correction due to formatting issues. The first iteration required editing due to the lack of inclusion of a conflict of interest statement on the unblinded title page and initial revisions to the references. The second iteration required additional revision to the references. The manuscript was rejected by the journal on May 29, 2019. The reviewer comments were reviewed and influenced subsequent audits. The manuscript was not submitted to another outlet for publication at the time of dissertation submission.

Abstract

Objective.

Since 2001 an increase in validated veteran suicides has rallied researchers and clinical professionals to further study factors associated with suicidal ideation. Several historical factors have been studied, but conclusions have been disparate among environmental factors. Additional research is required to evaluate how suicidal ideation is associated with a veteran's use of medical care services.

Method.

A nationwide sample of VHA patient records (106,608) who a) had at least one primary care or emergency department visit, and b) had an identified geographic residence designation within the previous ten years were analyzed.

Results.

The results indicate a lower odds ratio ($p < .001$, OR = .170 - .490) at levels of minimal primary care usage and the presence of a suicidal ideation. Also, the results indicate a lower odds ratio ($p < .001$, OR = .632) for those individuals with no emergency department visits and the presence of a suicidal ideation. Results also suggest that a positive association with urban residence ($p < .05$, OR = 1.892) and an increased risk of suicidal ideation may exist.

Conclusions.

Frequent use of medical care and urban residence may be an associated with suicidal ideation in the veteran population.

Introduction

Since 2011, suicide has been the second leading cause of death among military personnel.[1] Researchers found that the relative risk for military personnel and veterans ages 17 to 24 was 3.84 times greater than that in the general population.[2] As of 2016, the Department of Veterans Affairs Office of Mental Health and Suicide Prevention reported that the suicide rate (adjusted for age and gender) of veterans reached 30.5 per 100,000 in comparison to the rate for non-veteran adults, which was 16.4 per 100,000.[3] Also, the suicide rate of veterans ages 18- 34 reached 45 per 100,000.[3] Public health researchers have confirmed an increasing risk of suicide mortality in the veteran population has been confirmed through public health research.[4,5]

Factors associated with suicidal ideation include a variety of psychiatric diagnoses, comorbidities, and sociodemographic influences.[6] Although associated factors with veteran suicidality do not differ from those in the general population specific attributes related to veteran suicidality have been identified. Significant correlates include gender, diagnoses of major-depressive/manic-depressive disorders, alcohol and substance use disorder, and Post-Traumatic Stress Disorder.[4,6] The only notable difference between veteran suicidality and that of the general population is the association with PTSD.[4] Researchers have discovered that negative posttraumatic

cognitions related to the self were positively associated with suicidal ideation.[7] Additionally, depression, psychosis, mania, and PTSD were positively associated with higher severity suicidal ideation, but illicit drug use was found to only be associated with suicide attempt, not suicidal ideation.[8] However, the effect of combat exposure on an acquired capability for suicide, as described by the interpersonal-psychological theory of suicide (IPTS) may not be accurate.[9]

Furthermore, researchers have demonstrated that up to two-thirds of all suicides are completed by individuals diagnosed with a mood disorder.[10] More specifically, the risk for completing suicide may be higher for those individuals diagnosed with major depressive disorder.[10,11] However, there was no significant difference in depression between individuals exhibiting suicidal ideation versus suicidal behavior.[12] Also, many individuals who complete suicide do not have any previous attempts.[13] These findings are evidence of the complexity of suicide and show the need to study environmental factors. Deficiencies in care at key emergency and preventative care access points may contribute to veteran suicide.[14] Researchers found that some veterans have continued to complete suicide even after receiving care at a Veterans Health Administration facility.[15]

Researchers have identified a potential need for expanded suicide screening in primary care settings.[8,16] Also, researchers have evaluated the relationship between usage of VHA services and suicide mortality.[17] Veterans enrolled and utilizing VHA services were found to have a higher suicide mortality than the general population.[17] In addition, the types and frequency of health care contacts have been studied before completed

suicide. Researchers analyzed primary care usage prior to completed suicide and found differences by gender and age.[18] They found that older adults and women had a higher contact rate with a primary care provider than with a mental health provider in the year prior to suicide.[18] In the year prior to suicide, approximately 77% of all older adults were in contact with a primary care provider, and 100% of women were in contact with a primary care provider.[18] Researchers also discovered that women and older veterans had a higher contact rate (VHA visit) within the year prior to suicide.[19] Also, three-fifths of the individuals had at least one primary care or medical specialty visit without a mental health diagnosis.[20]

Residence is a secondary environmental factor that has received minimal attention as it relates to veteran suicide within the VHA. In previous studies, researchers have found that rural residence correlated with suicide in the veteran population[20]. However, research in this area is minimal. Therefore, a gap exists in understanding the relationship between aspects of veteran access to health care (primary care use, emergency care use, and rurality), and suicidal ideation. The results and discussion were intended to better understand the association between veterans' use of medical services in the VHA, their type of residence (urban, rural, highly rural), and suicidal ideation.

