MISCONDUCT-RELATED DISCHARGE FROM ACTIVE DUTY MILITARY

SERVICE: AN EXAMINATION OF PRECIPITATING FACTORS AND

POST-DEPLOYMENT HEALTH OUTCOMES

by

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ABSTRACT

Misconduct-Related Discharge from Active Duty Military Service: An Examination

of Precipitating Factors and Post-Deployment Health Outcomes

by

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U.S. military service members who are discharged from service for misconduct

have higher risk for mental health and substance use disorders, homelessness, mortality,

and incarceration than those discharged under routine conditions. The purpose of this

dissertation was to investigate the pre- and post-discharge experiences and characteristics

of this highly vulnerable population in order to inform improved prevention and

intervention strategies.

Administrative data from the Department of Defense and Veterans Health

Administration (VHA) for veterans of recent conflicts were used to conduct three related

retrospective cohort studies. These included (1) evaluation of demographic and military

service characteristics and service-connected disabilities associated with discharge for

misconduct; (2) examination of post-discharge health status and healthcare utilization

among misconduct-discharged veterans; and (3) development of predictive models for

homelessness and mortality among misconduct-discharged veterans.

Several demographic and military service characteristics were associated with increased risk for misconduct discharge, including Black and American Indian/Alaska Native relative to White race/ethnicity, younger age, and educational attainment lower than a high school diploma. Following discharge, veterans discharged for misconduct were more likely to screen positive for military sexual trauma (MST), and more likely to receive a service-connected disability designation related to mental illness. Misconduct-discharged veterans had higher post-discharge healthcare needs than routinely discharged veterans, including higher rates of all mental health conditions, and several chronic physical health conditions. They also used VHA clinical services and incurred costs at approximately double the rate of routinely discharged veterans. Several risk factors for homelessness and mortality were identified. Specialty clinical services usage, exposure to combat, and a positive or declined MST screen were associated with increased risk for both outcomes. Risk stratification models showed good predictive accuracy for homelessness, and fair predictive accuracy for mortality.

Targeted counter-attrition strategies and an increased focus on health-related determinants of misconduct, including rehabilitative approaches to behavioral problems, may help to reduce misconduct-related attrition. Efforts to transition post-discharge care from specialty settings to integrated primary care settings may be successful in mitigating adverse outcomes. Risk stratification techniques can facilitate the efficient targeting of VHA resources.

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PUBLIC ABSTRACT

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Emily Brignone

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Several demographic and military service characteristics were associated with
increased risk for misconduct discharge, as were exposure to sexual trauma, and post-
discharge designation of service-connected disabilities related to mental illness.
Misconduct-discharged veterans were found to have significant and complex healthcare

needs, and used clinical services at approximately double the rate of routinely discharged veterans. Several risk factors for homelessness and mortality among this population were identified. Risk stratification models showed good predictive accuracy for homelessness, and fair predictive accuracy for mortality.

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<div align="right">Emily Brignone</div>

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CHAPTER 1

INTRODUCTION

Discharge from military service for reasons related to misconduct is associated with a multitude of serious negative post-deployment outcomes, including mental health and substance use disorders,[1] homelessness,[2] suicide,[3] and incarceration.[4] These outcomes carry an enormous financial and human cost, and their mitigation is of great public health interest.[5-9] The scope of this problem is not trivial, as over 30,000 active duty service members deployed between 2001 and 2012 were discharged from military service for misconduct.[10]

In order to appropriately prevent and intervene on poor outcomes among this vulnerable subpopulation of veterans, an understanding of both the circumstances leading up to a misconduct discharge, and the pathway from a misconduct discharge to adverse post-deployment outcomes is necessary. Unfortunately, there are currently several important gaps in the literature regarding the pre- and post-discharge characteristics and experiences of misconduct-discharged veterans. First, while preliminary research indicates that military service members who go on to be discharged for misconduct have higher rates of in-service mental health diagnoses as compared to those who go on to routine discharges,[11-13] it is unclear whether these vulnerabilities are linked to military service experiences and exposures (ie, combat exposure, service-connected disability, and military sexual trauma). This is an important consideration, as failure to identify and appropriately treat service-connected impairments would likely contribute to inappropriate discharge classification and poor post-discharge outcomes. In addition to

potential vulnerabilities associated with service experiences, mental health disorders, and TBI, several studies indicate that misconduct discharge may be associated with certain demographic characteristics, including race/ethnicity and age.[1,11,12] More detailed information regarding demographic disparities in misconduct discharge may be useful in designing targeted counter-attrition programs. Next, aside from the recent identification of higher rates of certain mental health and substance use disorders among this subgroup of veterans,[1] no research has described the unique health status or healthcare utilization of misconduct-discharged veterans. An understanding of these characteristics is necessary to assess treatment needs and potential points of intervention. Last, while extant research demonstrates that misconduct discharged veterans have much higher rates of adverse post-deployment outcomes as compared to routinely discharged veterans,[1-4] we know little about how various demographic, military service, and health characteristics relate to these outcomes among this population, and we are unable to effectively discriminate between misconduct-discharged veterans at relatively low risk for serious outcomes versus those at high risk. Without these insights, we are limited both in our ability to develop strategies that appropriately target risk and protective factors, and to identify and provide preventive services to those veterans at greatest risk for negative outcomes.

One way to begin to understand the complex interplay among these issues is through the *Integrated Model of the Consequences of Post-Combat Mental Health and Cognitive Conditions* introduced in the 2010 *Invisible Wounds of War* report prepared by RAND.[14] This framework incorporates aspects of the diathesis-stress model and the life-span development perspective. Under this framework, the consequences of mental health

and cognitive conditions related to military experiences are described as a cascade of

negative outcomes, that in the absence of intervention, accumulate and affect a broad

range of domains over the life span of the Veteran. One implication of this perspective is

that early interventions that prevent or mitigate the short-term consequences of mental

health and cognitive conditions will also provide significant long-term benefits by

disrupting the paths toward emergent outcomes. While not an explicit consideration in

the original framework, misconduct discharge appears to be strongly associated with

several important components of the framework, including in-service mental health

disorders that may stem from military experiences, immediate post-discharge

consequences such as mental health comorbidities and drug use, and adverse emergent

outcomes such as homelessness, suicide, and incarceration. Therefore, this framework

could be expanded to include discharge type as an important intermediary between

military experiences and both immediate consequences and emergent outcomes in order

to more fully account for the dynamics among these factors (see Figure 1.1).

Figure 1.1. Proposed Theoretical Framework for the Role of Misconduct Discharge in
Pre- and Post-Discharge Outcomes
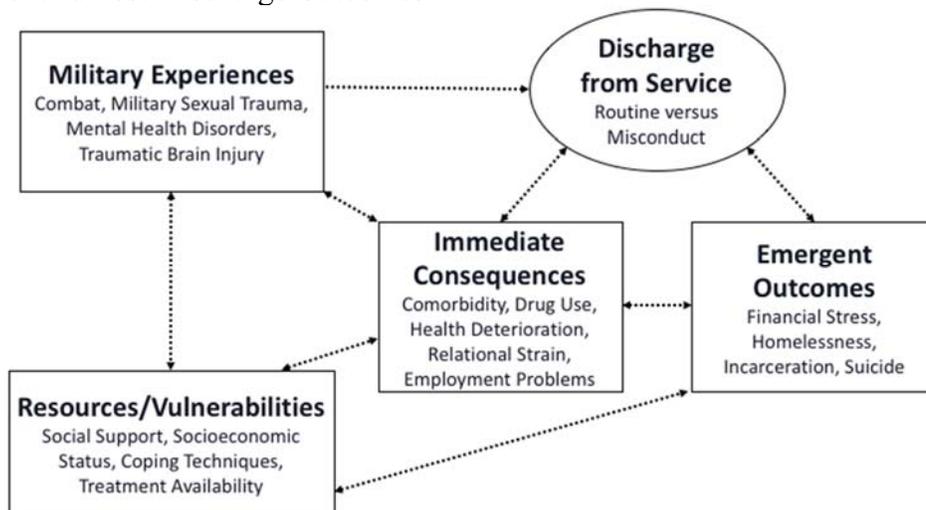
An examination of the role of misconduct discharge in these pathways will elucidate factors that precipitate and contribute to misconduct discharge, treatment needs before and after discharge, and resources and vulnerabilities related to the development of emergent outcomes. These insights will greatly enhance our ability to develop prevention, treatment, and case management strategies tailored to the unique needs of these military service members and veterans. Ultimately, as a long-term goal of this research, the development of these strategies can be expected to result in improved health and social outcomes among veterans and military service members who have experienced or are at risk for a misconduct discharge.

Literature Review

In order to maximize generalizability to modern era service members and veterans, this literature review focuses on peer-reviewed articles and government publications about misconduct-related discharge from the military during the Gulf War and Operations Iraqi Freedom, Enduring Freedom and New Dawn (OEF/OIF). The literature review is patterned after the theoretical framework, with a separate discussion of research related to the role of misconduct discharge in 3 major components of the model. To begin, the results of research studies related to the associations between misconduct and demographic characteristics and pre-discharge experiences such as military service exposures and in-service mental health conditions are examined. Next, studies related to the immediate outcomes associated with misconduct discharge are reviewed, including health disparities and healthcare utilization. Then, studies related to

emergent outcomes such as homelessness, incarceration, and suicide are discussed. Finally, directions for future research are discussed, along with a brief description of the proposed studies.

**Pre-Discharge Characteristics and Experiences
of Misconduct-Discharged Veterans**

To date, six studies have empirically examined risk factors for misconduct discharge among recent-era veterans. Of these, only one offers any insight into the role of military specific experiences. In a study of risk factors for misconduct discharge among 77,998 deployed Marines, Highfill-McRoy et al. reported effects separately for Marines whose deployments were to a war zone versus those deployed to non-war zones.[12] Results from this study indicated that while most risk factors were similar between the two groups, among war-deployed Marines, PTSD diagnosis was a strong risk factor for punitive discharge, with a hazard ratio of 11.1, while it was not a significant risk factor among non-war-deployed Marines. Such a striking finding suggests the need to directly evaluate the role of military service experiences alone and in interaction with mental health diagnoses.

While there is little evidence directly linking military service experiences to misconduct discharge, several studies have described an association between mental health disorders and traumatic brain injury (TBI) and misconduct. Veterans discharged for misconduct experience higher rates of in-service mental health disorders[11-13] and TBI[15] relative to those discharged under routine conditions. In a study that examined risk factors for misconduct discharge among 20,746 combat-deployed Marines, Booth-

Kewley and colleagues reported that those with a post-combat psychiatric diagnosis had a risk for misconduct discharge that was 9.0 times higher than risk among those with no post-combat psychiatric diagnosis—far and away the strongest risk factor uncovered in the study.[11] Results from a subsequent study by the same authors revealed that compared to deployed Marines with no psychiatric diagnosis, the risk for a drug-related discharge was 5.2-5.7 times higher among those with a non-PTSD psychiatric diagnosis, and 5.7-8.6 times higher among those with a PTSD diagnosis. The risk for non-drug-related punitive discharge was again 5.2-5.6 times higher among those with a non-PTSD psychiatric diagnosis relative to those with no psychiatric diagnosis, and 11.1 times higher among those with a PTSD diagnosis who were war-deployed.[12] Similarly, Hoge et al. reported that among 13,971 Army-enlisted soldiers with in-service hospitalizations, those who were hospitalized for a mental disorder were at 9.0 times higher risk for discharge from service for misconduct relative to those hospitalized for other reasons.[13] Last, a large-scale study of 1,879,724 Gulf War era service members by Ommaya and colleagues indicated that service members who were treated for TBI had odds for misconduct-related discharge that were 1.8 - 5.4 times higher than service members not treated for TBI.[15]

Discharge for reasons related to misconduct is based on the presumption that the negative behavior was willful in nature.[16,17] However, it is widely recognized that certain military experiences increase the risk for mental health conditions and TBI, and consequently, for behavioral problems that often overlap with misconduct, including impulsivity, drug use, and aggressive behavior.[18-22] Given these linkages, associations

between mental health disorders and TBI and misconduct discharge suggest that many cases of so called "willful misconduct" may in fact be the manifestation of secondary symptoms of mental health disorders or TBI that may be service-connected.

In addition to the role of health-related vulnerabilities, results from several studies indicate that demographic characteristics, including race/ethnicity and age, are related to risk for misconduct discharge.[1,11,12] In a recent study that used a large national sample of veterans to compare across several classifications of discharge, Brignone et al. reported that while veterans of Black race/ethnicity comprised 8% of those with a routine discharge, they made up 16% of those with a misconduct-discharge. However, adjusted risks for race/ethnicity were not reported in this study. Two studies that did report adjusted risks for race/ethnicity both found higher risk for misconduct-related outcomes among Black service members. Booth-Kewley et al. reported that in a sample of 20,746 male Marines, Black race/ethnicity was associated with 2.0 times higher risk for bad conduct discharge.[11] Highfill-McRoy et al. reported that for a separate sample of 77,881 Marines, black race/ethnicity was associated with 1.7 times higher risk for drug-related discharge and 2.5 times higher risk for non-drug related punitive discharge.[12]

Results from these same three studies also indicate that younger service members may be at higher risk for misconduct discharge. Brignone and colleagues reported that at the time of their first post-discharge VHA encounter, veterans who were discharged for misconduct were on average 5 years younger than those with a routine discharge.[1] Results from the remaining two studies had mixed findings regarding the adjusted effect of age. Booth-Kewley et al. reported that compared to service members over the age of

19, those who were 19 or younger at the time of their first deployment had at least double the risk for misconduct discharge.[11] Rather than measuring the effects of age at first deployment, Highfill-McRoy reported effects for age at accession, and found that relative to service members who were 19 or older at the time of accession, those who were younger than 19 had similar risk for drug-related discharge, and only 40% higher risk for non-drug related punitive discharge.

Information regarding these and other demographic variations in misconduct discharge are important to follow-up on, as they may highlight areas of vulnerability and inform the development of targeted counter-attrition programs. Specifically, the reduction of disparities in misconduct discharge by race/ethnicity would help to improve the retention and promotion of minorities in military service, which the Department of Defense currently is actively invested in.[23]

Studies to date have several important limitations in terms of their sampling, and the variables included. Both studies conducted by Booth-Kewley and colleagues relied on samples comprised of deployed Marines only,[11,12] and did not make direct comparisons across the war-deployed and non-war-deployed groups. This precludes examination of the effect of important military experiences such as exposure to combat, and findings may not be generalizable to military service members from other branches of service. The sample used by Hoge et al. is similarly limited to Army-enlisted soldiers with in-service hospitalizations, and did not report any information relating to military service experiences.[13] Last, while Ommaya and colleagues used a comprehensive sample of military service members to evaluate the association between TBI and discharge, they did

not report information relating to military service experiences, and their sample is over 20 years old. Given recent improvements in the detection and treatment of TBI, these findings may not reflect the current state of this association.[15]

In order to further our understanding of the associations between demographic characteristics, military service experiences, and misconduct discharge, future research should include a comprehensive sample of OEF/OIF service members from all branches of service and a broader set of indicators for military service experiences. Further, given that service-connected determinants of misconduct are not always appropriately identified during military service, research is needed that focuses on indicators in the longer-term to allow for the identification of service-connected conditions that manifest following discharge from military service. Such extensions to the findings of existing research will clarify the elements included on the pathway to misconduct-related discharges, and offer insights regarding prevention efforts among service members whose military experiences put them at risk, as well as potentially informing the administration of misconduct discharge.

Post-Discharge Health Status and Health Utilization
of Misconduct-Discharged Veterans

To date, only one study has examined the post-discharge health status of misconduct-discharged veterans. A study by Brignone et al. used administrative data to assess the risk for several mental health and substance use diagnoses among 443,360 veterans of active duty service in their initial year of VHA utilization following separation from the military.[1] Compared to veterans with routine separations, veterans

who were discharged due to misconduct had significantly higher odds for every diagnostic outcome measured, including 3.6 times higher odds for bipolar disorder, 4.4 times higher odds for suicidal behavior and ideation, 4.1 times higher odds for personality and psychotic disorders, and 6.9 times higher odds for alcohol and substance use disorders. While these results provide compelling support for a significant divide between misconduct and routinely discharged veterans with regard to post-discharge health status, there are many important unanswered questions concerning the health status of misconduct-discharged veterans. Because the follow-up period for the study only included the first year of VHA use, the nature of this relationship in the longer term is currently unknown. Further, no study has examined physical health comorbidities among this population. Several of the mental health and substance use diagnoses for which misconduct-discharged veterans are at greatly elevated risk are in turn associated with physical illness and premature mortality.[24,25] Thus, the importance of investigations into both long-term mental and physical health outcomes takes on added significance in light of these findings.

Completely missing from the literature is any examination of healthcare characteristics (ie, the relative frequency, types, and costs of health service utilization) of misconduct-discharged veterans. This represents an important gap for several reasons. First, while clinical diagnoses offer an indication of symptomology, they only convey one part of the larger picture of health needs. Clinical diagnoses are assigned at provider discretion and are subject to nonuniformity of recording, while utilization is largely patient-driven. In the case of misconduct-discharged veterans, this is of great importance,

as certain behavioral tendencies (eg, risky behavior, drug use) may result in dramatically different service seeking patterns. Next, an understanding of the types of clinics frequented by misconduct-discharged veterans will highlight treatment needs, as well as potential points of intervention. Additionally, the variability of healthcare costs offers an indication of intensity of care that diagnoses and encounter counts alone do not convey. Last, the examination of costs would directly inform VHA service provision planning by offering precise estimates of frequency and cost of care across various treatment categories.

An understanding the healthcare characteristics of misconduct-discharged veterans is necessary for the development of treatment and case management strategies tailored to their unique needs. Given certain similarities between misconduct-discharged veterans and other vulnerable Veteran populations that tend be heavy users of healthcare (eg, homeless veterans, veterans with severe mental illness), we hypothesize that veterans discharged for misconduct have significantly higher overall utilization and costs compared to their routinely-discharged counterparts, with particularly high utilization of acute services.

Research is needed to address these gaps by evaluating a more comprehensive set of health status indicators over a longer period of follow-up, as well as the frequencies, types, and costs of healthcare utilization. In other vulnerable populations, tailored interventions and case management strategies based on these types of insights have been effective in improving access and continuity of appropriate service use,[26] in several cases resulting in reductions in homelessness, drug and alcohol use, emergency department

visits, and healthcare expenditures.[27-29]

Predicting Risk for Adverse Outcomes Among
Misconduct-Discharged Veterans

Three studies to date have examined the relationship between misconduct

discharge and serious post-discharge outcomes, specifically, homelessness, suicide, and

incarceration.[2-4] All three found misconduct-discharge to be a strong risk factor. In a

national study of 448,290 VHA-utilizing veterans, Gundlapalli and colleagues reported

that the adjusted odds for post-deployment homelessness among veterans who were

discharged for misconduct were 4.7-6.3 times higher than their routinely discharged

counterparts.[2] A retrospective study by Reger et al. indicated that the suicide rate for

veterans with a characterization of service not classified as honorable was more than

double the suicide rate among honorably discharged veterans (45.8 versus 22.4 per

100,000 person-years at risk).[3] Last, a Bureau of Justice Statistics Special Report

indicated that veterans with misconduct-related discharge are overrepresented among

justice-involved veterans, with 38% of incarcerated veterans having a discharge not

characterized as honorable despite this group comprising less than 15% of the overall

Veteran population.[4]

These troubling outcomes underscore the extreme vulnerability of misconduct-

discharged veterans and the need for improved prevention and treatment strategies.

Unfortunately, no research has explored how various demographic, military service, and

health characteristics relate to adverse outcomes among this population, and relatedly,

which veterans among this vulnerable subgroup are at greatest risk for these outcomes

and in need of immediate intervention.

Previous research has demonstrated the utility of administrative clinical data in the prediction of adverse outcomes; recent studies suggest that increased health service utilization among high risk populations is associated with risk for suicide,[30,31] with one study reporting double the rate of encounters per person-year among patients who go on to complete suicide (24.5 versus 12.4). In addition, preliminary results from an ongoing study of predictors of Veteran homelessness indicate that frequency of VHA clinical encounters is among the most important predictors of homelessness.[32]

Given the distinct clinical characteristics of misconduct-discharged veterans, research investigating potentially unique risk or protective factors for adverse outcomes among this population, including models for risk stratification, is warranted. Research in the area would inform the tailoring of resources to meet the unique needs of this population, and the targeting of resources to veterans at critical risk for developing serious adverse outcomes.

Summary

While extant research makes clear the vulnerable status of misconduct-discharged veterans, there are several areas in which our understanding of the factors that contribute to misconduct discharge, and the role of misconduct discharge in post-military health, homelessness, and mortality, could be extended. Further, we have little information on how these associations might vary between male and female veterans, or between veterans with different subtypes of misconduct. These characteristics may be important

details to examine. For example, there are several differences between male and female service members with regard to military service experiences, such as widely disparate rates of military sexual trauma and exposure to combat. In addition, male and female veterans tend have different post-deployment diagnostic profiles. For example, male veterans have higher rates of substance use and PTSD, whereas female veterans have higher rates of depressive disorders.[33,34] In addition, female veterans tend to use primary care and mental health services at higher rates than male veterans.[33] However, it is unknown whether the associations between these factors and misconduct discharge may vary differentially by sex. Similarly, different subtypes of misconduct (eg, drug-related, court-martial, pattern of minor disciplinary infractions, etc.) may have unique associations with military service experiences and post-discharge characteristics and outcomes. Without a better understanding of the pre- and post-discharge characteristics and experiences of misconduct-discharged veterans, including potential differences by sex and misconduct subtype, we are limited in our ability to develop tailored prevention, treatment, and case management strategies based on the unique needs of this vulnerable population, and ultimately, unable to effectively address health disparities and long term negative outcomes such as homelessness and premature mortality.

Included Studies

This dissertation extends our understanding of several components of the theoretical framework by describing the role of military service experiences in misconduct discharge, as well as the associations between misconduct discharge and

immediate consequences, and emergent outcomes through the completion of 3 related studies. The next paragraphs provide a brief overview of each study. Studies 1 through 3 are described in full in Chapters 2, 3, and 4, respectively, and summarized in Chapter 5. Study 1. Demographic, military service, and health-related factors associated with misconduct discharge

This study explores factors associated with misconduct discharge, including demographic and military service characteristics, combat exposure, TBI, military sexual trauma, and service-connected disabilities. Results offer valuable insights regarding potential determinants of misconduct, which may guide prevention efforts among military service members at-risk, and rehabilitative efforts among veterans.

Study 2

Study 2 was titled, "*Post-Deployment Health Status and Healthcare Utilization Among U.S. Veterans Discharged from Service for Misconduct.*" This study examined health status and healthcare utilization of veterans who were discharged from service due to misconduct compared to those who were discharged under routine conditions, including clinical diagnoses, encounter types, frequencies and costs. Results highlight treatment needs, healthcare disparities, potential points of intervention, and opportunities to reduce costs.

Study 3

Study 3 was titled, "*Prediction of Risk for Homelessness and Mortality among Veterans Discharged from Service Due to Misconduct.*" This study identified

demographic, military service, and healthcare characteristics that effectively predict risk

for homelessness and mortality among veterans who were discharged from service due to

misconduct, and includes the development of predictive models for these outcomes

among misconduct-discharged veterans. Results inform for the tailoring of prevention

and intervention strategies, and the targeting of efforts to veterans who are most at risk

for these outcomes.

Collectively, these studies were designed to provide information necessary for the

development of effective prevention, treatment, and case management strategies to better

meet the needs of this vulnerable population, and may also inform improvements to

discharge classification procedures. The development of these strategies would ultimately

result in improved health and social outcomes veterans who have experienced

misconduct discharge, and those who may be at risk for such outcomes.

References

1. Brignone E, Fargo JD, Blais RK, Carter ME, Samore MH, Gundlapalli AV. Non-routine discharge from military service: mental illness, substance use disorders, and suicidality. *Am J Prev Med*. 2017;52(5):557-65.

2. Gundlapalli AV, Fargo JD., Metraux S, et al. Military misconduct and homelessness among us veterans separated from active duty, 2001-2012. *JAMA*. 2015; 314(8), 832-4.

3. Reger MA, Smolenski DJ, Skopp NA, et al. Risk of Suicide Among US Military Service Members Following Operation Enduring Freedom or Operation Iraqi Freedom Deployment and Separation from the US Military. *JAMA Psychiatry*. 2015; 72(6), 561-9. http://doi.org/10.1001/jamapsychiatry.2014.3195

4. Noonan ME, Mumola CJ. *Veterans in state and federal prison*. From the Bureau of Justice Statistics Special Report. 2004. Washington, DC: US Department of Justice.

5. O'Connell JJ. Premature Mortality in Homeless Populations: A Review of the Literature. 2005. National Healthcare for the Homeless Council. http://www.nhchc.org/wp-content/uploads/2011/10/Premature-Mortality.pdf. Accessed June 19, 2015.

6. Morrison DS. Homelessness as an independent risk factor for mortality: results from a retrospective cohort study. *Int J Epidemiol*. 2009; 38(3):877-83.

7. World Health Organization. *Public health action for the prevention of suicide: a framework*. http://apps.who.int/iris/handle/10665/75166. Accessed March 21, 2016.

8. Vera Institute of Justice. *On Life Support: Public Health in the Age of Mass Incarceration*. http://www.vera.org/pubs/public-health-mass-incarceration. Accessed March 21, 2016.

9. Rice DP, Kelman S, Miller S. *The Economic Burden of Mental Illness*. Psychiatric Services. 1992; 43(12):1227-32

10. US Department of Defense Manpower Data Center. *Interservice Separation Code for Active Separations*. http://www.dod.gov/pubs/foi/Reading_Room/Statistical_Data/13-F-0059_Separations_Code_FY01-12.xlsx. Accessed September 15, 2015.

11. Booth-Kewley S, Highfill-McRoy RM, Larson GE, Garland CF. Psychosocial predictors of military misconduct. *J Nerv Ment Dis*. 2010; 198(2), 91-8. http://doi.org/10.1097/NMD.0b013e3181cc45e9

12. Highfill-McRoy RM, Larson GE, Booth-Kewley S, & Garland, CF. Psychiatric diagnoses and punishment for misconduct: the effects of PTSD in combat-deployed Marines. *BMC Psychiatry*. 2010;10:88. http://doi.org/10.1186/1471-244X-10-88

13. Hoge CW, Tobani HE, Messer SC, et al. The Occupational Burden of Mental Disorders in the U.S. Military: Psychiatric Hospitalization, Involuntary Separation, and Disability. *Am J Psychiat*. 2005; 3(162), 585-2.

14. Tanielian T. *Invisible Wounds of War*. 2008. http://www.rand.org/pubs/monographs/MG720.html. Accessed February 25, 2016.

15. Ommaya A, Salazar A, Dannenberg A, et al. Outcome after Traumatic Brain Injury in the U.S. Military Medical System. *J Trauma*, 1996; 41(6), 972-5.

16. Seamone, ER, McGuire J, Sreenivasan S, Clark S, Smee D, Dow D. Moving upstream: Why rehabilitative justice in military discharge proceedings serves a public health interest. *Am J Public Health*. 2014; 104(10), 1805-11. http://doi.org/10.2105/AJPH.2014.302117

17. Wales HW. Causation in Medicine and Law: The Plight of the Iraq Veterans. *N Engl J Crim Civ Confin*. 2008; 373-4.

18. Rothberg JM, Koshes RJ, Shanahan J, Christman K: Desert shield deployment and social problems on a U.S. Army combat support post. *Mil Med*. 1994;159:246-8.

19. Bray RM, Hourani LL, Rae Olmsted KL, et al. *Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel Research*. Triangle Park, NC: Research Triangle Institute (Report RTI/ 7841/106-FR); 2006.

20. Killgore WDS, Cotting DI, Thomas JL, et al. Post-combat invincibility: violent combat experiences are associated with increased risk-taking propensity following deployment. *J Psychiatr Res*. 2008, 42:1112-21.

21. Orth U, Wieland E. Anger, hostility, and posttraumatic stress disorder in trauma-exposed adults: A meta-analysis. *J Consult Clin Psych*. 2006; 74(4), 698-706. http://doi.org/10.1037/0022-006X.74.4.698

22. Erickson SK, Rosenheck RA, Trestman RL, Ford JD, Desai RA: Risk of incarceration between cohorts of veterans with and without mental illness discharged from inpatient units. *Psychiatr Serv*. 2008; 59:178-83

23. Lim N, Cho M, Curry K. *Planning for Diversity: Options and Recommendations for DoD Leaders*. 2008. http://www.rand.org/content/dam/rand/pubs/monographs/2008/RAND_MG743.pdf. Accessed April 6, 2017.

24. Scott D, Happell B. The high prevalence of poor physical health and unhealthy lifestyle behaviours in individuals with severe mental illness. *Issues Ment Health Nurs*. 2011;32(9):589-97.

25. Vreeland B. Bridging the gap between mental and physical health: a multidisciplinary approach. *J Clin Psychiatry*. 2007; 68 Suppl 4:26-33.

26. Kumar GS, Klein R. Effectiveness of case management strategies in reducing emergency department visits in frequent user patient populations: a systematic review. *J Emerg Med*. 2013; 44(3), 717-29. http://doi.org/10.1016/j.jemermed.2012.08.035. Accessed May 15, 2017.

27. Phillips GA, Brophy DS, Weiland TJ, et al. The effect of multi- disciplinary case management on selected outcomes for frequent attenders at an emergency department. *Med J Aust*. 2006; 184: 602-8.

28. Okin RL, Boccellari A, Azocar F. The effects of clinical case management on hospital service use among ED frequent users. *Am J Emerg Med*. 2000;18:603-8.

29. Bertholet, N. Daeppen, J. Wietlisback, V. Fleming, M. Burnand, B. Reduction of Alcohol Consumption by Brief Alcohol Intervention in Primary Care. *Arch Intern Med*. 2014; 165(1), 986-95.

30. Liu HL, Chen LH, Huang SM. Outpatient health care utilization of suicide decedents in their last year of life. *Suicide Life Threat Behav*. 2012; 42(4):445-52.

31. Tran T, Luo W, Phung D, et al. Risk stratification using data from electronic medical records better predicts suicide risks than clinician assessments. *BMC Psychiatry*. 2014; 14(1):1-9. http://doi.org/10.1186/1471-244X-14-76

32. A. Gundlapalli, personal communication, February 24, 2016.

33. Haskell SG, Mattocks K, Goulet J. The Burden of Illness in the First Year Home: Do Male and Female VA Users Differ in Health Conditions and Healthcare Utilization. *Women's Health Issues*. 2011; 21(1):92-7.

34. Hawkins EJ, Lapham GT, Kivlahan DR, Bradley, KA. Recognition and management of alcohol misuse in OEF/OIF and other veterans in the VA: A cross-sectional study. *Drug and Alcohol Dependence*. 2010; 109:147-53.

CHAPTER 2

DEMOGRAPHIC, MILITARY SERVICE, AND HEALTH-RELATED

FACTORS ASSOCIATED WITH MISCONDUCT DISCHARGE

Abstract

Introduction: Discharge from military service due to misconduct is a considerable source of attrition from service, and is associated with several adverse post-discharge outcomes. Efforts to address and ultimately mitigate misconduct discharges from military service depend on a better understanding of the precipitating factors of this event.

Methods: Administrative records from the Department of Defense and Veterans Health Administration were extracted for a large, nationally representative sample of military service members with OEF/OIF deployments. Using logistic regression analysis, this study identified demographic and military service characteristics related to misconduct discharge, explored the association between misconduct discharge and military service exposures and service-connected disabilities.

Results: Several demographic and military service characteristics were associated with increased risk for misconduct discharge, including Black and American Indian/Alaska Native race/ethnicity relative to White (adjusted odds ratio [AOR] = 2.49 and 1.59, respectively), no high school diploma (AOR = 2.48), and rank of enlisted relative to officer (AOR=1.49). Relative to a negative screen for military sexual trauma, a positive screen was also associated with misconduct discharge (AOR = 2.1), as were service-disability designations related to Depression/PTSD and psychoses (AOR = 1.49 and 4.27, respectively).

Conclusions: Targeted counter-attrition strategies and an increased focus on health-related determinants of misconduct, including rehabilitative approaches to behavioral problems, may help to reduce misconduct-related attrition and improve in-service and post-discharge outcomes among service members/veterans.

Introduction

Over 40% of recent era enlisted military service members are discharged from

service under non-routine conditions, (ie, reasons for discharge other than expiration of

term of service or retirement).[1] This attrition is associated with substantial direct costs such as recruitment and training of replacements, and indirect costs such as damage to force stability and unit cohesion. With a combined recruitment and initial entry training costs of at least $50,000 per recruit, non-routine discharge from service is a serious and costly problem for the Department of Defense.[2-3] Non-routine discharge from service may occur for a variety of reasons, including disabling injuries, family obligations, or unsatisfactory performance. Of particular interest is discharge from service for reasons related to misconduct.

Misconduct-discharge constitutes a considerable source of attrition. Between 2001 and 2012, 15% of active duty enlisted service members were discharged for misconduct.[1] Even among service members who completed initial training and were deployed to conflicts related to OEF/OIF, 6% went on to be discharged for misconduct.[4] Attrition that occurs during or after initial deployment is particularly costly, as it represents the loss of higher level military occupational specialty-specific skills and experience. Further, personnel stability is particularly valued in combat units and other formations that deploy to a theater of operations.[5]

Unlike other forms of non-routine discharge such as disability and disqualification, service members at risk for discharge for misconduct are often physically able to continue in their service, but may be in need of mental health or behavioral interventions. A considerable body of research indicates that military service experiences such as combat, traumatic brain injury, and military sexual trauma can contribute to mental health and behavioral issues resulting in predictable declines in work

performance, including several misconduct stress behaviors (eg, irritability, angry outbursts, impulsivity, and drug use).[6-12] Further, several studies indicate that veterans with a misconduct discharge are more likely than routinely discharged veterans to have experienced an in-service mental health diagnoses or traumatic brain injury.[13-16] These findings point to certain treatable determinants of misconduct, and indicate that misconduct discharge may be a good target for prevention through rehabilitative approaches to behavioral problems. While such approaches are resource intensive, their potential benefits are much higher when the direct and indirect costs of attrition are considered.

Misconduct-discharged veterans are also at markedly higher risk for several serious negative post-discharge reintegration outcomes relative to routinely discharged veterans. Recent research indicates that following discharge from service, misconduct-discharged veterans are at substantially higher risk for virtually all mental health and substance use disorders, suicidal ideation and behaviors, completed suicide, incarceration, and homelessness.[4,17-20] Notably, while many misconduct-discharged service members remain eligible for veterans Health Administration (VHA) services, they are slower to engage in care than routinely discharged service members, despite their many health-related needs. Thus, a rehabilitative approach within the Department of Defense system, as opposed to a misconduct discharge and delayed engagement in treatment at VHA, would also likely improve long-term reintegration outcomes among this population.

In addition to potential vulnerabilities associated with service experiences, mental

health issues, and TBI, several studies indicate that certain demographic characteristics are associated with misconduct-discharge, including Black race.[4] Given previous reports of potential racial biases in the administration of military discipline,[21] this is an important area to evaluate. Regardless of the reasons for these disparities, information regarding demographic variations between those who receive a misconduct discharge relative to a routine discharge may be useful in designing targeted counter-attrition programs.

In order to address and ultimately mitigate this significant source of attrition, a better understanding of the factors associated with misconduct discharge is needed, including further examination of the role of demographic and military service characteristics, military service exposures, and health-related vulnerabilities. This information would further clarify the pathway to misconduct discharge, and offer insights regarding the administration of misconduct discharge, including opportunities for targeted prevention and rehabilitative efforts among service members who are at risk. Unfortunately, recent research on this topic is sparse, and the few studies that have examined precipitating factors associated with misconduct have relied on non-representative samples.[13-16] Therefore, the purpose of this study is to use a large, nationally representative sample of military service members to 1) identify the demographic and military service characteristics related to misconduct discharge, and 2) explore the association between misconduct discharge and military service exposures and service-connected disabilities.

Methods

The working dataset was created by merging demographic and military service data from the 2012 OEF/OIF official roster file with clinical data from VHA. The roster file includes veterans who had at least one deployment related to post-9/11 Middle Eastern conflicts including Operation Iraqi Freedom, Operation Enduring Freedom, and Operation New Dawn (OEF/OIF), and who separated from the military between fiscal years (FY) 2001-2012. The file contains the following administratively determined demographic and military service variables: age, education (no high school diploma or high school equivalency only, high school diploma, any college), race/ethnicity (White, Black, Hispanic, Asian/Pacific Islander, American Indian/Native Alaskan, Other, Unknown), marital status (never married, married, divorced/other), branch of service (Army, Marines, Air Force, Navy/Coast Guard), rank (enlisted, Officer), and type of discharge (routine, misconduct). VHA clinical data was extracted from the Patient 2.0 Domain of the VA Corporate Data Warehouse (CDW), FY 2001-2015, which contains several military service records including history of exposure to combat or military sexual trauma, and records of service-connected disabilities. See Supplementary Table A1 in the appendix for further description of data sources. In order to focus on risk factors during the most recent era of service, records were retained only for veterans whose service entry date was after the beginning of OEF/OIF conflicts. The final merged dataset included 177,583 Veterans of active duty service who were included on the roster, had a discharge type of "routine" or "misconduct," an initial service entry date in 2001 or later, and at least 1 year of follow-up data available in VHA clinical records. Approval

for this study was granted by the Institutional Review Board of the University of Utah

School of Medicine and the Research and Development Committee for the VA Salt Lake

City Health Care System.

Discharge Type

Every active duty service member receives an Interservice Separation Code (ISC)

that is assigned by the Department of Defense upon discharge from the military. There

are 72 separate ISCs, and codes are based on discharge classifications maintained by each

branch of the military, and indicate the circumstances related to separation from military

service. In the case of misconduct, these codes indicate the type of offense committed

that led to discharge from military service. ISCs are separate from character of discharge

classifications, which indicate broader classifications that directly relate to benefit

eligibility (eg, honorable, under honorable conditions, general, dishonorable). Some

misconduct offenses are deemed severe enough to warrant an "other than honorable"

character of discharge, which, until 2017, generally constituted ineligibility for VHA

benefits. Many instances of misconduct lead to a "general" or "under honorable

conditions" character of discharge under which the Veteran remains eligible for VHA

benefits.