Methods

The Veterans Informatics and Computing Infrastructure (VINCI) is the internal VHA organization that links researchers with data available within the infrastructure of the electronic medical record[21]. I queried databases within the VINCI environment using

structured query language protocol for applicable clinic stop coding and ICD-9 diagnoses coding.

Research question

What is the relationship between utilization of medical care and suicidal ideation in the veteran population, controlling for rurality, gender, age, and mental health diagnoses associated with suicidal behavior (PTSD, major depressive disorder, and substance disorders)?

Variables and Study Procedures

I completed the evaluation of suicidal ideation and veterans' medical care environment by identifying 106,608 veterans who (a) had a residence designation (urban/rural/highly rural), and (b) were seen by a primary care provider or within the emergency department of any VHA medical facility within the previous 10 years (2008-2018). Prior to data collection I conducted an *a priori* power analysis using *G*Power*. The following were assumed: two-tailed, alpha of 0.05, power of 0.80 and 0.95, and effect (odds ratio) of 1.12. This odds ratio is smaller than the odds ratios in previously conducted examples of associations between suicide risk factors and suicidality.[22] The sample size required depending on power (0.80-0.95), at least 3828 participants. I also completed a post hoc power analysis using *G*Power*. Using the final odds ratios, alpha of 0.05 and the total sample size of 106,608 the power output equaled 1.0 (100%). I used clinic stop codes associated with primary care provider primary visits and any emergency department visit, for which a discharge or admission occurred. These codes include

primary code and all associated secondary codes of 323: Primary Care Visit, and primary code and all associated secondary codes of 102: Emergency Department Visit. Queries capturing primary care visits and use of emergency care resulted in the number of times within the 10-year period the veteran received treatment in a clinic coded with the respective Decision Support System (DSS) stop code. Emergency use was recoded as a binary variable (No visits/one or more visits). Primary care visits were divided into quintiles. Diagnoses potentially associated with increased suicide attempts were correlated to the patient records using International Statistical Classification of Diseases and Related Health Problems Version 9 (ICD-9) codes. These codes included: 296.3: Depression, 309.81: PTSD, and 300.X: Substance Abuse. The ICD-9 code used to capture instances of suicidal ideation is V62.84X: Suicidal ideation. These queries resulted in the number of times within the 10-year period the ICD-9 diagnosis code was recorded. I then recoded these variables as binary variables (diagnosis present/diagnosis not present). Although at the time of this study ICD-10 codes had been nationally implemented across the VHA, uniform usage could not be guaranteed, nor could it be queried prior to 2017. Therefore, I did not use ICD-10 codes for this study.

I used structured query language to develop schema and query results from the Corporate Data Warehouse (CDW) working database. This database is the primary repository for all data associated with the electronic medical record, including clinic stop codes, ICD-9/ICD-10 codes, and Planning Systems Support Group (PSSG) codes.

I used chi-square and multinomial logistic regression analyses using the Statistical Package for the Social Sciences (SPSS) to ascertain if an association existed between suicidal ideation and the independent variables. Descriptive statistics were also completed for all variables (see Tables 1 and 2).

Results

In Table 1, frequencies are shown by ordinal level for primary care visits and emergency department visits. The sample population consisted of 2,359 veterans (2.2%) who exhibited suicidal ideation within the ten-year period (2008- 2018). Also, 11,790 (11.06%) veterans received emergency care during the 10-year period. I performed a chi-square test of independence to examine the relation between suicidal behavior and the use of primary care and emergency services. The relation between the variables was significant, X^2 (4, N = 106,608) = 1724.238, p <.01 and X^2 (1, N = 106,608) = 631.050, p <.01, respectively.

Results of the multinomial logistic regression showed a statistically significant association between suicidal ideation and all covariates. These results indicated that PTSD (p < .001, OR = 1.916), depression (p < .001, OR = 4.377), and substance abuse (p < .001, OR = 2.939) are independently and significantly associated with suicidal ideation (Table 3).

Multinomial logistic regression results pertaining to emergency department (p < .001, OR = .632) and primary care visits (p < .001, OR = .170 - .490) indicated a negative association (at all levels in comparison to the reference level) with suicidal ideation being

present (Table 3). Furthermore, residence at the *urban* level ($p < .05$, OR = 1.892) was positively and significantly associated with suicidal ideation, in comparison to the referent level (*highly rural*; Table 3). Finally, I found that gender was associated with suicidal ideation ($p < .001$, OR = .674).

Discussion

The results of the regression and chi-square analyses appear to support the conclusion that the adjusted odds of suicidal ideation is lower at the bottommost level of primary care usage, and the opposite is true at the highest level of primary care use. This could indicate that veterans may be utilizing medical services at a higher rate (> 13 visits/year) as they experience suicidal ideation. Also, non-use of emergency care services indicated a lower odds of suicidal ideation. A possible conclusion is that frequent use of emergency services and/or primary care visits may be interpreted as a veteran's attempt to reach out for help, regardless of diagnoses or perceived need to be seen by a medical provider. Researchers have recently concluded that social isolation (objective or subjective) is associated with aspects of suicidality.[23] One possible interpretation of the study results is that veterans at a higher risk of suicidal ideation may attempt to replace levels of the SEM with use of VHA services (subjective isolation). However, my study design does limit any ability to ascertain if veterans using VHA services at a higher frequency are also dealing with chronic physical illness necessitating more frequent primary care visits. Regardless, it is possible that veterans use VHA services to replace social involvement and reduce their subjective isolation to cope with

suicidal ideation. Therefore, it may be beneficial to include frequency of primary care and emergency care services in the development of future algorithms for suicide prevention in the VHA.

The results also support previous researchers' findings and reinforce the relationship between depression and suicidal behavior.[11,13] The results show that veterans diagnosed with depression are almost four times more likely to exhibit suicidal ideation ($p < .001$, OR = 4.377). Veterans diagnosed with PTSD or substance abuse were also at a higher relative risk of exhibiting suicidal ideation ($p < .001$, OR = 1.916) and ($p < .001$, OR = 2.939), respectively. These results support past research showing the same associations.[4,6]

The results of the multinomial regression analysis also show that urban residence may indicate a higher relative risk of suicidal ideation within the veteran population utilizing VHA services. Implications include monitoring of residence type for potential prevention strategies. One possible interpretation of these results is that there may be such a reduced sense of community (subjective isolation) at an urban level of residence, as described by the Social-Ecological Model (SEM), suicidal ideation persists.[24] It is also possible that individuals who have experienced suicidal ideation gravitate to urban living, where mental health resources are more readily available.

Some additional limitations to the research should be noted. First, the research is limited by the interpretation and coding of clinical professionals for diagnoses and suicidal ideation. The coding of the ICD-9 code for suicidal ideation is subjective and

may result in over or underrepresenting the veterans who have experienced suicidal ideation. Also, variations in interpretation of the clinical definition of suicidal ideation may impact representation within the sample. Additionally, the research is limited by the possible lack of standardization of DSS stop codes for clinical designation. Also, the clinical efficacy of the visits is unknown, and therefore could be a contributing factor to veterans' increased care utilization. Finally, the data incorporates only those visits and diagnostics within the VHA; utilization occurring outside the VHA is unknown.

Although there are limitations to the collection and support of the data, the implications for future research are evident. The statistical results supported the conclusions of previous researchers who have shown associations between PTSD, depression, and substance use with suicidal ideation.[8] It appears that historical conclusions suggest rural residence is associated with higher incidences of suicidal ideation.[20] However, the results of my study conflict with this conclusion, and therefore the relationship between rurality and suicidal ideation requires further analysis and modeling to assert an evidence-based conclusion. Veterans' frequent use of VHA services and increased suicidal ideation requires future research to assess this relationship in detail. Regardless, the findings may have social impact by potentially influencing future policy to implement early identification of suicidal ideation through the monitoring of veterans' use of medical care at primary access points within the VHA.

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Tables

Table 1

All Frequencies

Primary Care Use Frequency	
Minimal use (percent)	22257 (20.9)
Moderately low use (percent)	20309 (19.1)
Moderate use (percent)	21720 (20.4)
Moderately high use (percent)	20989 (19.7)
High use (percent)	21333 (20)
Emergency Department Visits Frequency	
None (percent)	94632 (88.8)
One or more visits (percent)	11976 (11.2)
Rurality Frequencies	
Urban (percent)	69389 (65.1)
Rural (percent)	35764 (33.5)
Highly rural (percent)	1455 (1.4)
Gender Frequencies	
Male	98831 (92.7)
Female	7777 (7.3)

ICD-9 Variable Frequencies	Not present	Present
Suicidal ideation (percent)	104249 (97.8)	2359 (2.2)
PTSD (percent)	87251 (81.8)	19357 (18.2)
Depression (percent)	96668 (90.7)	9940 (9.3)
Substance abuse (percent)	83922 (78.7)	22686 (21.3)

Table 2

Crosstabs

Primary Care Visits				Suicidal Ideation
	not present	present	total	p- value
Minimal use (percent)	22152 (99.5)	105 (.5)	22257	
Moderately low use (percent)	20119 (99.1)	190 (0.9)	20309	
Moderate use (percent)	21347 (98.3)	373 (1.7)	21720	
Moderately high use (percent)	20525 (97.8)	464 (2.2)	20989	
High use (percent)	20106 (94.2)	1227 (5.8)	21333	
Total (percent)	104249 (97.8)	2359 (2.2)	106608	< .001