Combat Exposure

A binary variable representing history of combat exposure was extracted from the

administrative data. The source column holds a variable indicating the presence or

absence of combat during any deployment on record for each Veteran.

Military Sexual Trauma

As part of routine clinical care, all veterans are screened for military sexual trauma (MST). The screen consists of the following two items: "While you were in the military…(a) Did you receive uninvited and unwanted sexual attention, such as touching, cornering, pressure for sexual favors, or verbal remarks? (b) Did someone ever use force or threat of force to have sexual contact with you against your will?" Veterans may respond "Yes," "No," or "Decline" to either item. The screen is considered positive if a veteran responds in the affirmative to either item. The screen is only administered once, unless the veteran declines screening, in which case the veteran will be re-screened in one year. veterans who had no valid screen on file were retained in the sample, and assigned a value of "Unknown" for this variable.

Service-Connected Disabilities

Records of disabling conditions that occurred as a result of military service were extracted from VHA clinical data. While these ratings are determined following discharge from service, their designation as service-connected indicates that the disabling event took place or was aggravated due to military service exposures. This allows for an indirect ascertainment of military service exposures, and more directly, their consequences in the post-discharge period. Service-connected disabilities are not directly entered as diagnosis codes, but a crosswalk file that links disability types to related ICD-9 and ICD-10 diagnoses is provided in the administrative database. Using these related diagnoses, each service-connected disability was classified according to the Elixhauser Comorbidity Index,[22] a widely-used method for categorizing comorbidities based on ICD

diagnosis codes found in administrative data. Elixhauser diagnostic categories with links to mental health, behavioral issues, or TBI were used, including categories "Depression," "Psychoses," and "Neurological Disorders'. Notably, Elixhauser category "Depression" contains the ICD code for Post-Traumatic Stress Disorder (PTSD). Categories "Alcohol Abuse" and "Drug Abuse" were not included due to very low rates of service connected disabilities in these categories. In order to allow adequate time for processing of disability claims and to focus on service-connected disabilities that were most likely to have been present during military service, service-connected disabilities that were recorded during the initial year of VHA service usage were included.

Data Analysis

Descriptive statistics were computed for demographic and military service characteristic variables and military service exposure variables, and stratified by discharge type. Binary logistic regression analysis was used to model the odds for misconduct discharge relative to routine discharge as a function of demographic and military service characteristics, service-connected disabilities, exposure to combat, and exposure to military sexual trauma. The first model included characteristics related to demographic and military service that were sourced from Department of Defense data (the roster file). Variables included race/ethnicity (Black, White, Hispanic, Other, Unknown), age, education (High School or Equivalent Only, Beyond High School), marital status (Never married, Married, Divorced, Other), branch of service (Army, Navy, Marines, Air Force, Coast Guard), and rank (Enlisted, Officer). In the second model, additional variables sourced from VHA data that reflect military service

exposures, including exposure to combat (Any, None), exposure to military sexual

trauma (Yes, No, Decline to Respond to Screening, and Unknown), and the presence or

absence of service-connected disabilities related to mental health, behavioral issues, or

TBI (Depression, Psychosis, and Neurological Disorders).

In addition to the computation of main effects-only models, several interactions of

interest were tested. A very large number of statistically significant interactions were

found, likely due to the high-powered nature of the tests. In order to evaluate whether

these interactions were meaningful, the least absolute shrinkage and selection operator

(LASSO) was used.[24] This form of regularized regression uses a tuning parameter, λ, to

penalize the number of parameters in the model. This reduces the chance of overstating

regression coefficients in high dimensional models. Because all main effects were of

theoretical interest and interpretable models were desired, penalties were only assigned to

interaction terms. The cross-validated λ associated with the simplest version of the model

that was within one standard error of the best model was selected. This method for λ

selection results in a more parsimonious model, and reduces the risk of overfitting. In

both models, all interaction terms had penalized coefficients of zero following the

LASSO estimation, indicating that although many of these terms were statistically

significant, their inclusion added little practical value to the models. Thus, no interaction

terms were included in final models.

Adjusted odds ratios and their 95% confidence intervals were calculated for all

models. All analyses in this study had sample sizes in the thousands, therefore, statistical

power was sufficient. Analyses were conducted using the R environment for statistical

computing[24] using the VA's secure Informatics and Computing Infrastructure research workspace.[25]

Results

Table 2.1 presents a summary of all demographic and military service characteristics and military service exposure variables, stratified by discharge type. Overall, 19,319 (10.9%) veterans were discharged for misconduct, 1.2 for every 10 routinely discharged veterans. There were statistically significant differences between routinely and misconduct-discharged veterans on all demographic, military service and exposure, and service-connected disability variables measured (all $p < .001$). On average, veterans who were discharged for misconduct were 5 months younger than routinely discharged veterans at the time of their first deployment. Those who were discharged for misconduct were also more likely to be male and of Black or American Indian/Native Alaskan race/ethnicity, and less likely to have a high school diploma. They were also less likely to have seen combat, but more likely to have experienced military sexual trauma. Finally, those with a misconduct discharge were more likely than those with a routine discharge to have a VHA-designated service-connected disability for depression, psychoses, or neurological disorders.

Table 2.2 presents adjusted odds ratios (AOR) and their confidence intervals (CI) for both logistic regression models. In the first model focusing on demographic and military service characteristics alone, every variable included was significantly associated with misconduct discharge. The odds for misconduct discharge were 1.6 times higher

Table 2.1. Demographic and Military Service Characteristics, Military Service Exposures, and Service Connected Disabilities Stratified by Discharge Type

Variable	Routine $N = 158,264$	Misconduct $N = 19,319$	t / χ^2 p-value
Sex			<.001
Female	15,142 (9.6%)	1,500 (7.8%)	
Male	143,122 (90.4%)	17,819 (92.2%)	
Race/ethnicity			<.001
White	108,968 (68.9%)	11,805 (61.1%)	
Black	17,441 (11.0%)	4,672 (24.2%)	
Hispanic	21,010 (13.3%)	1,996 (10.3%)	
American Indian/Alaska Native	1,004 (0.6%)	165 (0.9%)	
Asian/Pacific Islander	4,846 (3.1%)	283 (1.5%)	
Other/Unknown	4,995 (3.2%)	398 (2.1%)	
Age at First Deployment	22.45 (3.28)	22.08 (3.17)	<.001
Education Level			<.001
No HS Diploma/HS Equiv.	14,215 (9.0%)	4,673 (24.2%)	
HS Diploma	133,257 (84.2%)	13,767 (71.3%)	
Any College	10,792 (6.8%)	879 (4.5%)	
Marital Status			<.001
Never Married	121,767 (76.9%)	14,178 (73.4%)	
Married	34,893 (22.0%)	4,931 (25.5%)	
Divorced/Other	1,604 (1.0%)	210 (1.1%)	
Branch of Service			<.001
Army	71,918 (45.4%)	13,235 (68.5%)	
Navy	22,103 (14.0%)	2,807 (14.5%)	
Marines	51,511 (32.5%)	1,650 (8.5%)	
Air Force	12,732 (8.0%)	1,627 (8.4%)	
Rank			<.001
Enlisted	155,853 (98.5%)	19,221 (99.5%)	
Officer/Warrant	2,411 (1.5%)	98 (0.5%)	
Combat Exposure			<.001
Yes	49,221 (31.1%)	5,673 (29.4%)	
MST			
Yes	4,161 (2.6%)	883 (4.6%)	<.001
Decline	730 (0.5%)	128 (0.7%)	
No	135,079 (85.4%)	16,375 (84.8%)	
Unknown	18,294 (11.6%)	1,933 (10.0%)	
Neurological Disorders			<.001
Yes	6,369 (4.0%)	916 (4.7%)	
Psychoses			<.001
Yes	134 (0.1%)	78 (0.4%)	
Depression			<.001
Yes	36,959 (23.4%)	5,980 (31%)	

Table 2.2. Results from Logistic Regression Modeling: Odds for Misconduct Discharge Relative to Routine Discharge as a Function of Demographic and Military Service Characteristics, Military Service Exposures, and Service-Connected Disabilities

	AOR (95% CI)	
Variable	Model 1[a]	Model 2[a]
Sex (Ref = Male)		
Female	**1.60 (1.51, 1.70)**	**1.93 (1.81, 2.06)**
Race/ethnicity (Reference = White)		
Black	**2.45 (2.36, 2.55)**	**2.49 (2.39, 2.59)**
Hispanic	**0.89 (0.85, 0.94)**	**0.90 (0.86, 0.95)**
American Indian/Alaska Native	**1.64 (1.38, 1.95)**	**1.59 (1.33, 1.89)**
Asian/Pacific Islander	**0.58 (0.52, 0.66)**	**0.59 (0.52, 0.67)**
Other/Unknown	**0.80 (0.72, 0.89)**	**0.83 (0.74, 0.92)**
Age	**0.93 (0.92, 0.93)**	**0.93 (0.92, 0.93)**
Education Level (Ref = HS Diploma)		
No HS Diploma/HS Diploma Equiv.	**2.51 (2.41, 2.61)**	**2.48 (2.38, 2.58)**
Any College	0.94 (0.87, 1.01)	0.94 (0.87, 1.02)
Marital Status (Ref = Never Married)		
Married	**1.48 (1.27, 1.72)**	**1.30 (1.25, 1.35)**
Divorced/Other	**1.33 (1.28, 1.38)**	**1.43 (1.22, 1.66)**
Branch (Ref = Army)		
Navy	**0.74 (0.71, 0.78)**	**0.79 (0.76, 0.83)**
Marines	**0.20 (0.19, 0.21)**	**0.20 (0.19, 0.21)**
Air Force	**0.88 (0.84, 0.94)**	0.94 (0.89, 1.00)
Rank (Ref = Enlisted)		
Officer/Warrant	**0.63 (0.51, 0.79)**	**0.67 (0.54, 0.83)**
Combat Exposure (Ref = No)		
Yes	-	**0.92 (0.89, 0.96)**
MST (Ref = No)		
Yes	-	**2.07 (1.90, 2.26)**
Decline	-	**1.40 (1.14, 1.70)**
Unknown	-	1.03 (0.98, 1.08)
Depression (Ref = No)		
Yes	-	**1.49 (1.43, 1.54)**
Psychoses (Ref = No)		
Yes	-	**4.27 (3.15, 5.78)**
Neurological Disorders (Ref = No)		
Yes	-	0.98 (0.90, 1.05)

[a] Model 1 includes predictors for demographic and military service characteristics. Model 2 includes additional indicators of military service exposures, and related VHA-documented service-connected disabilities. Note: HS = high school. Bold indicates statistical significance, $p < .05$.

among men relative to women. Relative to Whites, the odds for misconduct were significantly higher among those with a Black or American Indian/Alaska Native race/ethnicity (AOR = 2.5 and 1.6, respectively), but significantly lower among those with a Hispanic, Asian/Pacific Islander, or Other/Unknown race/ethnicity (AOR = 0.9, 0.6, and 0.8, respectively). While there was not a significant difference between those with a high school diploma and those who attended college on odds for a misconduct discharge, those who did not receive a high school diploma or received a diploma equivalency had 2.5 times higher odds for a misconduct discharge than those who did receive a high school diploma. Relative to marital status "never married," marital status of "married" or "divorced/other" were associated with higher odds for misconduct discharge (AOR = 1.5 and 1.3, respectively). As compared to service members in the Army, the odds for misconduct discharge were lower among service members in the Air Force (AOR = 0.9), Navy/Coast Guard (AOR = 0.7), and Marines (AOR = 0.2). Finally, the odds for misconduct discharge were 1.6 times higher among service members of enlisted rank relative to those who were officers.

In the second model that included additional indicators for military service exposures and associated service-connected disabilities, the odds ratios for demographic and military characteristics were largely similar to those seen in model 1 in terms of their magnitude and significance (also in Table 2.2). In this model, however, combat exposure was associated with significantly lower odds for misconduct discharge (AOR = 0.9). Relative to a negative screen for military sexual trauma, a positive screen for military sexual trauma was associated with 2.1 times higher odds for misconduct discharge. Odds

for misconduct discharge were also 1.4 times higher odds among those who declined screening relative to those who screened negative. A screen result of unknown or missing was not significantly associated with misconduct discharge relative to a negative screen. Finally, having a service-connected disability in the category of "Depression" was associated with 1.5 times higher odds for misconduct discharge, and having a service connected disability in the category of "Psychosis" was associated with 4.3 times higher odds for misconduct discharge. Having a service-connected disability in the category of "Neurological Disorders" was not significantly associated with misconduct discharge.

Discussion

Findings from this study offer several insights into the pathway to misconduct discharge. The identification of demographic and military service risk factors for misconduct discharge as well as several associated health-related vulnerabilities points to opportunities for targeted prevention and intervention efforts for at-risk service members.

The American military is widely regarded as an institution that has served and continues to serve as a model of positive race relations.[21] However, the overrepresentation of Black, and to a lesser degree, American Indian/Alaska Native service members among those with a misconduct discharge is an important point of focus. While Black service members made up 11% of routine discharges, they made up 24% of misconduct discharges. American Indian/Alaska Native service members made up 0.6% of those with a routine discharge, and 0.9% of those with a misconduct discharge. Even after adjusting for other demographic and military service characteristics

and military service exposures, relative to White service members, the odds for
misconduct discharge were 2.5 and 1.6 times higher among Black and American
Indian/Alaska Native service members, respectively.

This study is not the first to point to racial/ethnic disparities in military discipline.
A 2001 analysis of military disciplinary actions indicated an overall declining rate of
court-martial convictions, but a rising rate among Black service members. A similar trend
was seen for less serious, non-judicial offenses.[26,27] Another study reported that only 38%
of Black enlisted service members believed that White and Black service members in
their unit received the same punishment for the same crime.[28] It has been suggested that
cultural differences may contribute to the overrepresentation of Black service members in
the military justice system, in that certain behaviors may be considered confrontational or
insubordinate to members of a predominately White officer corps.[27,29] Others suggest that
disparities in discipline may emerge at the gateway into the military justice system, where
commanding officers have discretion in determining what charges and punishments, if
any, might be levied against a service member.[28] This discretion is largely unchecked,
and may result in greater leniency for White service members. Similar discretion exists in
the handling of discharge procedures and the assignment of interservice separation codes.
According to a RAND report,[30] most service members who were discharged under non-
routine conditions had a combination of problems listed in their file, including work/duty
problems, mental health issues, and misconduct. It is possible that in the event of multiple
problems, mental health issues are more commonly assigned as the primary reason for
discharge for White service members, while misconduct is more commonly assigned as

the primary reason for discharge for Black or American Indian/Alaska Native service members. Indeed, White service members are more likely than any other racial/ethnic group to be discharged due to disability,[4] and up to 40% of disability discharges are attributable to mental health issues.[31]

Also of interest was the considerable variability between branches in administration of misconduct discharge. Relative to Army members, the adjusted odds for misconduct discharge are slightly lower among members of the Air Force and Navy, and substantially lower among members of the Marines. Further examination of the differences between service members and administrative processes between the Army and Marines may yield useful information regarding high-quality recruiting, preparation of service members for military life, or handling of incidents of misconduct.

Although exposure to combat was not associated with increased risk for misconduct discharge, and actually had a mildly protective effect, military service members, particularly service members who deploy to OEF/OIF conflicts, may experience many potentially traumatizing non-combat situations including harassment or assault, training accidents, and exposure to deaths or injuries of fellow service members. These non-combat forms of military service exposures may help to explain the elevated risk for post-discharge determination of service-connected disabilities for depression or psychosis among those who were discharged for misconduct.

Military sexual trauma is an example of a non-combat military trauma that is associated with misconduct discharge. Those who reported experiencing military sexual trauma were twice as likely to be discharged for misconduct than those who did not

report experiencing military sexual trauma. The association between military sexual trauma to misconduct seen in this study may have been amplified by the "Don't Ask, Don't Tell" policy that was in place until 2011.[32] Under this policy, disclosure of sexual activity or orientation other than heterosexual was a dischargeable offense. In addition to public ridicule, service members who reported assault by a same-sex offender could face accusations of homosexuality, or charges of fraternization or other associated prohibited behaviors (eg, underage drinking).[33,34]

Due to limited access to Department of Defense records, including in-service diagnoses of mental health issues, substance use, traumatic brain injury or associated treatment, exploration of the associations between misconduct discharge other in-service exposure was indirectly assessed through post-discharge designations of disabilities that were determined to be the consequences of in-service exposures. While these indicators are imperfect, they suggest higher rates of pre-discharge health-related vulnerabilities among those discharged for misconduct relative to those discharged under routine conditions. Particularly striking were the 4.3 times higher odds for misconduct discharge among those with a service-connected disability related to psychosis. Due to the limitations of the data, we cannot determine whether psychotic symptoms were present during service. However, the designation of service-connection by VHA depends upon evidence that a military service exposure was the precipitating factor for the appearance or aggravation of symptoms. This indicates that there may be opportunities for the Department of Defense to better recognize and treat service members whose in-service exposures make them vulnerable to misconduct-related symptoms. If a service member is

still unfit for duty following treatment, disability discharge may by more suitable than misconduct discharge.

The current study includes several limitations. As previously discussed, while VHA-recorded service-connected disabilities are determined to be attributable to pre-discharge military service exposures, they are based on assessments that take place following military service, and causal order cannot be determined. Further, not all exposures that may contribute to misconduct will be recorded in the form of service-connected disabilities, and misconduct-discharged veterans may be more likely than their routinely discharged counterparts to seek compensation for service connected disabilities. The ascertainment of experiences of TBI from post-discharge disability designations was particularly difficult in this study, as the service-connected disabilities stemming from TBI are often recorded as secondary symptoms that are presumed to be attributable to Department of Defense-recorded TBI, such as mental illness. Thus, some of the association between service-connected depression and psychosis and misconduct discharge seen in these results may be attributable to TBI. However, regardless of causal order and the details of precipitating event that led to disability, this information is useful in assessing the post-discharge health needs of this population, and for service provision planning within VHA.

Policy Implications

Heading off misconduct-related problems before they become serious enough to require a discharge, including recognizing and providing prompt assessment and treatment to service members whose misconduct-related behaviors are associated with

physical or mental health vulnerabilities, would provide major benefits to the military

workforce and improve the short and long-term outcomes among military service

members and veterans.

Diversity Initiatives

Although the Department of Defense currently invests in several strategies to

improve diversity, it has faced challenges with regard to retention and promotion of

minorities.[35] A stronger focus on diversity through development and retention rather than

recruitment may help reduce disparities by discharge type. For example, high rates of

misconduct discharge among Black and American Indian/Alaska Native service members

might be mitigated through a greater emphasis on cultural training, both to introduce new

recruits into culture of military society, but also to train officers to become more attuned

to the various cultures found in an increasingly diverse force.

Promoting a Treatment Seeking Culture
in the Military

Despite the availability of a mental health treatment, the proportion of service

members who seek needed treatment is low.[36] Many military service members do not

acknowledge or seek timely help for their mental health symptoms for fear that they will

be perceived as weak, or that it will negatively impact their military career.[37,38]

According to a recent RAND report, there are several promising programmatic and

policy approaches to reducing mental health stigma, which may in turn improve

treatment seeking. These include educating key power groups and changing policy to

reduce discriminatory behavior among individual service members and leadership, who

often set the climate within units and the military institution as a whole, exposing service members to peers who are in recovery from a mental health disorder, education and training programs, and multimedia campaigns.[36] Expanded emphasis on these approaches, potentially including targeted education among service members who have recently experienced traumatic exposures, may promote more timely treatment provision and mitigate the symptoms that may lead to a misconduct event.