Emergency department visits				Suicidal Ideation
	not present	present	total	p- value
None (percent)	92919 (98.2)	1713 (1.8)	94632	
1 or more visits (percent)	11330 (94.6)	646 (5.4)	11976	
Total (percent)	104249 (97.8)	2359 (2.2)	106608	< .001

PTSD				Suicidal Ideation
	not present	present	total	p- value
Not diagnosed (percent)	86261 (98.9)	990 (1.1)	87251	
Positive diagnosis (percent)	17988 (92.9)	1369 (7.1)	19357	
Total (percent)	104249(97.8)	2359 (2.2)	106608	< .001

Depression				Suicidal ideation
	not present	present	total	p- value
Not diagnosed (percent)	95550 (98.8)	1118 (1.2)	96668	

Positive diagnosis (percent)	8699 (87.5)	1241 (12.5)	9940	
Total (percent)	104249 (97.8)	2359 (2.2)	106608	< .001

SUD				Suicidal Ideation
	not present	present	total	p- value
Not diagnosed (percent)	83198 (99.1)	724 (.9)	83922	
Positive diagnosis (percent)	21051 (92.8)	1635 (7.2)	22686	
Total (percent)	104249 (97.8)	2359 (2.2)	106608	< .001

Gender				Suicidal Ideation
	not present	present	total	p- value
Female (percent)	7516 (96.6)	261 (3.4)	7777	
Male (percent)	96733 (97.9)	2098 (2.1)	98831	
Total (percent)	104249 (97.8)	2359 (2.2)	106608	< .001

Rurality				Suicidal Ideation
	not present	present	total	p- value
Urban (percent)	67705 (97.6)	1684 (2.4)	69389	
Rural (percent)	35107 (98.2)	657 (1.8)	35764	
Highly rural (percent)	1437 (98.8)	18 (1.2)	1455	
Total (percent)	104249 (97.8)	2359 (2.2)	106608	< .001

Table 3

Multinomial logistic regression

Variable	OR (95% CI)	p
PTSD diagnosis[a]	1.916 (1.92 – 2.10)	< .001
Depression diagnosis[b]	4.377 (3.99 – 4.81)	< .001
Substance Abuse/Substance Use Disorder (SUD) diagnosis[c]	2.939 (2.66 – 3.25)	< .001
Age	.969 (.966 - .972)	< .001
Emergency Department Use		
No recorded visits[d]	.632 (.571 - .700)	< .001
Primary Care Use[e]		
Minimal use	.170 (.137 - .211)	< .001
Moderately low use	.292 (.247 - .345)	< .001
Moderate use	.458 (.404 - .521)	< .001
Moderately high use	.490 (.436 - .550)	< .001
Rurality[f]		
Urban	1.892 (1.17 – 3.08)	.010
Rural	1.421 (.871 – 2.32)	.159
Gender[g]	.674 (.585 – .777)	< .001

Reference categories: [a] "No PTSD diagnosis"; [b] "No depression diagnosis"; [c] "No substance abuse/substance use disorder diagnosis"; [d] "1 or more emergency department visits"; [e] "High use"; [f] "highly rural"; [g] "male"

Manuscript 3

Use of Medical Care and Suicide Risk Among Veterans

Wyatt Meriwether

Outlet for Manuscript

No outlet was identified for this manuscript at the time of submission.

Abstract

Since 2001 an increase in validated veteran suicides has rallied researchers and clinical professionals. Although socioeconomic demographics, gender, psychiatric diagnoses, and environmental factors have been studied in relation to veteran suicide, a congruent conclusion regarding environmental factors has not been confirmed. Additional research is required to evaluate how suicide risk correlates to a veteran's use of medical care services within the Veterans Health Administration (VHA). This study focused on environmental variables and their relationship with suicide risk. Patient records of 106,608 veterans who a) had at least one primary care or emergency department visit, and b) had an identified geographic residence designation within the previous ten years were analyzed. The results indicate a lower odds ratio ($p < .05$, OR = .154 - .656) at levels of minimal primary care usage where a risk of suicide was identified. Results validate a positive association between PTSD ($p < .05$, OR = 1.407) and substance abuse ($p < .05$, OR = 1.510), and suicide risk. Results of the associations between suicide risk and residence, depression, gender, and emergency department use were not statistically significant. The potential social significance is discussed in relation to the statistical results.

Introduction

Since 2011, suicide has been the second leading cause of death among military personnel (Bryan et al., 2015). Gibbons, Brown, and Hur (2012) found that the relative risk for military personnel and veterans ages 17 to 24 was 3.84 times greater than in the general population. As of 2016, the Department of Veterans Affairs Office of Mental Health and Suicide Prevention (OMHSP) reported that the suicide rate (adjusted for age and gender) of veterans reached 30.5 per 100,000 in comparison to the rate for non-veteran adults, which was 16.4 per 100,000 (OMHSP, 2018). Also, the suicide rate of veterans ages 18-34 reached 45 per 100,000 (OMHSP, 2018). The high risk of suicide mortality in the veteran population has also been confirmed by the public health research (Weiner, Richmond, Conigliaro, & Wiebe, 2011; Kang et al., 2015).

Factors associated with suicide include a variety of psychiatric diagnoses, comorbidities, and sociodemographic influences (LeardMann et al., 2013). Associated factors with veteran suicidality do not differ from those in the general population specific attributes related to veteran suicidality have been identified. Significant correlates to veteran suicidality include gender, diagnoses of major-depressive/manic-depressive disorders, alcohol and substance use disorder, and post-traumatic stress Disorder (LeardMann et al., 2013; Weiner et al., 2011). The only notable difference between veteran suicidality and that of the general population is the association with PTSD (Weiner et al., 2011).

Furthermore, researchers have shown that up to two-thirds of all suicides are completed by individuals diagnosed with a mood disorder (Isometsä, 2014). More specifically, the risk for completing suicide may be higher for those individuals diagnosed with major depressive disorder (Fisher, Overholser, Ridley, Braden, & Rosoff, 2015; Isometsä, 2014). However, Khazem and Anestis (2016) found that there was no significant difference in depression between individuals exhibiting suicidal ideation versus suicidal behavior. Also, many individuals who complete suicide do not have any previous attempts (Isometsä & Lönnqvist, 1998). These findings are evidence of the complexity of suicide and justify the need to study environmental factors. Deficiencies in care at key emergency and preventative care access points may contribute to veteran suicide (Hoge & Castro, 2012). Denneson et al., 2016) found that some veterans have continued to complete suicide even after receiving care at a Veterans Health Administration facility.

Researchers have identified a potential need for expanded suicide screening in a primary care setting (Lish et al., 1996). Also, researchers have evaluated the relationship between usage of VHA services and suicide mortality (Blow et al., 2012). Veterans enrolled and utilizing VHA services were found to have a higher suicide mortality than the general population (Blow et al., 2012). In addition, the types and frequency of health care contacts have been studied before completed suicide. Luoma, Martin, and Pearson (2002) analyzed primary care usage prior to completed suicide and found differences by gender and age. Specifically, they found that older adults and women had a higher

contact rate with a primary care provider than with a mental health provider in the year prior to suicide (Luoma et al., 2002). In the year prior to suicide approximately 77% of all older adults were in contact with a primary care provider, and 100% of women were in contact with a primary care provider (Luoma et al., 2002). Ahmedani et al. (2014) also discovered that women and older veterans had a higher contact rate (VHA visit) within the year prior to suicide. Also, three-fifths of the individuals had at least one primary care or medical specialty visit without a mental health diagnosis (Ahmedani et al., 2014).

Residence is a secondary environmental factor that has received minimal attention as it relates to veteran suicide within the VHA. The relationship between access to medical care in relation to residence type (urban versus rural) and suicidality must also be addressed. In previous studies, researchers have found that rural residence was correlated with suicide in the veteran population (McCarthy et al., 2012). However, research in this area is minimal. Therefore, a gap exists in understanding the relationship between aspects of veteran access to health care (primary care use, emergency care use, and rurality), and suicide risk.

Previous researchers have shown the difficulty in defining and establishing a baseline protocol for identifying levels of suicide risk. However, identification of suicide risk as a history of self-harm has been studied and validated. Although self-harm should not be explicitly studied as the only indicator of an imminent suicide, previous research has shown the importance of focusing on self-harm within populations. For example, Hawton et al. (2015) concluded that suicide risk following episodes of self-harm may be

underestimated. Furthermore, Cheung et al. (2017) concluded that a history of self-harm could be a significant risk factor for suicide in older populations (65-96 years of age). The results and discussion were intended to better understand the association between veterans' use of medical services in the VHA, their type of residence (urban, rural, highly rural), and suicidal risk.

Methods

The Veterans Informatics and Computing Infrastructure (VINCI) is the internal VHA organization that links researchers with data available within the infrastructure of the electronic medical record (HSR&D, n.d.). I queried databases, within the VINCI environment using structured query language protocol for applicable clinic stop coding and ICD-9 diagnoses coding.

Research question

What is the relationship between utilization of medical care and suicide risk in the veteran population, controlling for rurality, gender, age, and mental health diagnoses associated with suicide risk (PTSD, major depressive disorder, and substance disorders)?

Variables and study procedures

I completed the evaluation of suicide risk and veterans' medical care environment by identifying 106,608 veterans who (a) had a residence designation (urban/rural/highly rural), and (b) were seen by a primary care provider or within the emergency department of any VHA medical facility within the previous 10-years (2008-2018). Prior to data collection, I conducted an *a priori* power analysis using *G*Power*. The following were

assumed: two-tailed, alpha of 0.05, power of 0.80 and 0.95, and effect (odds ratio) of 1.12. This odds ratio is smaller than the odds ratios in previously conducted examples of associations between suicide risk factors and suicidality (Kaplan et al., 2012). The sample size required, depending on power (0.80-0.95), was calculated as at least 3828 participants. I also completed a post hoc power analysis using *G*Power*. Using the final odds ratios, alpha of 0.05 and the total sample size of 106,608 the power output equaled 1.0 (100%).