Investigate Service Members" Perspectives

While the investigation of administratively observable factors associated with discharge due to misconduct provides rapid and valuable information, research that examines the pathway to misconduct discharge from the perspective of service members who have experienced this event would likely provide additional unique and relevant insights.

"Warm Handoff" Between Department of Defense and VHA

Improved data sharing procedures among practitioners and health services researchers operating in the Department of Defense and VHA healthcare systems would benefit both systems and the service-members/veterans they serve. Enhanced data sharing that allows for administrative follow-up from the time of enlistment through the post-discharge period would likely provide new insights into deployment and discharge practices that promote long-term well-being, and would improve the ability of VHA to provide care that is better tuned to veterans" unique needs. In addition, cross-system case management would promote continuity of care and early engagement with VHA primary

care teams. This would guide high-risk veterans, such as those with a history of misconduct, toward preventive models of care in the early post-discharge period.

Conclusion

Several demographic and military service characteristics are associated with increased risk for misconduct discharge, including Black and American Indian/Alaska Native race/ethnicity, low levels of education, enlisted rank, and service in the Army. A positive screen for military sexual trauma was also associated with misconduct discharge, as were service-disability designations related to Depression/PTSD and psychoses. Targeted counter-attrition strategies and an increased focus on health-related determinants of misconduct, including rehabilitative approaches to behavioral problems, may help to reduce misconduct-related attrition and improve in-service and post-discharge outcomes among service members/veterans.

References

1. US Department of Defense Manpower Data Center. *Interservice Separation Code for Active Separations*. http://www.dod.gov/pubs/foi/Reading_Room/Statistical_Data/13-F-0059_Separations_Code_FY01-12.xlsx. Accessed April 5, 2017.

2. Buddin RJ. *Success of First-Term Soldiers: The Effects of Recruiting Practices and Recruit Characteristics*. 2005. http://www.rand.org/content/dam/rand/pubs/monographs/2005/RAND_MG262.pdf. Accessed April 5, 2017.

3. Gilmore GJ. *Recruit Attrition Rates Fall Across the Services.* American Forces Press Service. August 13, 2001. http://archive.defense.gov/news/newsarticle.aspx?id=44782. Accessed April 5, 2017.

4. Brignone E, Fargo JD, Blais RK, Carter ME, Samore MH, Gundlapalli A V. Non-routine Discharge from Military Service: Mental Illness, Substance Use Disorders, and Suicidality. *Am J Prev Med*. 2017;52(5):557-565.

5. Lippiatt TF, Polich JM. *Reserve Component Unit Stability: Effects on Deployment and Training*. 2010. http://www.rand.org/pubs/monographs/MG954.html. Accessed April 5, 2017.

6. Seamone E, Sreenivasan S, McGuire J, Smee D, Clark S, Dow D. 2017. A Rehabilitative Justice Pathway for War-Traumatized Offenders Caught in the Military Misconduct Catch-22. *Armed Forces Soc*. In Press.

7. U.S. Department of Army. Field manual 4-02.51 (FM 8-51): *Combat and operational stress control*. Washington, DC: U.S. Government Publishing Office. 2006. https://fas.org/irp/doddir/army/fm4-02-51.pdf Accessed April 6, 2017.

8. Rothberg JM, Koshes RJ, Shanahan J, Christman K. Desert shield deployment and social problems on a U.S. Army combat support post. *Mil Med*. 1994;159:246-8.

9. Bray RM, Hourani LL, Rae Olmsted KL, et al. 2006. *Department of Defense Survey of Health Related Behaviors Among Active Duty Military Personnel*. Research Triangle Park, NC: Research Triangle Institute (Report RTI/ 7841/106-FR).

10. Killgore WDS, Cotting DI, Thomas JL, et al. Post-combat invincibility: violent combat experiences are associated with increased risk-taking propensity following deployment. *J Psychiatr Res*. 2008; 42(11), 12-21.

11. Orth U, Wieland E. Anger, hostility, and posttraumatic stress disorder in trauma-exposed adults: A meta-analysis. *J Consult Clin Psych*. 2006; 74(4), 698-706. http://doi.org/10.1037/0022-006X.74.4.698

12. Erickson SK, Rosenheck RA, Trestman RL, Ford JD, Desai RA: Risk of incarceration between cohorts of veterans with and without mental illness discharged from inpatient units. *Psychiatr Serv*. 2008; 59:178-83

13. Booth-Kewley S, Highfill-McRoy RM, Larson GE, Garland CF. Psychosocial predictors of military misconduct. *J Nerv Ment Dis*. 2010; 198(2), 91-98. http://doi.org/10.1097/NMD.0b013e3181cc45e9

14. Highfill-McRoy RM, Larson GE, Booth-Kewley S, & Garland, CF. Psychiatric diagnoses and punishment for misconduct: the effects of PTSD in combat-deployed Marines. *BMC Psychiatry*. 2010;10:88. http://doi.org/10.1186/1471-244X-10-88

15. Hoge CW, Tobani HE, Messer SC, et al. The Occupational Burden of Mental Disorders in the U.S. Military: Psychiatric Hospitalization, Involuntary Separation, and Disability. *Am J Psychiat*. 2005; 3(162), 585-592.

16. Crain JA, Larson GE, Highfill-Mcroy RM, Schmied EA. Postcombat outcomes among marines with preexisting mental diagnoses. *J Trauma Stress*. 2011;24(6):671-679. doi:10.1002/jts.20700.

17. Ommaya A, Salazar A, Dannenberg A, et al. Outcome after Traumatic Brain Injury in the U.S. Military Medical System. *J Trauma*, 1996; 41(6), 972-975.

18. Gundlapalli AV, Fargo JD., Metraux S, et al. Military misconduct and homelessness among us veterans separated from active duty, 2001-2012. *JAMA*. 2015;314(8), 832-834.

19. Reger MA, Smolenski DJ, Skopp NA, et al. Risk of Suicide Among US Military Service Members Following Operation Enduring Freedom or Operation Iraqi Freedom Deployment and Separation from the US Military. *JAMA Psychiatry*. 2015;72(6), 561-9. http://doi.org/10.1001/jamapsychiatry.2014.3195

20. Noonan ME, Mumola CJ. *Veterans in state and federal prison*. From the Bureau of Justice Statistics Special Report. 2004. Washington, DC: US Department of Justice.

21. Burk J, Espinoza E. Race Relations Within the US Military. *Annu. Rev. Sociol*. 2012; 38:401-22

22. Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, Saunders LD, Beck CA, Feasby TE, Ghali WA. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care*. 2005;43(11):1130-1139.

23. Tibshirani R. Regression shrinkage and selection via the lasso. *J R Stat Soc. Series B (Methodological)*. 1996;58(1):267-88.

24. R Core Team. *R: A language and environment for statistical computing*. 2017. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/. Accessed April 6. 2017.

25. U.S. Department of Veterans Affairs. *VA Informatics and Computing Infrastructure* (VINCI). 2017. http://www.hsrd.research.va.gov/for_researchers/vinci/. Accessed April 6. 2017.

26. Walker MR. 2001. An analysis of discipline rates among racial/ethnic groups in the military, fiscal years 1987-1991. In Dansby MR, Stewart JB, Webb SC, eds., *Managing Diversity in the Military*, pp. 417-41. New Brunswick, NJ: Transaction Books

27. Dansby MR, Stewart JB, Webb SC, eds. 2001. Managing Diversity in the Military. New Brunswick, NJ: Transaction Books.

28. Verdugo N. Crimes and punishment: Blacks in the Army's criminal justice system. *Mil. Psychol*. 1998;10(2), 107-25

29. Edwards JE, Thomas PJ, Newell CE, Thomas E. The equity of the Navy disciplinary system: a review. *Int. J. Intercult. Relat*. 2001;25:591-606

30. Klein S, Hawes-Dawson J, Martin T. *Why Recruits Separate Early*. 1991. http://www.rand.org/pubs/reports/R3980.html. Accessed April 6, 2017.

31. Elmasry H, Gubata ME, Packnett ER, Niebuhr DW, Cowan DN. Risk factors for disability retirement among active duty air force personnel. *Mil Med.* 2014;179(1):5-10.

32. Policy Concerning Homosexuality in the Armed Forces. 10 U.S. Code § 654. https://www.gpo.gov/fdsys/pkg/USCODE-2010-title10/pdf/USCODE-2010-title10-subtitleA-partII-chap37-sec654.pdf. Accessed April 6, 2017.

33. Department of Defense, Office of the Inspector General. 2000. *Military Environment with Respect to the Homosexual Conduct Policy*. Report number D-2000-101. http://www.dodig.mil/audit/reports/fy00/00-101.pdf. Accessed April 6, 2017.

34. Turchik J, Wilson SM. Sexual Assault in the U.S. Military: A review of the literature and recommendations for the future. *Aggress Violent Beh*. 2010; 15(4): 264-277.

35. Lim N, Cho M, Curry K. *Planning for Diversity: Options and Recommendations for DoD Leaders*. 2008. http://www.rand.org/content/dam/rand/pubs/monographs/2008/RAND_MG743.pdf. Accessed April 6, 2017.

36. Acosta JD, Becker A, Cerully JL, Fisher MP, Martin LT, Vardavas R, Slaughter ME, Schell T. *Mental Health Stigma in the Military*. 2014. http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR426/RAND_RR426.pdf. Accessed April 6, 2017.

37. Gould M, Adler A, Zamorski M, et al. Do stigma and other perceived barriers to mental health care differ across Armed Forces? *J R Soc Med*. 2010;103(4):148-56.

38. Dichter ME, True G. "This Is the Story of Why My Military Career Ended Before It Should Have": Premature Separation from Military Service Among U.S. Women Veterans. *J of Women and Social Work*. 2015;30(2):187-199.

CHAPTER 3

POST-DEPLOYMENT HEALTH STATUS AND HEALTHCARE UTILIZATION

AMONG U.S. VETERANS DISCHARGED FROM SERVICE FOR

MISCONDUCT

Abstract

Introduction: Veterans who were discharged from service due to misconduct are at high risk for adverse health-related outcomes. Examination of the post-discharge healthcare characteristics of this vulnerable subgroup of veterans may provide important insights into treatment needs, problematic patterns of care, potential points of intervention.

Methods: National administrative data from the Department of Defense and Veterans Health Administration for 301,820 veterans who deployed to post-9/11 conflicts was used in a retrospective cohort design. Health status and healthcare utilization and costs were compared between routinely and misconduct-discharged veterans, adjusting for demographic and military service characteristics. Logistic regression analysis was used to model the odds for clinical diagnoses; two-part hurdle models were used to model the odds for and conditional rate of utilization across several treatment types.

Results: Relative to routinely discharged veterans, misconduct-discharged veterans were at significantly higher risk for all mental health disorders, and several behaviorally-linked chronic health conditions. Over 5 years, the incremental effect of a misconduct discharge relative to routine discharge on utilization was 44.4 outpatient encounters, 6.9 inpatient bed days, and $14,422 for women, and 36.2 outpatient encounters, 11.0 inpatient bed days, and $16,106 for men.

Conclusion: Misconduct-discharged veterans have significant and complex healthcare needs. Results suggest the potential success of healthcare-based intervention strategies in mitigating adverse outcomes. Insights can help to inform the development of treatment and case management strategies tailored to the unique needs of this subpopulation.

Introduction

Approximately 6% of U.S. veterans who deployed to post-9/11 conflicts and are

eligible for Veterans Health Administration (VHA) services were discharged from

military service for misconduct.[1] Compared to veterans discharged under routine

conditions, misconduct-discharged veterans have an elevated risk for several post-discharge social outcomes of great public health concern, including up to six times higher odds for homelessness,[2] a two times higher rate of suicide,[3] and rates of incarceration significantly higher than the general veteran population.[4] These veterans also experience more in-service mental health issues, including higher rates of mental health diagnoses and psychiatric hospitalization,[5-7] as well as higher rates of in-service traumatic brain injury (TBI).[8] While the pre-discharge vulnerabilities and post-discharge outcomes linked to this subpopulation of veterans are generally associated with increased healthcare needs, we currently know little about the post-discharge health status (ie, clinical diagnoses and comorbidities) and healthcare characteristics (ie, the relative frequency, types, and costs of health service utilization) of these veterans.

The examination of unique healthcare characteristics among vulnerable populations can provide important insights into treatment needs and prevention and intervention strategies. Population-based strategies facilitate the identification of determinants of problems in the population that may not be apparent through the examination of individual-level risks alone.[9] In other vulnerable populations, tailored interventions and case management strategies have been effective in improving access and continuity of appropriate service use, in many cases resulting in reductions in homelessness, drug and alcohol use, emergency department visits and hospitalization, and healthcare expenditures.[10-15] Despite the clear divide between misconduct and routinely discharged veterans with regard to the incidence of several serious negative outcomes, the post-discharge healthcare characteristics of misconduct-discharged

veterans as a distinct population have been largely ignored in extant research literature. This represents an important gap in our knowledge, as the examination of these characteristics among misconduct-discharged veterans may provide important insights into treatment needs, problematic patterns of care (ie, overuse of specialty and emergency services), potential points of intervention, and opportunities to reduce costs. These insights are necessary for the development of treatment and case management strategies tailored to the unique needs of misconduct-discharged veterans.

Therefore, the purpose of this study WAS to evaluate the health status and healthcare characteristics of misconduct-discharged veterans in order to inform the development of tailored strategies aimed at improving post-deployment outcomes among this population. Given certain similarities between misconduct-discharged veterans and other vulnerable veteran populations that tend be heavy healthcare users (eg, homeless veterans, veterans with severe mental illness), we hypothesized that compared to their routinely-discharged counterparts, veterans discharged for misconduct would have significantly higher rates of mental health and medical comorbidities, higher overall utilization and costs, and particularly high utilization of specialty services. These hypotheses were addressed with the following set of aims: (1) compare the presence of mental health and medical diagnoses in male and female veterans between those discharged from service due to misconduct and those discharged under routine conditions, and (2) compare utilization and cost of mental health and medical treatment in male and female veterans between those discharged from service due to misconduct and those discharged under routine conditions.

Methods

The working dataset was created by merging national administrative data from the Department of Defense and VHA. The final dataset included records for 301,820 veterans of active duty service, including 23,006 with a misconduct discharge, who served in Operations Iraqi Freedom, Enduring Freedom, or New Dawn (OEF/OIF), separated from service through fiscal year (FY) 2012, and had an initial VHA encounter in FY 2005 or later. Demographic and military service data were extracted from the official Department of Defense OEF/OIF roster file and included the following variables: age, sex (male, female), race/ethnicity (White, Black, Hispanic, Other/Unknown), education (no high school diploma/diploma equivalency, high school diploma, any college), marital status (never married, married, divorced/other), branch of service (Army, Navy/Coast Guard, Marines, Air Force), rank (enlisted, officer/warrant), and type of discharge (routine, misconduct). Clinical data were extracted from the VHA Managerial Cost Accounting National Data Extracts for fiscal years 2005 through 2015, and included outpatient and inpatient encounter records for clinics visited, types of treatment and clinical diagnoses received, and costs incurred. See Supplemental Table A1 for further description of data sources.

A retrospective cohort design was used to compare health status and healthcare characteristics between misconduct-discharged and routinely-discharged veterans. In order to address individual variability in the available length of follow-up in VHA clinical data, and to evaluate both the short- and long-term relationship between misconduct discharge and post-deployment health status and healthcare characteristics,

follow-up cohorts of 1 and 5 years were created. For health status outcomes, each period

of follow-up began on the date of each veteran's initial VHA encounter. Analyses were

conducted with R[16] and Stata[17] through VINCI, the VA's secure Informatics and

Computing Infrastructure research workspace.[18]

Discharge Type

The Department of Defense assigns every active duty service member an

Interservice Separation Code (ISC) upon discharge from the military. There are 72

separate ISCs, and codes are based on discharge classifications maintained by each

branch of the military, and indicate the circumstances related to separation from military

service. In the case of misconduct, these codes indicate the type of offense committed

that led to discharge from military service. Some misconduct offenses are deemed severe

enough to warrant an "other than honorable" character of discharge, including

dishonorable which, until 2017, generally constituted ineligibility for VHA benefits.

Many instances of misconduct lead to a "general" or "under honorable conditions"

character of discharge under which the veteran remained eligible for VHA benefits.

Health Status

Clinical diagnoses were retrieved from VHA administrative data using primary

ICD-9-CM codes recorded in outpatient and inpatient encounters. The enhanced

Elixhauser comorbidity index algorithm was used to create a set of 31 binary medical and

mental health diagnostic indicators (see Supplemental Table A2). This index was

designed to predict mortality and healthcare expenditures in large administrative

datasets.[19] For the present study, veterans who received one or more primary diagnosis within a given category were considered positive for that diagnosis.

Healthcare Utilization and Costs

For each cohort, utilization and costs were computed overall, and separately for inpatient and outpatient care. Inpatient care was further stratified into the following categories based on treatment specialty codes: psychiatric, substance use, and medical. Outpatient care was further stratified into the following categories based on stop code classifications: mental health, substance use, primary care, emergency department/urgent care, social work, medical specialty, diagnostic, homeless services, polytrauma (including TBI care), and other outpatient services (see Supplemental Table A3). Outpatient utilization was represented by encounter counts, and inpatient utilization was represented by counts of admitted days on record (bed days). Costs were represented by VHA direct and indirect healthcare production costs corresponding to care received over each administrative surveillance period. All costs were inflation adjusted to 2015 Consumer Price Index values.[20]

Data Analysis

Descriptive statistics for study covariates, diagnostic categories, encounters, and costs were computed overall and stratified by discharge type and sex. To address aims 1 and 2, a series of regression models were computed. For aim 1, logistic regression analysis was used to model the odds of each diagnostic outcome as a function of discharge type, with "routine" discharge as the referent. For aim 2, in order to account for

excess zeros due to non-utilization, outcomes were computed using two-part hurdle models. In these models, the odds for the presence of any utilization/costs in each treatment type were estimated, along with the expected rate of utilization/costs given any use of that treatment type.[21] For all outcomes, logistic regression was used for the binomial portion of the hurdle models. For the count process portion of the hurdle models, negative binomial regression was used to model utilization outcomes, and generalized linear modeling with a gamma distribution and log link was used to model cost outcomes. Total combined costs were modeled using generalized linear modeling with a gamma distribution and log link. Finally, the average adjusted marginal effect of a misconduct discharge versus a routine discharge was computed for utilization encounter count and cost outcomes.[22]

In all models for both aims, outcomes were modeled as a function of discharge type and demographic and military service covariates including age, education, marital status, race/ethnicity, branch of service, and rank. Because male and female veterans tend to have different patterns of health status and utilization, a term for the interaction between discharge type and sex was included. Due to the large number of statistical tests that were conducted in this study, an alpha level of .01 was used for significance testing. Given the very large sample, there was sufficient statistical power for these analyses. Adjusted odds ratios and their 99% confidence intervals were calculated for binomial outcomes, and adjusted rate ratios and their 99% confidence intervals were calculated for count outcomes.