I used clinic stop codes associated with primary care provider primary visits and any emergency department visit, for which a discharge or admission occurred. These codes include primary code and all associated secondary codes of 323: Primary Care Visit, and primary code and all associated secondary codes of 102: Emergency Department Visit. Queries capturing primary care visits and use of emergency care resulted in the number of times within the 10-year period the veteran received treatment in a clinic coded with the respective Decision Support System (DSS) stop code. Emergency use was recoded as a binary variable (No visits/one or more visits). Primary care visits were divided into quintiles. Diagnoses potentially associated with increased suicide risk were correlated to the patient records using International Statistical Classification of Diseases and Related Health Problems Version 9 (ICD-9) codes. These codes included: 296.3: Depression, 309.81: PTSD, and 300.X: Substance Abuse. The ICD-9 code used to capture instances of suicidal risk is E98X: Unknown Self Harm. The queries resulted in the number of times within the 10-year period the ICD-9 diagnosis

code was recorded. I then recoded these variables as binary variables (diagnosis present/diagnosis not present). Although at the time of this study ICD-10 codes had been nationally implemented across the VHA, uniform usage could not be guaranteed, nor could it be queried prior to 2017. Therefore, I did not use ICD-10 codes for this study.

I used structured query language to develop schema and query results from the Corporate Data Warehouse (CDW) working database. This database is the primary repository for all data associated with the electronic medical records, including clinic stop codes, ICD-9/ICD-10 codes, and Planning Systems Support Group (PSSG) codes.

I used chi-square and multinomial logistic regression analyses using the Statistical Package for the Social Sciences (SPSS) to ascertain if an association existed between suicide risk and the independent variables. Descriptive statistics were also completed for all variables (see Tables 1 and 2).

Results

Table 1 shows frequencies by ordinal level for primary care visits and emergency department visits. The sample population consisted of 770 veterans (0.7%) who exhibited unknown self-harm within the 10-year period (2008-2018). Also, 11,790 (11.06%) veterans received emergency care during the 10-year period. I performed a chi-square test of independence to examine the relation between suicidal behavior and the use of primary care and emergency services. The relation between the variables was significant, X^2 (4, N = 106,608) = 356.291, p <.01 and X^2 (1, N = 106,608) = 52.899, p <.01, respectively.

Results of the multinomial logistic regression showed a statistically significant association between unknown self-harm and primary care use, PTSD, and substance abuse. These results indicated that PTSD ($p < .001$, OR = 1.407) and substance abuse ($p < .001$, OR = 1.510) are independently and significantly associated with unknown self-harm (suicide risk; Table 3). The reference level was the absence of these mental health diagnoses.

Multinomial logistic regression results pertaining to primary care visits ($p < .001$, OR = .154 - .656) indicated a negative association (at all levels in comparison to the reference level) with unknown self-harm being present (Table 3).

Discussion

The results of the regression and chi-square analyses appear to support the conclusion that the adjusted odds of unknown self-harm is lower at the bottommost level of primary care usage, and the opposite is true at the highest level of primary care use This could indicate that veterans may be utilizing medical services at a higher rate (> 13 visits/year) as they are more prone to self-harm. A possible conclusion is that frequent use of primary care may be interpreted as a veteran's attempt to reach out for help, regardless of diagnoses or perceived need to be seen by a medical provider. Researchers have recently concluded that social isolation (objective or subjective) is associated with aspects of suicidality (Calati et al., 2018). One possible interpretation of the study results is that veterans at a higher risk may attempt to replace levels of the SEM with use of VHA services (subjective isolation). However, my study design does limit any ability to

ascertain if veterans using VHA services at a higher frequency are also dealing with chronic physical illness necessitating more frequent primary care visits. Regardless, it is possible that veterans use VHA services to replace social involvement and reduce their subjective isolation to cope with thoughts or feelings leading to self-harm. Therefore, it may be beneficial to include frequency of primary care and emergency care services in the development of future algorithms for suicide prevention in the VHA.

Some additional limitations to the research should be noted. First, the research is limited by the interpretation and coding of clinical professionals for psychiatric diagnosis, and the subjective identification of unknown self-harm. The coding of the ICD-9 code for self-harm is subjective and may result in over or underrepresentation. Additionally, the research is limited by the possible lack of standardization of DSS stop codes for clinical designation. Also, the clinical efficacy of the visits is unknown, and therefore could be a contributing factor to veterans' increased care utilization. Finally, the data incorporate only those visits and diagnostics within the VHA; utilization occurring outside the VHA is unknown.