Results

Table 3.1 presents a summary of the demographic and military service characteristics of the full sample, stratified by sex and discharge type. There were statistically significant differences by discharge type on all measured characteristics. Among both men and women, misconduct-discharged veterans tended to be younger, have lower levels of education, be unmarried, have served in the Army, and be of enlisted rank.

Health Status

Tables 3.2 and 3.3 present health status information corresponding to the 1-year and 5-year follow-up cohorts, and include the prevalence of diagnoses in each of the 31 Elixhauser diagnostic categories stratified by discharge type and sex. In the 1-year follow-up cohort, women with a misconduct discharge were significantly less likely to receive diagnoses in the category *Hypothyroidism*, but significantly more likely to receive diagnoses in categories *Other Neurological Disorders*, *Chronic Pulmonary Disease*, *Fluid and Electrolyte Disorders*, *Alcohol Abuse*, *Drug Abuse*, *Depression*, and *Psychoses*. Men were statistically less likely to receive diagnoses of *Uncomplicated Hypertension*, *Complicated Hypertension*, *Uncomplicated Diabetes*, *Hypothyroidism*, and *Obesity*, but statistically more likely to receive diagnoses in categories *Paralysis*, *Other Neurological Disorders*, *Chronic Pulmonary Disease*, *Liver Disease*, *AIDS/HIV*, *Weight Loss*, *Fluid and Electrolyte Disorders*, *Alcohol Abuse*, *Drug Abuse*, *Depression*, and *Psychoses.*

Table 3.1. Demographic and Military Service Characteristics of VHA-Enrolled Veterans of Active Duty OEF/OIF Service with a Routine or Misconduct Discharge and at Least One Year of Clinical Follow-Up

Variable	Women			Men		
	Routine N = 28,458	Misconduct N = 1,748	t / χ^2 p-value	Routine N=250,356	Misconduct N = 21,258	t / χ^2 p-value
Age	32.03 (8.54)	27.04 (5.41)	<.001	32.04 (8.77)	27.05 (4.84)	<.001
Race/ethnicity			<.001			<.001
White	13,486 (47.4%)	777 (44.5%)		156,948 (62.7%)	12,768 (60.1%)	
Black	8,242 (29%)	693 (39.6%)		36,272 (14.5%)	5,147 (24.2%)	
Hispanic	3,308 (11.6%)	161 (9.2%)		27,961 (11.2%)	2,250 (10.6%)	
Other/Unknown	3,422 (12%)	117 (6.7%)		29,175 (11.7%)	1,093 (5.1%)	
Marital Status			<.001			<.001
Never Married	15,778 (55.6%)	1,158 (66.6%)		137,034 (54.8%)	14,412 (67.9%)	
Married	10,559 (37.2%)	513 (29.5%)		106,831 (42.7%)	6,543 (30.8%)	
Divorced/Other	2,033 (7.2%)	69 (4%)		6,179 (2.5%)	276 (1.3%)	
Education			<.001			<.001
No HS Diploma/Equiv.	818 (2.9%)	209 (12.2%)		17,023 (6.9%)	4,648 (22.2%)	
HS Diploma	20,783 (74.3%)	1,336 (77.8%)		191,177 (77.6%)	14,957 (71.5%)	
Beyond HS	6,374 (22.8%)	173 (10.1%)		38,282 (15.5%)	1,308 (6.3%)	
Branch of Service			<.001			<.001
Army	11,208 (39.4%)	1,008 (57.7%)		104,178 (41.6%)	13,536 (63.7%)	
Marines	2,441 (8.6%)	57 (3.3%)		62,289 (24.9%)	1,972 (9.3%)	
Air Force	7,296 (25.6%)	335 (19.2%)		36,353 (14.5%)	1,949 (9.2%)	
Navy/Coast Guard	7,513 (26.4%)	348 (19.9%)		47,533 (19%)	3,801 (17.9%)	
Rank			<.001			<.001
Enlisted	25,823 (90.7%)	1,667 (95.4%)		233,005 (93.1%)	20,770 (97.7%)	
Officer/Warrant	2,635 (9.3%)	81 (4.6%)		17351 (6.9%)	488 (2.3%)	

Table 3.2. Health Status During the First Year of Treatment among VHA-Enrolled Veterans of Active Duty OEF/OIF Service with a Routine or Misconduct Discharge

Variable	Women			Men		
	Routine N=28,458 N (%)	Misconduct N=1,748 N (%)	t / χ^2 p-value	Routine N=250,356 N (%)	Misconduct N=21,258 N (%)	t / χ^2 p-value
Congestive Heart Failure	17 (0.1%)	1 (0.1%)	1.000	170 (0.1%)	15 (0.1%)	0.995
Cardiac Arrhythmias	233 (0.8%)	12 (0.7%)	0.645	2,346 (0.9%)	201 (0.9%)	0.932
Valvular Disease	47 (0.2%)	0 (0%)	0.165	300 (0.1%)	22 (0.1%)	0.575
Pulmonary Circulation Disorders	18 (0.1%)	1 (0.1%)	1.000	141 (0.1%)	13 (0.1%)	0.893
Peripheral Vascular Disorders	20 (0.1%)	0 (0%)	0.529	164 (0.1%)	9 (0%)	0.253
Hypertension, Uncomplicated	1,260 (4.4%)	61 (3.5%)	0.072	16,529 (6.6%)	964 (4.5%)	<.001
Hypertension, Complicated	7 (0%)	0 (0%)	1.000	86 (0%)	0 (0%)	0.012
Paralysis	9 (0%)	0 (0%)	0.976	121 (0%)	24 (0.1%)	<.001
Other Neurological Disorders	118 (0.4%)	20 (1.1%)	<.001	1,070 (0.4%)	229 (1.1%)	<.001
Chronic Pulmonary Disease	1,111 (3.9%)	86 (4.9%)	0.040	5,885 (2.4%)	546 (2.6%)	0.048
Diabetes, Uncomplicated	196 (0.7%)	9 (0.5%)	0.478	2,470 (1%)	101 (0.5%)	<.001
Diabetes, Complicated	12 (0%)	0 (0%)	0.810	184 (0.1%)	4 (0%)	0.009
Hypothyroidism	480 (1.7%)	18 (1%)	0.046	1,037 (0.4%)	51 (0.2%)	<.001
Renal Failure	6 (0%)	1 (0.1%)	0.878	230 (0.1%)	17 (0.1%)	0.664
Liver Disease	38 (0.1%)	3 (0.2%)	0.932	584 (0.2%)	68 (0.3%)	0.016
Peptic Ulcer Disease	22 (0.1%)	4 (0.2%)	0.094	215 (0.1%)	24 (0.1%)	0.248
AIDS/HIV	4 (0%)	1 (0.1%)	0.687	208 (0.1%)	56 (0.3%)	<.001
Lymphoma	9 (0%)	0 (0%)	0.976	101 (0%)	9 (0%)	1.000
Metastatic Cancer	5 (0%)	0 (0%)	1.000	54 (0%)	4 (0%)	0.985
Solid Tumor without Metastasis	124 (0.4%)	9 (0.5%)	0.765	668 (0.3%)	49 (0.2%)	0.387

(*table continues*)

Variable	Women			Men		
	Routine N=28,458 N (%)	Misconduct N=1,748 N (%)	t / χ^2 p-value	Routine N=250,356 N (%)	Misconduct N=21,258 N (%)	t / χ^2 p-value
Rheumatoid Arthritis/Collagen Vascular Diseases	140 (0.5%)	6 (0.3%)	0.489	465 (0.2%)	38 (0.2%)	0.885
Coagulopathy	27 (0.1%)	1 (0.1%)	0.922	152 (0.1%)	16 (0.1%)	0.499
Obesity	891 (3.1%)	48 (2.7%)	0.407	5323 (2.1%)	327 (1.5%)	<.001
Weight Loss	29 (0.1%)	4 (0.2%)	0.236	228 (0.1%)	40 (0.2%)	<.001
Fluid and Electrolyte Disorders	60 (0.2%)	10 (0.6%)	0.005	320 (0.1%)	46 (0.2%)	0.001
Blood Loss Anemia	8 (0%)	0 (0%)	1.000	5 (0%)	2 (0%)	0.180
Deficiency Anemia	153 (0.5%)	9 (0.5%)	1.000	144 (0.1%)	13 (0.1%)	0.950
Alcohol Abuse	349 (1.2%)	149 (8.5%)	<.001	8,314 (3.3%)	2,843 (13.4%)	<.001
Drug Abuse	172 (0.6%)	125 (7.2%)	<.001	3,751 (1.5%)	2,391 (11.2%)	<.001
Depression	150 (0.5%)	34 (1.9%)	<.001	1,489 (0.6%)	547 (2.6%)	<.001
Psychoses	6,985 (24.5%)	835 (47.8%)	<.001	67,163 (26.8%)	10,811 (50.9%)	<.001

Table 3.3. Health Status During the First Five Years of Treatment among VHA-enrolled Veterans of Active Duty OEF/OIF Service with a Routine or Misconduct Discharge

	Women			Men		
Variable	Routine $N = 20,835$ N (%)	Misconduct $N = 1,263$ N (%)	t / χ^2 p-value	Routine $N = 182,339$ N (%)	Misconduct $N = 14,170$ N (%)	t / χ^2 p-value
Congestive Heart Failure	34 (0.2%)	3 (0.2%)	0.785	324 (0.2%)	28 (0.2%)	0.662
Cardiac Arrhythmias	464 (2.2%)	30 (2.4%)	0.804	4,002 (2.2%)	381 (2.7%)	<.001
Valvular Disease	76 (0.4%)	4 (0.3%)	0.972	460 (0.3%)	29 (0.2%)	0.313
Pulmonary Circulation Disorders	37 (0.2%)	4 (0.3%)	0.436	220 (0.1%)	23 (0.2%)	0.217
Peripheral Vascular Disorders	40 (0.2%)	2 (0.2%)	1.000	354 (0.2%)	28 (0.2%)	1.000
Hypertension, Uncomplicated	1,658 (8%)	86 (6.8%)	0.157	21,623 (11.9%)	1,299 (9.2%)	<.001
Hypertension, Complicated	15 (0.1%)	1 (0.1%)	1.000	200 (0.1%)	15 (0.1%)	0.999
Paralysis	24 (0.1%)	1 (0.1%)	1.000	269 (0.1%)	42 (0.3%)	<.001
Other Neurological Disorders	212 (1%)	43 (3.4%)	<.001	1,972 (1.1%)	376 (2.7%)	<.001
Chronic Pulmonary Disease	1,642 (7.9%)	143 (11.3%)	<.001	8,993 (4.9%)	992 (7%)	<.001
Diabetes, Uncomplicated	389 (1.9%)	17 (1.3%)	0.218	4,285 (2.4%)	196 (1.4%)	<.001
Diabetes, Complicated	30 (0.1%)	0 (0%)	0.339	457 (0.3%)	28 (0.2%)	0.255
Hypothyroidism	826 (4%)	42 (3.3%)	0.289	1,783 (1%)	104 (0.7%)	0.005
Renal Failure	27 (0.1%)	1 (0.1%)	0.935	556 (0.3%)	43 (0.3%)	1.000
Liver Disease	103 (0.5%)	12 (1%)	0.047	1,519 (0.8%)	168 (1.2%)	<.001
Peptic Ulcer Disease	42 (0.2%)	8 (0.6%)	0.005	411 (0.2%)	56 (0.4%)	<.001
AIDS/HIV	11 (0.1%)	2 (0.2%)	0.366	237 (0.1%)	88 (0.6%)	<.001
Lymphoma	19 (0.1%)	0 (0%)	0.562	171 (0.1%)	13 (0.1%)	1.000
Metastatic Cancer	15 (0.1%)	3 (0.2%)	0.135	114 (0.1%)	13 (0.1%)	0.251
Solid Tumor without Metastasis	231 (1.1%)	18 (1.4%)	0.370	1,119 (0.6%)	70 (0.5%)	0.087

(*table continues*)

Variable	Women			Men		
	Routine $N=20,835$ N (%)	Misconduct $N=1,263$ N (%)	t/χ^2 p-value	Routine $N=182,339$ N (%)	Misconduct $N=14,170$ N (%)	t/χ^2 p-value
Rheumatoid Arthritis/Collagen Vascular Diseases	292 (1.4%)	14 (1.1%)	0.459	1,030 (0.6%)	90 (0.6%)	0.311
Coagulopathy	44 (0.2%)	5 (0.4%)	0.295	338 (0.2%)	26 (0.2%)	1.000
Obesity	1,854 (8.9%)	125 (9.9%)	0.248	10,164 (5.6%)	686 (4.8%)	<.001
Weight Loss	102 (0.5%)	15 (1.2%)	0.002	567 (0.3%)	82 (0.6%)	<.001
Fluid and Electrolyte Disorders	170 (0.8%)	15 (1.2%)	0.212	862 (0.5%)	130 (0.9%)	<.001
Blood Loss Anemia	31 (0.1%)	2 (0.2%)	1.000	26 (0%)	2 (0%)	1.000
Deficiency Anemia	383 (1.8%)	27 (2.1%)	0.510	403 (0.2%)	26 (0.2%)	0.407
Alcohol Abuse	604 (2.9%)	221 (17.5%)	<.001	13,557 (7.4%)	3,558 (25.1%)	<.001
Drug Abuse	363 (1.7%)	215 (17%)	<.001	7,666 (4.2%)	3,339 (23.6%)	<.001
Depression	308 (1.5%)	63 (5%)	<.001	2850 (1.6%)	838 (5.9%)	<.001
Psychoses	8,011 (38.4%)	855 (67.7%)	<.001	73,047 (40.1%)	9,566 (67.5%)	<.001

In the 5-year follow-up cohort, women with a misconduct discharge were significantly more likely to receive diagnoses in categories *Other Neurological Disorders, Chronic Pulmonary Disease, Liver Disease, Peptic Ulcer Disease, Weight Loss, Alcohol Abuse*, *Drug Abuse*, *Depression*, and *Psychoses*. Men were again statistically less likely to receive diagnoses in categories of *Hypertension, Uncomplicated, Diabetes, Uncomplicated, Hypothyroidism,* and *Obesity,* but statistically more likely to receive diagnoses in categories of *Cardiac Arrhythmias, Paralysis, Other Neurological Disorders, Chronic Pulmonary Disorders, Liver Disease, Peptic Ulcer Disease*, *AIDS/HIV*, *Weight Loss*, *Fluid and Electrolyte Disorders*, *Alcohol Abuse*, *Drug Abuse*, *Depression*, and *Psychoses.*

Results of logistic regression analyses predicting diagnoses in each cohort as a function of discharge type, sex, their interaction, and demographic and military service covariates are presented in Table 3.4. In the 1-year follow-up cohort, misconduct-discharged veterans had significantly higher odds for *Other Neurological Disorders* (adjusted odds ratios [AOR] = 2.4), *Fluid and Electrolyte Disorders* (AOR = 2.6), *Alcohol Abuse* (AOR = 6.2), *Drug Abuse* (AOR = 9.9), *Depression* (AOR=2.3), and *Psychoses* (AOR = 2.9).

In the 5-year follow-up cohort, misconduct-discharged veterans had significantly higher odds for diagnoses in categories *Uncomplicated Hypertension* (AOR = 1.4), *Other Neurological Disorders* (AOR = 3.0), *Liver Disease* (AOR = 2.92), *Peptic Ulcer Disease* (AOR = 4.9), *Alcohol Abuse* (AOR = 5.8), *Drug Abuse* (AOR = 7.8), *Depression* (AOR=2.7), and *Psychoses* (AOR = 2.9).

Table 3.4. Health Status as a Function of Discharge Type, Sex, and their Interaction among VHA-enrolled Veterans of Active Duty OEF/OIF Service with a Routine or Misconduct Discharge

Variable	Discharge Type (Misconduct vs Routine) 1-Year Cohort	Discharge Type (Misconduct vs Routine) 5-Year Cohort	Sex (Male vs Female) 1-Year Cohort	Sex (Male vs Female) 1-Year Cohort	Discharge Type*Sex 5-Year Cohort	Discharge Type*Sex 1-Year Cohort
			Adjusted Odds Ratio (99% CI)			
Congestive Heart Failure	1.80 (0.20, 7.20)	0.67 (0.01, 5.00)	1.14 (0.71, 1.95)	1.14 (0.71, 1.96)	0.81 (0.18, 7.72)	2.17 (0.26, 282.25)
Cardiac Arrhythmias	0.90 (0.48, 1.53)	0.95 (0.52, 1.59)	**1.15 (1.01, 1.33)**	0.94 (0.82, 1.08)	1.11 (0.64, 2.11)	1.47 (0.86, 2.73)
Valvular Disease	0.23 (0.00, 1.58)	1.23 (0.25, 3.66)	0.72 (0.53, 1.00)	0.74 (0.54, 1.06)	4.98 (0.67, 636.88)	0.89 (0.26, 4.62)
Pulmonary Circulation Disorders	1.65 (0.18, 6.58)	1.59 (0.17, 6.35)	0.86 (0.53, 1.48)	0.60 (0.36, 1.05)	0.72 (0.16, 6.92)	1.03 (0.21, 10.08)
Peripheral Vascular Disorders	0.62 (0.00, 4.58)	1.55 (0.17, 5.99)	0.90 (0.57, 1.50)	0.82 (0.54, 1.29)	1.76 (0.21, 230.64)	0.93 (0.21, 8.78)
Hypertension, Uncomplicated	1.16 (0.88, 1.50)	**1.41 (1.02, 1.89)**	**1.61 (1.51, 1.71)**	**1.59 (1.48, 1.72)**	0.87 (0.67, 1.16)	0.79 (0.58, 1.09)
Hypertension, Complicated	1.46 (0.01, 12.24)	4.41 (0.47, 19.89)	1.20 (0.59, 2.80)	1.43 (0.74, 3.15)	0.07 (0.00, 14.03)	0.25 (0.04, 2.67)
Paralysis	0.92 (0.01, 7.26)	0.66 (0.01, 4.98)	1.17 (0.63, 2.45)	1.16 (0.69, 2.15)	2.62 (0.31, 343.04)	3.92 (0.49, 507.82)
Other Neurological Disorders	**2.35 (1.39, 3.77)**	**2.98 (1.81, 4.67)**	0.94 (0.78, 1.15)	0.99 (0.81, 1.21)	0.98 (0.60, 1.69)	0.74 (0.46, 1.25)
Chronic Pulmonary Disease	1.21 (0.96, 1.51)	1.30 (0.99, 1.68)	**0.6 (0.56, 0.64)**	**0.58 (0.54, 0.63)**	0.84 (0.66, 1.08)	1.05 (0.79, 1.40)
Diabetes, Uncomplicated	1.54 (0.74, 2.81)	1.06 (0.43, 2.15)	**1.47 (1.26, 1.71)**	**1.23 (1.06, 1.44)**	0.64 (0.34, 1.35)	1.21 (0.58, 3.03)
Diabetes, Complicated	1.18 (0.01, 9.05)	1.18 (0.01, 8.87)	1.57 (0.91, 2.97)	**1.91 (1.15, 3.42)**	0.51 (0.05, 69.72)	1.41 (0.17, 183.82)
Hypothyroidism	0.78 (0.46, 1.22)	1.18 (0.76, 1.75)	**0.23 (0.21, 0.26)**	**0.21 (0.19, 0.24)**	0.88 (0.51, 1.58)	0.73 (0.44, 1.24)

(*table continues*)

Variable	Discharge Type (Misconduct vs Routine)		Sex (Male vs Female)		Discharge Type*Sex	
	1-Year Cohort	5-Year Cohort	1-Year Cohort	1-Year Cohort	5-Year Cohort	1-Year Cohort
			Adjusted Odds Ratio (99% CI)			
Renal Failure	4.50 (0.47, 21.52)	2.93 (0.32, 12.25)	**4.19 (2.07, 10.24)**	**2.44 (1.43, 4.58)**	0.23 (0.04, 2.27)	0.54 (0.12, 5.10)
Liver Disease	1.23 (0.25, 3.67)	**2.92 (1.24, 5.97)**	**1.69 (1.22, 2.41)**	**1.55 (1.17, 2.11)**	1.16 (0.38, 5.76)	0.44 (0.21, 1.08)
Peptic Ulcer Disease	3.18 (1.00, 8.09)	**4.86 (1.86, 11.05)**	1.06 (0.69, 1.72)	1.07 (0.71, 1.70)	0.38 (0.14, 1.31)	**0.31 (0.12, 0.87)**
AIDS/HIV	4.60 (0.46, 24.97)	2.45 (0.26, 10.73)	**7.89 (3.48, 23.73)**	**1.91 (1.03, 4.00)**	0.55 (0.10, 5.53)	1.60 (0.35, 15.31)
Lymphoma	0.91 (0.01, 7.26)	0.77 (0.01, 5.97)	1.25 (0.67, 2.63)	1.05 (0.59, 2.08)	1.24 (0.13, 165.12)	1.56 (0.17, 208.18)
Metastatic Cancer	2.01 (0.02, 19.07)	3.90 (0.41, 17.61)	1.41 (0.59, 4.36)	1.01 (0.51, 2.26)	0.53 (0.04, 74.19)	0.35 (0.06, 3.74)
Solid Tumor without Metastasis	1.77 (0.85, 3.27)	1.13 (0.46, 2.31)	**0.60 (0.49, 0.74)**	**0.49 (0.40, 0.59)**	0.68 (0.34, 1.49)	1.03 (0.46, 2.68)
Rheumatoid Arthritis/Collagen Vascular Diseases	0.96 (0.39, 1.97)	1.47 (0.70, 2.72)	**0.38 (0.31, 0.46)**	**0.45 (0.37, 0.55)**	1.20 (0.54, 3.11)	0.77 (0.38, 1.71)
Coagulopathy	0.91 (0.10, 3.50)	2.52 (0.50, 8.13)	**0.62 (0.41, 0.97)**	1.18 (0.72, 2.04)	1.40 (0.32, 13.12)	0.51 (0.14, 2.73)
Obesity	0.86 (0.63, 1.14)	1.25 (0.95, 1.62)	**0.69 (0.64, 0.75)**	**0.58 (0.54, 0.63)**	0.77 (0.57, 1.07)	**0.68 (0.51, 0.91)**
Weight Loss	1.37 (0.37, 3.66)	1.59 (0.58, 3.55)	0.79 (0.54, 1.20)	**0.64 (0.47, 0.88)**	1.10 (0.39, 4.24)	0.96 (0.4, 2.76)
Fluid and Electrolyte Disorders	**2.57 (1.21, 4.90)**	1.69 (0.77, 3.25)	**0.60 (0.45, 0.80)**	**0.58 (0.46, 0.75)**	0.63 (0.31, 1.42)	1.04 (0.51, 2.38)
Blood Loss Anemia	1.27 (0.01, 11.23)	3.26 (0.63, 11.11)	**0.07 (0.02, 0.24)**	**0.13 (0.06, 0.27)**	5.92 (0.37, 887.80)	0.50 (0.04, 4.27)
Deficiency Anemia	0.78 (0.34, 1.53)	1.36 (0.75, 2.27)	**0.13 (0.10, 0.16)**	**0.13 (0.10, 0.16)**	1.28 (0.51, 3.42)	0.61 (0.27, 1.37)

(*table continues*)

Variable	Discharge Type (Misconduct vs Routine)		Sex (Male vs Female)		Discharge Type*Sex	
	1-Year Cohort	5-Year Cohort	1-Year Cohort	1-Year Cohort	5-Year Cohort	1-Year Cohort
	Adjusted Odds Ratio (99% CI)					
Alcohol Abuse	**6.16** **(5.02, 7.53)**	**5.75** **(4.48, 7.33)**	**2.31** **(2.07, 2.58)**	**2.25** **(2.00, 2.54)**	**0.65** **(0.53, 0.81)**	**0.68** **(0.53, 0.88)**
Drug Abuse	**9.92** **(7.79, 12.62)**	**7.79** **(5.91, 10.22)**	**2.18** **(1.87, 2.57)**	**2.29** **(1.96, 2.68)**	**0.68** **(0.53, 0.87)**	**0.69** **(0.52, 0.92)**
Depression	**2.26** **(2.04, 2.50)**	**2.66** **(2.22, 3.19)**	**0.93** **(0.90, 0.96)**	**0.92** **(0.88, 0.97)**	1.05 (0.95, 1.17)	0.94 (0.78, 1.13)
Psychoses	**2.87** **(1.91, 4.19)**	**2.93** **(1.92, 4.33)**	1.18 (1.00, 1.42)	1.11 (0.94, 1.32)	1.22 (0.83, 1.86)	1.09 (0.72, 1.69)

The effect of discharge type on diagnoses varied between men and women for several outcomes. In the 1-year cohort, the risk conferred by a misconduct discharge for diagnoses in both categories *Alcohol Abuse* and *Drug Abuse* was differentially stronger among women relative to men (AOR = 0.65 and 0.68, respectively for the interaction effects). Similarly, in the 5-year follow-up cohort, the risk conferred by a misconduct discharge for diagnoses in categories *Peptic Ulcer Disease*, *Alcohol Abuse*, and *Drug Abuse* was differentially strong among women relative to men (AOR = 0.31, 0.62, and 0.69, respectively for the interaction effects).

Health Care Utilization and Costs

Mean health care utilization and costs by discharge type and sex and the adjusted incremental effect of a misconduct versus a routine discharge on each treatment type are presented in the following sections. Also provided are the adjusted odds ratios and adjusted rate ratios and their confidence intervals for the binomial and count portions of the hurdle models for both follow-up cohorts, including effects for discharge type, sex, and their interaction. Virtually all veterans with utilization of a given treatment type also incurred costs in that category, so the results for the binomial portion of the utilization and cost outcome models are identical.

One-year follow-up cohort. In the binomial portion of these models, a misconduct discharge was associated with significantly higher odds for utilization of every treatment type except for primary care, diagnostic, and medical specialty. AORs were highest for outpatient and inpatient substance use treatment, inpatient psychiatric, and homeless services (AOR = 6.2, 20.5, 5.6, and 6.2, respectively). Misconduct

discharge was also associated with 1.5-2.8 times higher odds for utilization of outpatient mental health, emergency department, social work, outpatient mental health, and inpatient medical. Conversely, the odds for utilization of primary care were 1.4 times higher among routinely discharged veterans relative to misconduct discharged veterans.

In count process models for utilization conditional on having any encounters, misconduct discharge was associated 43% more outpatient encounters, 239% more inpatient bed days, and 60% higher costs overall, with a significantly higher conditional rate of encounters and costs for most outpatient treatment types. While effects were largely similar between men and women, misconduct discharge conferred greater odds for any utilization of both outpatient and inpatient substance use treatment among women relative to men (AOR = 0.7 and 0.5, respectively, for the interaction effects), and a differentially greater increase in the rate of outpatient substance use treatment among women relative to men (ARR = 0.5).

Overall, the incremental effect of a misconduct discharge relative to routine discharge on utilization was 7.9 outpatient encounters, 2.3 inpatient bed days, and $3,039 for women, and 7.5 outpatient encounters, 3.4 inpatient bed days, and $4,061 for men. The comparison between men and women for the incremental effect of misconduct discharge varied across treatment types; while differentially larger among women for primary care and homeless services, it was differentially larger among men for inpatient psychiatric services and overall inpatient bed days. Means, incremental effects, and their comparisons for utilization and costs in the 1-year follow-up cohort are presented in full in Tables 3.5 and 3.6, respectively.

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Table 3.5. Observed Inpatient and Outpatient Service Utilization by Discharge Type, Adjusted Differences in Utilization for a Misconduct Discharge Relative to a Routine Discharge, and Comparison of Adjusted Differences Between Men and Women U.S. Veterans of Active Duty OEF/OIF Service Over 1 Year of VHA Treatment

	Women			Men			Comparison of Incremental Effects (Discharge Type*Sex)
	Average Encounters (1% margin of error)		Incremental Effect (1% margin of error)	Average Encounters (1% margin of error)		Incremental Effect (1% margin of error)	
	Routine	Misconduct	Difference	Routine	Misconduct	Difference	χ² p-value
Variable	N = 28,458	N = 1,748		N = 250,356	N = 21,258		
Outpatient Services (Encounters Counts)							
Mental Health	2.1 (0.1)	4.4 (0.6)	1.8 (0.4)	2.2 (0.0)	4.5 (0.2)	1.8 (0.1)	0.760
Substance Use	0.1 (0.0)	1.3 (0.5)	1.1 (0.3)	0.3 (0.0)	1.6 (0.2)	1.1 (0.1)	0.729
Primary Care	3.2 (0.0)	3.8 (0.2)	0.5 (0.3)	2.4 (0.0)	2.8 (0.1)	0.3 (0.1)	0.198
Emergency	0.3 (0.0)	0.7 (0.1)	0.3 (0.1)	0.3 (0.0)	0.7 (0.0)	0.3 (0.0)	0.580
Homeless	0.1 (0.0)	1.0 (0.3)	0.7 (0.2)	0.1 (0.0)	0.5 (0.1)	0.3 (0.0)	<.001
Social Work	0.3 (0.0)	0.7 (0.1)	0.3 (0.1)	0.4 (0.0)	0.8 (0.0)	0.3 (0.0)	0.152
Diagnostic	3.8 (0.1)	4.8 (0.3)	0.9 (0.4)	2.9 (0.0)	3.8 (0.1)	0.7 (0.1)	0.286
Medical Specialty	0.7 (0.0)	0.6 (0.1)	0.0 (0.1)	0.6 (0.0)	0.6 (0.0)	0.0 (0.0)	0.909
Other	7.1 (0.1)	9.9 (0.8)	2.4 (0.7)	5.5 (0.0)	8.2 (0.2)	2.2 (0.2)	0.584
Total Outpatient	18.1 (0.3)	27.9 (2.0)	7.9 (1.7)	15.2 (0.1)	24.4 (0.5)	7.5 (0.4)	0.547
Inpatient Services (Bed Days)							
Psychiatric	0.1 (0)	1.1 (0.9)	0.7 (0.3)	0.2 (0.0)	1.7 (0.2)	1.1 (0.1)	0.004
Substance Use	0.0 (0.0)	0.5 (0.4)	0.5 (0.4)	0.1 (0.0)	0.8 (0.1)	0.6 (0.1)	0.409
Medical	0.1 (0.1)	1.5 (1.1)	1.2 (0.6)	0.2 (0.0)	2.3 (0.3)	1.6 (0.2)	0.097
Total Inpatient	0.3 (0.1)	3.2 (1.6)	2.3 (0.8)	0.6 (0.0)	4.8 (0.5)	3.4 (0.3)	0.001

Notes: Incremental effects are adjusted for age, education (high school, post-high school), marital status (married, never married, divorced/other), race/ethnicity (White, Black, Hispanic, Other, Unknown), rank (enlisted, officer, warrant), and branch of service (Army, Navy/Coast Guard, Marines, Air Force).

Table 3.6. Observed Inpatient and Outpatient Costs by Discharge Type, Adjusted Differences in Utilization for a Misconduct Discharge Relative to a Routine Discharge, and Comparison of Adjusted Differences Between Men and Women U.S. Veterans of Active Duty OEF/OIF Service over 1 Year of VHA Treatment

	Women			Men			Comparison of Incremental Effects (Discharge Type*Sex) χ^2 p-value
	Average Costs (1% margin of error)		Incremental Effect (1% margin of error)	Average Costs (1% margin of error)		Incremental Effect (1% margin of error)	
Variable	Routine $N = 20,835$	Misconduct $N = 1,263$	Difference	Routine $N = 182,339$	Misconduct $N = 14,170$	Difference	
Outpatient Services							
Mental Health	$622 ($26)	$1,350 ($182)	$544 ($169)	$662 ($9)	$1,375 ($53)	$549 ($50)	0.944
Substance Use	$19 ($5)	$224 ($97)	$180 ($94)	$45 ($3)	$280 ($29)	$199 ($29)	0.625
Primary Care	$1,177 ($18)	$1,373 ($119)	$177 ($90)	$925 ($5)	$1,046 ($22)	$103 ($21)	0.041
Emergency	$145 ($7)	$365 ($52)	$148 ($42)	$141 ($2)	$351 ($14)	$136 ($12)	0.500
Homeless	$30 ($11)	$253 ($80)	$163 ($72)	$17 ($1)	$137 ($15)	$79 ($13)	0.002
Social Work	$106 ($8)	$227 ($43)	$85 ($44)	$122 ($3)	$285 ($20)	$115 ($16)	0.090
Diagnostic	$718 ($15)	$821 ($59)	$117 ($74)	$570 ($4)	$649 ($16)	$87 ($18)	0.311
Medical Specialty	$244 ($11)	$240 ($47)	$20 ($69)	$243 ($5)	$233 ($15)	$10 ($20)	0.714
Other	$1,528 ($1,016)	$1,650 ($424)	$101 ($1,212)	$967 ($29)	$1,271 ($51)	$222 ($274)	0.800
Total Outpatient	$4,698 ($1,019)	$6,694 ($657)	$1,612 ($1574)	$3,905 ($38)	$5,989 ($140)	$1,667 ($412)	0.930

(*table continues*)

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| | Women | | | Men | | | Comparison of Incremental Effects (Discharge Type*Sex) χ² p-value |
| | Average Costs (1% margin of error) | | Incremental Effect (1% margin of error) | Average Costs (1% margin of error) | | Incremental Effect (1% margin of error) | |
Variable	Routine N = 20,835	Misconduct N = 1,263	Difference	Routine N = 182,339	Misconduct N = 14,170	Difference	
Inpatient Services							
Psychiatric	$131 ($38)	$1,003 ($536)	$618 ($358)	$240 ($18)	$1,722 ($178)	$1,099 ($160)	0.001
Substance Use	$16 ($11)	$302 ($188)	$291 ($229)	$48 ($8)	$413 ($64)	$348 ($78)	0.534
Medical	$162 ($44)	$847 ($477)	$490 ($595)	$299 ($41)	$1,263 ($197)	$801 ($263)	0.212
Total Inpatient	$309 ($65)	$2,151 ($878)	$1,381 ($835)	$587 ($46)	$3,398 ($296)	$2,250 ($359)	0.012
Overall	$5,007 (1,022)	$8,845 ($1,167)	$3,039 ($2,096)	$4,491 ($63)	$9,387 ($357)	$4,061 ($654)	.0228

Notes: Incremental effects are adjusted for age, education (high school, post-high school), marital status (married, never married, divorced/other), race/ethnicity (White, Black, Hispanic, Other, Unknown), rank (enlisted, officer, warrant), and branch of service (Army, Navy/Coast Guard, Marines, Air Force).

Five-year follow-up cohort. Results for the binomial portion of models for the 5-year follow-up cohort were largely similar to those seen in the 1-year cohort. A misconduct discharge was associated with significantly higher odds for utilization except for primary care, diagnostic, and medical specialty. Odds ratios were again highest for outpatient and inpatient substance use treatment, inpatient psychiatric, and homeless services (adjusted odds ratio range was 4.3-12.5).

In count process models for utilization conditional on having any encounters, misconduct discharge was associated 63% more outpatient encounters, 236% more inpatient bed days, and 86% higher costs overall, again with a significantly higher conditional rate of encounters and costs for most outpatient treatment types. Overall, the incremental effect of a misconduct discharge relative to routine discharge on utilization was 44.4 outpatient encounters, 6.9 inpatient bed days, and $14,422 for women, and 36.2 outpatient encounters, 11.0 inpatient bed days, and $16,106 for men. Similar to the pattern seen in the 1-year cohort, the incremental effect of misconduct discharge was differentially larger among women for primary care and homeless services, and differentially larger among men for all inpatient treatment. Means, incremental effects, and their comparisons for utilization and costs in the 5-year follow-up cohort are presented in full in Tables 3.7 and 3.8, respectively. Finally, adjusted odds and rate ratios for both portions of hurdle models for utilization and costs for both follow-up cohorts are presented in Table 3.9.

Table 3.7. Observed Inpatient and Outpatient Service Utilization by Discharge Type, Adjusted Differences in Utilization for a Misconduct Discharge Relative to a Routine Discharge, and Comparison of Adjusted Differences Between Men and Women U.S. Veterans of Active Duty OEF/OIF Service over 5 Years of VHA Treatment

	Women			Men			Comparison of Incremental Effects (Discharge Type*Sex) χ^2 p-value
	Average Encounters (1% margin of error)		Incremental Effect (1% margin of error) Difference	Average Encounters (1% margin of error)		Incremental Effect (1% margin of error) Difference	
Variable	Routine N=20,835	Misconduct N=1,263		Routine N=182,339	Misconduct N=14,170		
Outpatient Services (Encounters Counts)							
Mental Health	7.9 (0.4)	18.5 (2.6)	7.1 (2.0)	7.5 (0.1)	17.1 (0.7)	8.1 (0.7)	0.297
Substance Use	0.4 (0.1)	5.9 (2.1)	4.6 (1.6)	1.1 (0.1)	6.8 (0.7)	4.8 (0.5)	0.620
Primary Care	10.7 (0.2)	14.2 (1)	3.0 (1.5)	7.0 (0.0)	9.3 (0.2)	1.9 (0.3)	0.012
Emergency	1.2 (0.0)	2.9 (0.3)	1.3 (0.4)	1.0 (0.0)	2.6 (0.1)	1.1 (0.1)	0.398
Homeless	0.6 (0.1)	6.1 (1.4)	2.6 (1.0)	0.3 (0.0)	2.6 (0.2)	1.2 (0.2)	<.001
Social Work	0.6 (0.0)	2.1 (0.5)	0.9 (0.3)	0.8 (0.0)	2.4 (0.2)	1.0 (0.1)	0.418
Diagnostic	12.2 (0.2)	17.6 (1.3)	4.7 (1.9)	8.1 (0.1)	12.4 (0.3)	4.0 (0.5)	0.064
Medical Specialty	2.6 (0.1)	2.9 (0.4)	0.5 (0.5)	2.1 (0.0)	2.3 (0.1)	0.4 (0.2)	0.266
Other	30.6 (0.8)	47.7 (4.2)	14.3 (5.2)	22.4 (0.2)	35.6 (1.1)	13.4 (1.3)	0.668
Total Outpatient	68.4 (1.5)	120.4 (9.9)	44.4 (8.5)	52.4 (0.4)	93.8 (2.6)	36.2 (2.0)	0.016
Inpatient Services (Bed Days)							
Psychiatric	0.5 (0.1)	4.1 (1.7)	2.4 (0.9)	1.1 (0.1)	6.6 (0.6)	4.1 (0.4)	<.001
Substance Use	0.1 (0.1)	1.7 (0.8)	1.3 (0.8)	0.4 (0.0)	2.8 (0.3)	2.1 (0.3)	0.017
Medical	0.5 (0.1)	4.5 (2.4)	3.2 (1.2)	1.0 (0.1)	7.1 (0.8)	4.9 (0.5)	0.001
Total Inpatient	1.2 (0.2)	10.4 (3.5)	6.9 (1.8)	2.4 (0.1)	16.4 (1.3)	11.0 (0.8)	<.001

Notes: Incremental effects are adjusted for age, education (high school, post-high school), marital status (married, never married, divorced/other), race/ethnicity (White, Black, Hispanic, Other, Unknown), rank (enlisted, officer, warrant), and branch of service (Army, Navy/Coast Guard, Marines, Air Force).