Although there are limitations to the data, the implications for future research are evident. The statistical results supported the conclusions of previous researchers that have shown associations between PTSD and substance use with suicide (Ashrafioun et al., 2012). Veterans' frequent use of primary care services and unknown self-harm requires future research to assess this relationship in detail. Regardless, the findings may have social impact by potentially influencing future policy to implement early

identification of suicidal intent through the monitoring of veterans' use of medical care at primary access points within the Veterans Health Administration.

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Tables

Table 1

All Frequencies

Primary Care Use Frequency		
Minimal use (percent)		22257 (20.9)
Moderately low use (percent)		20309 (19.1)
Moderate use (percent)		21720 (20.4)
Moderately high use (percent)		20989 (19.7)
High use (percent)		21333 (20)
Emergency Department Visits Frequency		
None (percent)		94632 (88.8)
One or more visits (percent)		11976 (11.2)
Rurality Frequencies		
Urban (percent)		69389 (65.1)
Rural (percent)		35764 (33.5)
Highly rural (percent)		1455 (1.4)
Gender Frequencies		
Male		98831 (92.7)
Female		7777 (7.3)
ICD-9 Variable Frequencies	**Not present**	**Present**
Suicidal risk (percent)	105838 (99.3)	770 (.7)
PTSD (percent)	87251 (81.8)	19357 (18.2)
Depression (percent)	96668 (90.7)	9940 (9.3)
Substance abuse (percent)	83922 (78.7)	22686 (21.3)

Table 2

Crosstabs

Primary Care Visits				Suicide Risk
	not present	present	total	p- value
Minimal use (percent)	22215 (99.8)	42 (0.2)	22257	
Moderately low use (percent)	20238 (99.7)	71 (0.3)	20309	
Moderate use (percent)	21589 (99.4)	131 (0.6)	21720	
Moderately high use (percent)	20798 (99.1)	191 (0.9)	20989	
High use (percent)	20998 (98.4)	335 (1.6)	21333	
Total (percent)	105838 (99.3)	770 (0.7)	106608	< .001

Emergency department visits				Suicide Risk
	not present	present	total	p- value
None (percent)	94012 (99.3)	620 (0.7)	94632	
1 or more visits (percent)	11826 (98.7)	150 (1.3)	11976	
Total (percent)	105838 (99.3)	770 (0.7)	106608	< .001

PTSD				Suicide Risk
	not present	present	total	p- value
Not diagnosed (percent)	86749 (99.4)	502 (0.6)	87251	
Positive diagnosis (percent)	19089 (98.6)	268 (1.4)	19357	
Total (percent)	105838 (99.3)	770 (0.7)	106608	< .001

Depression				Suicide Risk
	not present	present	total	p- value
Not diagnosed (percent)	96042 (99.4)	626 (0.6)	96668	

Positive diagnosis (percent)	9796 (98.6)	144 (1.4)	9940	
Total (percent)	105838 (99.3)	770 (0.7)	106608	< .001

SUD				Suicide Risk
	not present	present	total	p- value
Not diagnosed (percent)	83463 (99.5)	459 (0.5)	83922	
Positive diagnosis (percent)	22375 (98.6)	311 (1.4)	22686	
Total (percent)	105838 (99.3)	770 (0.7)	106608	< .001

Gender				Suicide Risk
	not present	present	total	p- value
Female (percent)	7706 (99.1)	71 (0.9)	7777	
Male (percent)	98132 (99.3)	699 (0.7)	98831	
Total (percent)	105838 (99.3)	770 (0.7)	106608	.039

Rurality				Suicide Risk
	not present	present	total	p- value
Urban (percent)	68889 (99.3)	500 (0.7)	69389	
Rural (percent)	35501 (99.3)	263 (0.7)	35764	
Highly rural (percent)	1448 (99.5)	7 (0.5)	1455	
Total (percent)	105838 (99.3)	770 (0.7)	106608	.530

Table 3

Multinomial logistic regression

Variable	OR (95% CI)	p
PTSD diagnosis[a]	1.407 (1.41 – 1.66)	< .001
Depression diagnosis[b]	1.115 (0.91 – 1.36)	.287
Substance Abuse/Substance Use Disorder (SUD) diagnosis[c]	1.510 (1.28 – 1.78)	< .001
Age	.996 (.991 – 1.00)	.090
Emergency Department Use		
No recorded visits[d]	.847 (.704 – 1.02)	.079
Primary Care Use[e]		
Minimal use	.154 (.110 - .216)	< .001
Moderately low use	.275 (.211 - .360)	< .001
Moderate use	.449 (.364 - .554)	< .001
Moderately high use	.646 (.538 - .775)	< .001
Rurality[f]		
Urban	1.566 (.740 – 3.31)	.241
Rural	1.539 (.724 – 3.27)	.262
Gender[g]	1.088 (.843 – 1.40)	.516

Reference categories: [a] "No PTSD diagnosis"; [b] "No depression diagnosis"; [c] "No substance abuse/substance use disorder diagnosis"; [d] "1 or more emergency department visits"; [e] "High use"; [f] "highly rural"; [g] "male"