Table 3.8. Observed Inpatient and Outpatient Costs by Discharge Type, Adjusted Differences in Utilization for a Misconduct Discharge Relative to a Routine Discharge, and Comparison of Adjusted Differences Between Men and Women U.S. Veterans of Active Duty OEF/OIF Service over 5 Years of VHA Treatment

	Women			Men			Comparison of Incremental Effects (Discharge Type*Sex) χ^2 p-value
	Average Costs (1% margin of error)		Incremental Effect (1% margin of error)	Average Costs (1% margin of error)		Incremental Effect (1% margin of error)	
Variable	Routine N=28,458	Misconduct N=1,748	Difference	Routine N=250,356	Misconduct N=21,258	Difference	
Outpatient Services							
Mental Health	$2,266 ($107)	$5,452 ($790)	$2,442 ($750)	$2,156 ($33)	$4,937 ($205)	$2,179 ($320)	0.381
Substance Use	$72 ($15)	$978 ($390)	$693 ($310)	$202 ($12)	$1,181 ($116)	$766 ($146)	0.560
Primary Care	$3,319 ($65)	$4,491 ($374)	$1,019 ($349)	$2,210 ($14)	$2,870 ($65)	$543 ($99)	<.001
Emergency	$621 ($26)	$1,561 ($199)	$646 ($175)	$559 ($8)	$1,439 ($60)	$580 ($68)	0.349
Homeless	$154 ($30)	$1,566 ($372)	$976 ($386)	$97 ($8)	$739 ($68)	$391 ($71)	<.001
Social Work	$209 ($18)	$693 ($158)	$346 ($198)	$272 ($10)	$808 ($112)	$373 ($69)	0.739
Diagnostic	$2,119 ($47)	$2,795 ($217)	$629 ($281)	$1,392 ($12)	$1,942 ($53)	$498 ($89)	0.238
Medical Specialty	$942 ($46)	$1,088 ($205)	$242 ($257)	$802 ($16)	$887 ($47)	$145 ($97)	0.347
Other	$4,787 ($1,394)	$6,944 ($1,310)	$1,847 ($2,550)	$3,172 ($63)	$5,172 ($199)	$1,756 ($1,092)	0.928
Total Outpatient	$14,889 ($1,431)	$26,261 ($2,530)	$9,162 ($3,726)	$11,470 ($115)	$20,948 ($596)	$7,793 ($907)	0.356

(*table continues*)

| | Women | | | Men | | | Comparison of Incremental Effects (Discharge Type*Sex) χ^2 p-value |
| | Average Costs (1% margin of error) | | Incremental Effect (1% margin of error) | Average Costs (1% margin of error) | | Incremental Effect (1% margin of error) | |
Variable	Routine N=28,458	Misconduct N=1,748	Difference	Routine N=250,356	Misconduct N=21,258	Difference	
Inpatient Services							
Psychiatric	$577 ($128)	$4,067 ($1,316)	$2,338 ($1,068)	$1,085 ($61)	$6,434 ($548)	$3,875 ($785)	0.001
Substance Use	$81 ($37)	$1,014 ($458)	$755 ($448)	$220 ($21)	$1,635 ($198)	$1,214 ($303)	0.014
Medical	$823 ($167)	$3,491 ($1,960)	$2,231 ($1,870)	$1,127 ($95)	$4,434 ($535)	$2,837 ($1,148)	0.430
Total Inpatient	$1,481 ($229)	$8,573 ($2,796)	$5,336 ($2,444)	$2,432 ($124)	$12,503 ($921)	$8,040 ($1,052)	0.008
Overall	$16,371 ($1,466)	$34,834 ($4,384)	$14,422 ($5,790)	$13,902 ($197)	$33,452 ($1,302)	$16,106 ($2,947)	0.470

Notes: Incremental effects are adjusted for age, education (high school, post-high school), marital status (married, never married, divorced/other), race/ethnicity (White, Black, Hispanic, Other, Unknown), rank (enlisted, officer, warrant), and branch of service (Army, Navy/Coast Guard, Marines, Air Force). Bold indicates statistical significance, $p < 0.01$ for the adjusted difference in utilization associated with a routine discharge relative to a misconduct discharge.

Table 3.9. Results of Regression Models for VHA Health Care Utilization and Costs as a Function of Discharge Type, Sex, and Their Interaction among U.S. Veterans of Active Duty OEF/OIF Service over 1 and 5 years of VHA Treatment

Variable	Discharge Type (Misconduct vs Routine)		Sex (Male vs Female)		Discharge Type*Sex	
	1-Year Cohort	5-Year Cohort	1-Year Cohort	1-Year Cohort	5-Year Cohort	1-Year Cohort
	Binomial Portion of Hurdle Models for both Utilization and Cost Outcomes—Adjusted Odds Ratio (99% CI)					
Outpatient Services						
Mental Health	**1.89** **(1.65, 2.17)**	**2.37** **(1.95, 2.88)**	**0.93** **(0.90, 0.96)**	**0.91** **(0.87, 0.95)**	1.08 (0.94, 1.25)	0.98 (0.80, 1.19)
Substance Use	**6.24** **(4.81, 8.08)**	**5.52** **(4.48, 6.81)**	**1.93** **(1.67, 2.22)**	**1.75** **(1.57, 1.94)**	**0.72** **(0.55, 0.94)**	**0.74** **(0.59, 0.91)**
Primary Care	**0.74** **(0.59, 0.92)**	**0.66** **(0.47, 0.93)**	**0.73** **(0.69, 0.78)**	**0.72** **(0.65, 0.80)**	0.90 (0.72, 1.13)	0.96 (0.67, 1.37)
Emergency Department	**1.80** **(1.56, 2.07)**	**1.85** **(1.58, 2.16)**	0.99 (0.95, 1.04)	**0.90** **(0.86, 0.94)**	1.00 (0.86, 1.16)	1.02 (0.86, 1.20)
Homeless	**6.15** **(4.87, 7.78)**	**5.52** **(4.55, 6.71)**	0.89 (0.78, 1.02)	0.92 (0.84, 1.02)	0.84 (0.66, 1.08)	**0.78** **(0.63, 0.95)**
Social Work	**1.46** **(1.27, 1.69)**	**1.62** **(1.39, 1.90)**	1.00 (0.96, 1.04)	1.00 (0.95, 1.04)	1.02 (0.88, 1.18)	1.05 (0.89, 1.24)
Diagnostic	1.03 (0.85, 1.25)	1.37 (0.97, 1.95)	**0.80** **(0.76, 0.84)**	**0.85** **(0.79, 0.91)**	0.94 (0.77, 1.15)	0.73 (0.51, 1.05)
Medical Specialty	0.97 (0.84, 1.12)	1.14 (0.98, 1.33)	**0.95** **(0.91, 0.98)**	**0.86** **(0.83, 0.90)**	1.01 (0.87, 1.18)	0.99 (0.84, 1.16)
Other	**1.23** **(1.02, 1.48)**	**1.61** **(1.19, 2.19)**	**0.83** **(0.80, 0.87)**	**0.91** **(0.86, 0.97)**	0.98 (0.81, 1.19)	0.78 (0.57, 1.06)
Inpatient Services						
Psychiatric	**5.60** **(4.00, 7.86)**	**4.34** **(3.38, 5.59)**	**1.61** **(1.33, 1.95)**	**1.35** **(1.20, 1.53)**	0.84 (0.59, 1.18)	0.92 (0.71, 1.19)
Substance Use	**20.47** **(8.98, 46.67)**	**12.52** **(7.40, 21.18)**	**2.96** **(1.56, 5.61)**	**2.45** **(1.70, 3.54)**	**0.43** **(0.18, 0.98)**	**0.52** **(0.31, 0.90)**

(*table continues*)

Variable	Discharge Type (Misconduct vs Routine)		Sex (Male vs Female)		Discharge Type*Sex	
	1-Year Cohort	5-Year Cohort	1-Year Cohort	1-Year Cohort	5-Year Cohort	1-Year Cohort
Medical	**2.84** **(1.95, 4.14)**	**2.40** **(1.86, 3.09)**	**1.18** **(1.01, 1.39)**	0.93 (0.85, 1.02)	1.05 (0.71, 1.55)	1.12 (0.86, 1.46)
Total Inpatient	**4.05** **(3.12, 5.25)**	**3.16** **(2.59, 3.85)**	**1.39** **(1.23, 1.58)**	1.08 (1.00, 1.17)	0.95 (0.73, 1.24)	1.07 (0.87, 1.32)
	Count Portion of Hurdle Models for Utilization Outcomes - Adjusted Rate Ratio (99% CI)					
Outpatient Services						
Mental Health	**1.38** **(1.27, 1.51)**	**1.57** **(1.44, 1.71)**	**0.94** **(0.91, 0.96)**	**0.86** **(0.84, 0.88)**	0.98 (0.90, 1.08)	1.01 (0.92, 1.11)
Substance Use	**1.75** **(1.35, 2.27)**	**2.49** **(2.05, 3.02)**	1.02 (0.87, 1.18)	**1.40** **(1.26, 1.55)**	**0.74** **(0.57, 0.97)**	**0.60** **(0.49, 0.73)**
Primary Care	**1.17** **(1.08, 1.26)**	**1.30** **(1.20, 1.41)**	**0.76** **(0.75, 0.78)**	**0.65** **(0.64, 0.66)**	1.01 (0.93, 1.09)	1.00 (0.92, 1.09)
Emergency Department	**1.25** **(1.08, 1.44)**	**1.42** **(1.27, 1.59)**	**0.94** **(0.90, 0.99)**	**0.91** **(0.88, 0.95)**	0.98 (0.85, 1.13)	1.00 (0.89, 1.12)
Homeless	**1.43** **(1.13, 1.82)**	**1.86** **(1.57, 2.21)**	**0.74** **(0.64, 0.86)**	**0.75** **(0.68, 0.83)**	0.86 (0.67, 1.10)	**0.76** **(0.63, 0.91)**
Social Work	**1.40** **(1.21, 1.62)**	**1.91** **(1.68, 2.17)**	**1.07** **(1.02, 1.12)**	**1.14** **(1.09, 1.19)**	1.00 (0.87, 1.16)	0.88 (0.77, 1.01)
Diagnostic	**1.23** **(1.14, 1.32)**	**1.36** **(1.26, 1.47)**	**0.77** **(0.76, 0.79)**	**0.66** **(0.64, 0.67)**	1.03 (0.95, 1.11)	1.07 (0.99, 1.16)
Medical Specialty	1.03 (0.89, 1.19)	1.12 (1.00, 1.26)	1.00 (0.97, 1.04)	**0.90** **(0.87, 0.93)**	1.00 (0.86, 1.16)	0.96 (0.86, 1.08)
Other	**1.29** **(1.20, 1.39)**	**1.45** **(1.34, 1.57)**	**0.76** **(0.74, 0.77)**	**0.68** **(0.67, 0.69)**	1.05 (0.97, 1.13)	1.05 (0.97, 1.14)
Total Outpatient	**1.43** **(1.34, 1.53)**	**1.63** **(1.51, 1.76)**	**0.79** **(0.78, 0.81)**	**0.71** **(0.70, 0.73)**	1.04 (0.97, 1.12)	1.03 (0.95, 1.12)

(table continues)

Variable	Discharge Type (Misconduct vs Routine)		Sex (Male vs Female)		Discharge Type*Sex	
	1-Year Cohort	5-Year Cohort	1-Year Cohort	1-Year Cohort	5-Year Cohort	1-Year Cohort
Inpatient Services						
Psychiatric	1.24 (0.87, 1.75)	**1.37** **(1.08, 1.75)**	0.93 (0.76, 1.14)	**1.19** **(1.04, 1.35)**	1.07 (0.75, 1.53)	0.97 (0.76, 1.25)
Substance Use	1.12 (0.48, 2.60)	0.95 (0.56, 1.61)	0.97 (0.50, 1.87)	0.96 (0.66, 1.40)	0.95 (0.40, 2.24)	1.12 (0.65, 1.91)
Medical	**3.78** **(2.57, 5.56)**	**2.96** **(2.31, 3.79)**	**1.61** **(1.36, 1.90)**	**1.72** **(1.56, 1.91)**	0.68 (0.45, 1.01)	0.79 (0.61, 1.03)
Total Inpatient	**2.39** **(1.85, 3.09)**	**2.36** **(1.97, 2.83)**	**1.28** **(1.12, 1.46)**	**1.54** **(1.42, 1.67)**	0.82 (0.63, 1.06)	0.82 (0.68, 1.00)
Count Portion of Hurdle Models for Cost Outcomes - Adjusted Rate Ratio (99% CI)						
Outpatient Services						
Mental Health	**1.40** **(1.22, 1.60)**	**1.59** **(1.36, 1.85)**	**0.95** **(0.91, 0.99)**	**0.86** **(0.82, 0.90)**	0.97 (0.84, 1.12)	0.99 (0.84, 1.17)
Substance Use	**1.77** **(1.07, 2.94)**	**1.33** **(1.23, 1.44)**	1.07 (0.80, 1.42)	**0.66** **(0.65, 0.68)**	0.75 (0.44, 1.25)	0.96 (0.89, 1.05)
Primary Care	**1.18** **(1.11, 1.26)**	**1.33** **(1.19, 1.49)**	**0.80** **(0.79, 0.81)**	**0.67** **(0.65, 0.69)**	0.99 (0.92, 1.06)	0.96 (0.86, 1.09)
Emergency Department	**1.29** **(1.16, 1.44)**	**1.47** **(1.30, 1.67)**	**0.95** **(0.92, 0.99)**	**0.93** **(0.89, 0.96)**	0.97 (0.87, 1.09)	0.98 (0.86, 1.12)
Homeless	1.19 (0.81, 1.76)	**1.73** **(1.20, 2.50)**	**0.73** **(0.58, 0.93)**	**0.79** **(0.64, 0.97)**	0.97 (0.64, 1.47)	0.78 (0.53, 1.15)
Social Work	**1.35** **(1.09, 1.67)**	**1.93** **(1.36, 2.76)**	1.05 (0.98, 1.12)	**1.13** **(1.01, 1.26)**	1.07 (0.86, 1.33)	0.88 (0.61, 1.28)
Diagnostic	**1.16** **(1.06, 1.26)**	**1.27** **(1.15, 1.41)**	**0.80** **(0.78, 0.82)**	**0.65** **(0.63, 0.67)**	1.00 (0.91, 1.09)	1.07 (0.96, 1.19)
Medical Specialty	1.11 (0.87, 1.42)	1.19 (0.96, 1.47)	1.05 (0.99, 1.12)	**0.92** **(0.87, 0.97)**	0.95 (0.74, 1.23)	0.94 (0.75, 1.17)

(*table continues*)

Variable	Discharge Type (Misconduct vs Routine)		Sex (Male vs Female)		Discharge Type*Sex	
	1-Year Cohort	5-Year Cohort	1-Year Cohort	1-Year Cohort	5-Year Cohort	1-Year Cohort
Other	1.03 (0.48, 2.23)	1.33 (0.90, 1.96)	**0.64 (0.52, 0.78)**	**0.64 (0.57, 0.70)**	1.15 (0.51, 2.56)	1.14 (0.76, 1.71)
Total Outpatient	**1.34 (1.04, 1.73)**	1.61 (1.37, 1.88)	**0.79 (0.74, 0.85)**	**0.72 (0.69, 0.75)**	1.06 (0.82, 1.38)	1.04 (0.89, 1.23)
Inpatient Services						
Psychiatric	1.02 (0.64, 1.62)	1.26 (0.89, 1.79)	0.93 (0.71, 1.22)	1.14 (0.95, 1.38)	1.22 (0.76, 1.96)	1.03 (0.72, 1.48)
Substance Use	0.96 (0.43, 2.15)	0.82 (0.49, 1.39)	0.81 (0.43, 1.52)	0.83 (0.57, 1.20)	1.02 (0.45, 2.32)	1.27 (0.74, 2.17)
Medical	1.39 (0.56, 3.47)	1.61 (0.88, 2.95)	1.40 (0.95, 2.08)	**1.30 (1.02, 1.65)**	0.90 (0.35, 2.30)	0.87 (0.46, 1.63)
Total Inpatient	1.39 (0.84, 2.29)	**1.63 (1.14, 2.31)**	1.18 (0.92, 1.52)	**1.26 (1.08, 1.48)**	0.97 (0.58, 1.62)	0.93 (0.65, 1.34)
Overall	**1.60 (1.23, 2.09)**	**1.86 (1.54, 2.25)**	**0.84 (0.79, 0.90)**	**0.78 (0.74, 0.81)**	1.18 (0.90, 1.56)	1.16 (0.95, 1.41)

Note: Bold indicates statistical significance, $p < .01$.

Discussion

Results from this study make clear several health status and healthcare utilization differences between routinely discharged and misconduct-discharged veterans, with misconduct-discharged veterans at striking risk for mental health diagnoses as well as certain medical conditions, and utilizing healthcare services at much higher rates. These findings provide strong support for the conception of misconduct discharge and its associated sequelae as closely related to health factors, and accordingly suggest the potential success of healthcare-based intervention strategies in mitigating adverse outcomes among this vulnerable population.

The finding of mental health risks during the early reintegration period corresponds with previous research suggesting elevated rates of in-service mental health problems among service members who go on to be discharged for misconduct.[5-7] Together, these findings indicate that mental health disorders are strongly associated with misconduct both pre- and post-discharge. In the absence of proper intervention, pre-discharge mental health issues continue or worsen following separation from service. Pre-existing mental health issues may even be directly aggravated by a misconduct discharge, as veterans discharged for misconduct may encounter stigma and a sense of lost honor related to their discharge circumstances. Further, the premature nature of non-routine separation may leave veterans unprepared for the challenges associated with separation from service and more vulnerable to difficulties during the early reintegration period.

In addition to mental health disorders, misconduct-discharged veterans had a significantly elevated risk for several behaviorally-linked chronic health conditions,

including hypertension, liver disease, and peptic ulcer disease. The finding of elevated risk for these diagnoses in this relatively young sample on signals the need to closely monitor this population for early signs of chronic health conditions, and the potential benefits of targeted prevention efforts that focus on health-promoting behaviors. Given misconduct-discharged veterans" lower propensity for accessing primary care, efforts to transition care from specialty clinical environments to integrated primary/preventive care settings may be an important focus.