Part 3: Summary

Integration of the Studies

The three dependent variables I studied—suicidal behavior, suicidal ideation, and suicide risk—are naturally related. However, the ideation-to-action framework describes suicidal ideation and attempt as "distinct phenomena with distinct explanations and predictors" (Klonsky, May, & Saffer, 2016). Clearly, this framework and similar contexts describe these facets of suicidality from a behavioral standpoint. Current research focusing on correlative factors with increased suicidality in similar populations continues to focus on behavior phenomena theorized by professionals in the psychiatric and psychological fields (Boffa et al., 2017). With deference to these frameworks, my intention in this study was to provide suicidologists with a social-ecological systems view of suicide. Social epidemiology requires that researchers do not become fixated on proximate associated factors related to health outcomes and that they ensure a larger systems perspective is taken to understand population health determinants (McMichael, 1999). In this regard the study can be considered a successful venture.

As I previously addressed, the three facets of suicidality are directly related to the community level of the SEM. A potential conclusion is that increased medical care utilization is an indication of veterans seeking additional contact within their known community. Using the SEM, I have described the veteran sub-population's associations between key facets of suicidality and medical care utilization. Theoretically, the veteran sub-population potentially overuses easily accessible VHA medical services when

exhibiting suicidal behavior, ideation, or unidentified self-harm. Due to accessibility, the veterans experiencing any of the three facets of suicidality may be compensating for objective or subjective isolation (Calati et al., 2018) Although I have identified several limitations to the study's methodology including the inability to identify the efficacy of each medical care visit, it is possible that researchers will continue to find these associations in subsequent population research and could use them to develop a more detailed population model for understanding and describing suicidality among veterans. Also, I previously noted that the chronic illnesses of the sample population are unknown and may necessitate the need to be seen by a primary care physician at a higher frequency. However, the mean number of primary care visits per veteran per year was 5.113. Fourteen visits or more (highest quintile) is approximately one standard deviation from the mean. This fact should be considered when considering the associated limitations. Additionally, these variables and their individual studies show a more complete and logical view of suicidality.

To summarize, I found a positive association between higher levels of primary care use and emergency care use in relation to suicidal behavior and ideation. Although the same was found in relation to primary care use and suicide risk, higher emergency department use was not found to be positively associated with suicide risk. It should also be noted that the associated risk factors (depression, PTSD, substance use, gender, and age) were generally found to be significantly associated with each facet of suicidality,

and thus reinforced findings in previous public health research and research in related fields.

I found urban residence to be positively associated with suicidal behavior and ideation. Previous researchers have shown that rural residence is a suicide risk factor (McCarthy et al., 2012). However, the results of this study may provide a different perspective. Although McCarthy et al., (2012) utilized the same measurement (zip code classification) for rurality, both studies did not appropriately account for homelessness. Although rurality was identified, homelessness was not a factor and is a major limitation of both studies. Therefore, subsequent research studies should continue this evaluation, but ensure homelessness is identified in relation to rurality designation. Furthermore, homelessness has been reinforced as a suicide risk factor in the veteran population and should be evaluated as a key associated factor in future studies (Tsai, Jack, & Xing Cao, 2019). An increase in medical care utilization could also be related to individual homelessness and could be directly related to an urban rurality.

The results of the study may impact social change in two ways. First, future research building upon the use of medical care services as a predictive factor of suicide could lead to more comprehensive suicide theory in the veteran population and in the general population. Second, these results could lead to future research breakthroughs that compel VHA policymakers to reassess and include frequency of medical care use within prevention algorithms.

Conclusion

Overutilization of medical care is a potential associated factor of suicidality among the veteran population. Further research is required to ascertain the extent of that association. Medical care utilization should be measured in such a way to assess the efficacy of the visit when potential overuse of the service is a possible risk factor. Also, other correlated risk factors should have been included. Homelessness, spectrum gender identity, household income, and race/ethnicity are key variables that could have made the study more robust and increased generalizability.

Although urban residence was found to be a potential associated risk factor, this metric should be analyzed controlling for homelessness, household income, and race/ethnicity to assess the true relevance of its association with suicidality. Researchers may find that residence is a key risk factor of suicidal behavior, ideation, and risk, but further research is required to describe that relationship.

The SEM is a strong framework on which to base future subpopulation models related to residence and medical care utilization. Proximate risk factors can be described at lower levels of the SEM, while prevalent population risk factors can be described by the community and societal levels of the model. Therefore, the use of this model in future veteran subpopulation study of medical care use, residency, and other aspects of social relationships should continue in earnest.

Researchers must continue to develop models for prevention within the veteran population. However, research and development of prevention strategies must include

interdisciplinary work that can describe the impact of factors related to suicide from a systems approach. This study and future interdisciplinary research on veteran suicidality could potentially influence development of robust prevention strategies and assist in positive policy decisions.

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