The magnitude of the differences in utilization between veterans with a routine and misconduct discharge was striking. In addition to very large incremental differences in mental-health, substance use, and homelessness related treatment types, misconduct-discharged veterans also had significantly higher odds for accessing most types of non-mental health-related treatment. And importantly, even compared to routinely discharged veterans who used the same treatment types, misconduct-discharged veterans used nearly all treatment types at significantly higher rates and incurred significantly higher costs. This may indicate a greater burden of symptoms among misconduct-discharged veterans even as compared to those with similar treatment type needs.

Primary care was the only treatment type that misconduct-discharged veterans were significantly less likely to use. This finding, coupled with the finding of higher usage of nearly all non-primary care treatment types and particularly high usage of inpatient treatment, suggests that there may be opportunities to transition the care of misconduct-discharged veterans from acute settings into integrated primary care settings such as Patient Aligned Care Teams in order to more efficiently meet the complex health

needs of these veterans.

These findings have important implications for VA service provision planning. For the 23,000 misconduct-discharged OEF/OIF veterans with 5 years of follow-up data who were included in utilization and cost modeling, the average incremental cost associated with a misconduct-discharge after adjusting for demographic and military service characteristics was over $14,000 for women and over $16,000 for men. This equates to a total incremental cost of over $360 million overall just for the subsample of misconduct-discharged veterans from this era of service who had a full 5 years of data available at the time that administrative follow-up was cut off. In terms of raw costs, although misconduct-discharged veterans made up 7% of this sample, they accounted for 15% of the costs incurred. Given their increased risk for adverse outcomes like homelessness and chronic health conditions, excess service utilization and costs for this group are likely to persist in the long term.

These findings take on added significance in light of the recently announced change to VA policy allowing veterans with a discharge characterized as "other than honorable" to receive certain mental health services at VHA facilities. We hypothesize that misconduct-discharged veterans whose discharge was characterized as "general" or "under honorable conditions" and were thus included in the sample of the present study have mental health, substance use, and behavioral characteristics that are similar to those who were, until recently, ineligible for services due to their character of discharge. Results from this study shed some light on the potential vulnerabilities and healthcare needs of this incoming veteran cohort.

This study has several limitations. First, the sample is based on users of VHA care, which may limit generalizability. While the proportion of veterans seeking VHA care who were discharged for misconduct is similar to the overall proportion of veterans who receive a misconduct diagnosis, there may be important differences between those who do and do not access VHA services. We are also unable to assess non-VA health service utilization, and we did not include information relating to service-connected disability benefit level, which may factor in to the decision to use VA services as opposed to non-VA or dual service usage.

Conclusions

Relative to veterans with a routine discharge from service, those discharged for misconduct are at significantly higher risk for all mental health disorders and several behaviorally-linked chronic health conditions. They also utilize services and incur costs at approximately twice the rate, and are less likely to use primary care services. Findings indicate significant and complex healthcare needs among misconduct-discharged veterans, and suggest the need for healthcare-based interventions among this vulnerable subpopulation.

References

1. Brignone E, Fargo JD, Blais RK, Carter ME, Samore MH, Gundlapalli A V. Non-routine Discharge from Military Service: Mental Illness, Substance Use Disorders, and Suicidality. *Am J Prev Med*. 2017;52(5):557-65.

2. Gundlapalli AV, Fargo JD., Metraux S, et al. Military misconduct and homelessness among us veterans separated from active duty, 2001-2012. *JAMA*. 2015; 314(8), 832-4.

3. Reger MA, Smolenski DJ, Skopp NA, et al. Risk of Suicide Among US Military Service Members Following Operation Enduring Freedom or Operation Iraqi Freedom Deployment and Separation from the US Military. *JAMA Psychiatry*. 2015; 72(6), 561-9.

4. Noonan ME, Mumola CJ. *Veterans in state and federal prison*. From the Bureau of Justice Statistics Special Report. 2004. Washington, DC: US Department of Justice.

5. Booth-Kewley S, Highfill-McRoy RM, Larson GE, Garland CF. Psychosocial predictors of military misconduct. *J Nerv Ment Dis*. 2010; 198(2), 91-8.

6. Highfill-McRoy RM, Larson GE, Booth-Kewley S, & Garland, CF. Psychiatric diagnoses and punishment for misconduct: the effects of PTSD in combat-deployed Marines. *BMC Psychiatry*. 2010;10:88. http://doi.org/10.1186/1471-244X-10-88

7. Hoge CW, Tobani HE, Messer SC, et al. The Occupational Burden of Mental Disorders in the U.S. Military: Psychiatric Hospitalization, Involuntary Separation, and Disability. *Am J Psychiat*. 2005; 3(162), 585-92.

8. Ommaya A, Salazar A, Dannenberg A, et al. Outcome after Traumatic Brain Injury in the U.S. Military Medical System. *J Trauma*, 1996; 41(6), 972-5.

9. Rose G. Sick individuals and sick populations. *Int J Epidemiol*. 2001; 30(3):427-32.

10. Hickam DH, Weiss JW, Guise J-M, et al. *Outpatient Case Management for Adults with Medical Illness and Complex Care Needs*. Rockville, MD: Agency for Healthcare Research and Quality. 2013. https://www.effectivehealthcare.ahrq. gov/ehc/products/240/1369/CER99_OutpatientCaseManagement_Executive Summary_20130102.pdf. Accessed April 6, 2017.

11. O'Toole TP, Johnson EE, Aiello R, Kane V, Pape L. Tailoring Care to Vulnerable Populations by Incorporating Social Determinants of Health: The Veterans Health Administration's "Homeless Patient Aligned Care Team" Program. *Prev Chronic Dis*. 2016;13:E44.

12. Kumar GS, Klein R. Effectiveness of case management strategies in reducing emergency department visits in frequent user patient populations: a systematic review. *J Emerg Med*. 2013; 44(3), 717-29.

13. Phillips GA, Brophy DS, Weiland TJ, et al. The effect of multi- disciplinary case management on selected outcomes for frequent attenders at an emergency department. *Med J Aust*. 2006; 184: 602-8.

14.	Okin RL, Boccellari A, Azocar F. The effects of clinical case management on hospital service use among ED frequent users. *Am J Emerg Med*. 2000;18:603-8.

15.	Bertholet, N. Daeppen, J. Wietlisback, V. Fleming, M. Burnand, B. Reduction of Alcohol Consumption by Brief Alcohol Intervention in Primary Care. *Arch Intern Med*. 2014; 165(1), 986-95.

16.	R Core Team. *R: A language and environment for statistical computing*. 2017. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/. Accessed April 6, 2017.

17.	Stata Statistical Software: Release 14. 2014. College Station, TX: StataCorp LP. http://www.stata.com/ Accessed April 6, 2017.

18.	U.S. Department of Veterans Affairs. *VA Informatics and Computing Infrastructure* (VINCI). 2017. http://www.hsrd.research.va.gov/for_researchers/vinci/. Accessed April 6, 2017.

19.	Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, Saunders LD, Beck CA, Feasby TE, Ghali WA. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care*. 2005;43(11):1130-9.

20.	Bureau of Labor Statistics, U.S. Department of Labor. *CPI Inflation Calculator*. https://data.bls.gov/cgi-bin/cpicalc.pl Accessed April 6, 2017.

21.	Belotti F, Partha B. twopm: Two-part models. *The Stata Journal*. 2015;15(1):3-20.

22.	Williams R. Using the margins command to estimate and interpret adjusted predictions and marginal effects. *Stata J*. 2012;12(2):308-31

CHAPTER 4

PREDICTION OF RISK FOR HOMELESSNESS AND MORTALITY AMONG

VETERANS DISCHARGED FROM SERVICE DUE TO MISCONDUCT

Abstract

Introduction: Veterans who were discharged from military service for misconduct are at high-risk for homelessness and mortality. Early detection of risk for these outcomes allows for improved tailoring and targeting of preventive services.

Methods: Retrospective data for 25,821 misconduct-discharged veterans from the Department of Defense and the Veterans Health Administration were used to develop datasets containing demographic, military service, and clinical characteristics. For each outcome, logistic regression analysis was used to identify risk and protective factors, and random forest machine learning was used to develop predictive models.

Results: In logistic regression models, exposure to combat was associated with increased risk for both homelessness and mortality (adjusted odds ratio [AOR] = 1.3 for both), as was usage of several specialty clinical services (AOR range = 1.4-3.5). Diagnoses related to legal problems were a strong risk factor for homelessness (AOR = 3.9). Relative to White, Black race/ethnicity was a risk factor for homelessness, but a protective factor against mortality (AOR = 2.1 and 0.6, respectively). Relative to no benefits, high levels of service-connected disability benefits were protective against homelessness, but a risk factor for mortality (AOR = 0.51 and 1.41, respectively). In best-performing machine learning models, among those identified as at high-risk for homelessness, 70% became homeless (43% among all homeless); among those identified as at moderate-risk, 30% became homeless (38% among all homeless). Among those identified as at high-risk for mortality, 23% died (11% among all deaths); among those identified as at moderate-risk for mortality, 6% died (37% among all deaths).

Conclusion: Findings extend our understanding of risk and protective factors for homelessness and mortality among this vulnerable population, and suggest the viability of risk stratification techniques to facilitate the targeting of prevention or intervention strategies among this population.

Introduction

Veterans who were discharged from military service for reasons related to

misconduct are at high-risk for several serious adverse outcomes relative to those who were discharged under routine conditions. These include 4-6 times higher risk for homelessness,[1] and higher risk for early mortality, including mortality due to suicide, drug overdose, and accidents.[2,3] These largely preventable outcomes carry an enormous human and financial cost. The vulnerabilities of misconduct-discharged veterans are often apparent long before the emergence of homelessness and early mortality. While still in-service, misconduct-discharged veterans are more likely than routinely discharged veterans to have experienced traumatic brain injury, mental illness, and psychiatric hospitalization.[4-6] During the early post-discharge period, they are at elevated risk behaviorally-linked chronic health conditions, mental illness, and substance use disorders.[7]

Early detection of risk for these and other adverse outcomes is critical, as it allows for the targeted provision of preventive services to those most at risk, interrupting the accumulation and progression of symptoms that often precede these outcomes. To achieve this, risk prediction strategies and an understanding of markers for these outcomes are needed. Given the distinct clinical characteristics of misconduct-discharged veterans, research investigating potentially unique risk or protective factors for serious adverse outcomes among specific to this population is warranted.

Previous research has demonstrated the utility of administrative clinical data in the prediction of several adverse outcomes that are of particular concern among misconduct-discharged veterans, including suicide,[8,9] drug overdose,[10] unintentional injury,[11] and homelessness.[12] Veterans discharged for misconduct tend to be heavy users

of Veterans Health Administration (VHA) services, and recorded in the electronic medical records (EMRs) of those seeking care at VHA are a wide range of indicators with strong potential for discriminating risk for homelessness and mortality, including demographic information, military service experiences, and clinical diagnoses, and health service utilization characteristics. The use of this information in predictive modeling represents a potential opportunity to improve the provision of timely and appropriate intervention to those in this subgroup who are high risk for homelessness or early mortality. Therefore, the purpose of this study is to develop models to predict homelessness and mortality among veterans who were discharged from service due to misconduct. The aims of this study were: (1) using traditional statistical modeling techniques, determine risk factors for homelessness and mortality among veterans who were discharged for misconduct; and (2) using modern machine learning, develop algorithms to predict risk for homelessness and mortality among veterans who were discharged for misconduct.

Methods

For each of the two outcomes of interest, a dataset was created by merging national data from the Department of Defense and Veterans Health Administration (VHA). The dataset included records for 25,821 VHA-enrolled veterans with a misconduct discharge who deployed to OEF/OIF conflicts, separated from service through fiscal year (FY) 2012, and had at least post-discharge VHA encounter. Demographic and military service data were extracted from the official Department of

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Defense OEF/OIF roster file included the following variables: age, sex (male, female), race (White, Black, Hispanic, other/unknown), education (no high school diploma/ diploma equivalency only, high school diploma, any college), marital status (never married, married, divorced/other), branch of service (Army, Navy/Coast Guard, Marines, Air Force), rank (enlisted, officer/warrant), and type of discharge (see section misconduct subtype below).

Clinical service usage data were extracted from the VHA Corporate Data Warehouse (CDW) through 2015, and included frequencies for clinical diagnoses and outpatient and inpatient encounter records. Additional administrative military service variables including exposure to combat, military sexual trauma status, and service-connected disabilities were extracted from the Patient 2.0 Domain of the CDW. Death records were extracted from both the Vital Status File, which contains dates of death, but not causes of death. See Supplemental Table A1 for further description of data sources.

Veteran Homelessness

Veterans were identified as having administrative evidence of post-deployment homelessness if they received an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code of V60.0 (indicating "lack of housing") as either their primary or other code during a VA visit, or a non-ICD VA clinic or specialty code related to the receipt of homeless services.[13]

Mortality

Veteran deaths were identified by linking VHA data to the Vital Status File,

which includes date of death, but not cause of death.

Health Status

Clinical diagnoses were retrieved from VHA administrative data using primary ICD-9-CM codes recorded in outpatient and inpatient encounters. Classifications from the enhanced Elixhauser comorbidity index,[14] a widely used method for categorizing comorbidities, were used to create a set of 31 medical and mental health diagnostic indicators (see supplemental Table A2 in the appendix). In order to provide the algorithm with the maximum amount of information possible, Elixhauser variables were represented as the counts of diagnoses by category, rather than using typical binary coding of these variables. In addition to Elixhauser variables, diagnostic count indicators were created for ICD-9 codes of V62.5 (Legal Circumstances), and 309.81 (PTSD).

Healthcare Utilization

For each cohort, utilization frequencies were for computed for both inpatient and outpatient care. Inpatient care was further stratified into the following categories based on treatment specialty codes: psychiatric, substance use, and medical. Outpatient care was further stratified into the following categories based on stop code classifications: mental health, substance use, primary care, emergency department/urgent care, social work, medical specialty, diagnostic, homeless services, polytrauma (including TBI care), veterans justice outreach, and other outpatient (see Supplemental Table A3 in the appendix for a description of stop code and treatment specialty code classifications).

Combat Exposure

A binary variable representing history of combat exposure was extracted from the administrative data. The source column holds a variable indicating the presence or absence of combat during any deployment on record for each veteran.

Military Sexual Trauma

As part of routine clinical care, all veterans are screened for military sexual trauma (MST). The screen consists of the following two items: "While you were in the military…a) Did you receive uninvited and unwanted sexual attention, such as touching, cornering, pressure for sexual favors, or verbal remarks? b) Did someone ever use force or threat of force to have sexual contact with you against your will?" Veterans may respond "yes," "no," or "decline" to either item. The screen is considered positive if a veteran responds in the affirmative to either item. The screen is only administered once, unless the veteran declines screening, in which case the veteran will be re-screened in one year. Veterans who had no valid screen on file were retained in the sample, and assigned a value of "unknown" for this variable.

Service-Connected Disability

Records of disabling conditions that occurred as a result of military service were extracted from VHA clinical data. Service-connected disabilities are not directly entered as diagnosis codes, but a crosswalk file that links disability types to related ICD-9 and ICD-10 diagnoses is provided in the administrative database. Using these related diagnoses, service-connected disabilities were classified according to the Elixhauser

Comorbidity Index[14] into 31 categories of chronic health conditions based on ICD diagnosis codes found in administrative data. Notably, Elixhauser category "depression" contains the ICD code for post-traumatic stress disorder (PTSD). Due to the complex nature of the computation of service-connected disability percentages for individual disabilities, these variables were coded as binary, and were set to "0" until the time of their documentation, and "1" thereafter. In addition, a variable for total level of service-connected disability was extracted using the level recorded at the time of each clinical encounter. Values for total service-connected disability in the administrative database were coded into 3 categories consistent with previous literature,[15] including not service-connected, 1-49% service-connected, and 50-100% service-connected.

Misconduct Subtype

In order to examine potential differences between types of misconduct in the prediction of adverse outcomes among misconduct-discharged veterans, a variable for misconduct subtype was created using the following classifications of ISC codes: drugs/alcohol, commission of a serious offense, discreditable incidents - civilian or military, alcoholism, discharge in lieu of court-martial, pattern of minor disciplinary infractions, and other.

Data Manipulation and Case Matching

In order to account for individual variability in length of follow-up available in the administrative data, a modified case-control design was used to standardize follow-up. Separate analytic datasets were created for the analysis of homelessness and

mortality. In each file, veterans who experienced the given event of interest at any point during administrative follow-up were considered cases, while those who did not experience the event of interest were considered controls.

In order to capture timely clinical characteristics in relation to the events of interest, administrative follow-up was extracted for cases for the period of service usage immediately preceding the date that the event of interest was recorded. Because levels of clinical service usage tend to vary as a function of the age of the clinical relationship, it was necessary to ensure that there were no systematic differences between cases and controls in the age of the clinical relationship at the time of their selected administrative follow-up. To address this, the administrative follow-up selected for controls was matched to cases on the age of the clinical relationship, as measured by the time from initial VHA encounter to the selected period of administrative follow-up. In order to achieve this, the length of time from initial VHA encounter to the recording of the event of interest was calculated for all cases, and assigned into one of 17 time-based strata spanning 10 years of administrative follow-up. Service usage tends to be higher at the time that service is initiated, and declines over the first year before leveling off. Thus, unevenly spaced follow-up strata were used, with narrow intervals corresponding to the first year of VHA service usage, followed by more widely spaced intervals corresponding to later service usage (a description of follow-up strata, including frequencies for each dataset, are described later in the chapter).

Because ascertainment of homelessness status is dependent upon a VHA encounter, records of VHA encounters of controls were assigned into the 17 strata based

on the amount of time elapsed from the initial VHA encounter until each given encounter. The date denoting the cutoff for administrative follow-up of controls was then selected by randomly sampling encounters from strata proportionately to cases. Conversely, the ascertainment of death does not depend on a VHA encounter, as deaths are recorded by a variety of external sources before being added to the Vital Status File. Thus, the end of follow-up for controls was selecting by proportionately and randomly sampling available dates, rather than encounters, from strata. For both cases and controls in both datasets, one year of clinical data was extracted for the period preceding the end of administrative follow-up.

For Aim 1, in order to create a dataset of reduced dimensionality that was free of highly correlated variables and suitable for traditional statistical analysis, time-varying clinical variables were recoded to indicators representing records aggregated over the 90 days preceding the end of follow-up. The 90-day interval was selected for aggregation based on descriptive analyses that indicated that clinical service usage tends to most sharply diverge between cases and controls in the 1-3 months that immediately precede the events of interest, which was consistent with previous findings.[16] Resulting variables reflected the sum of diagnoses and encounters, and the max service-connected disability percentage recorded during the 90-day interval.

For Aim 2, data from the 1 year of administrative follow-up were aggregated into discrete 30-day intervals. Like in the aim 1 dataset, aggregated variables reflected the sum of diagnoses and encounter counts recorded during each 30-day interval, and the max service-connected disability percentage on file during each interval. Service-

connected disability categories were coded to positive if there was a corresponding disability on file preceding or during the given interval. While standard machine-learning methods are not equipped to explicitly account for time-trends in longitudinal data, pre-processing of data was conducted to extract time-trend features from the data to be used as additional inputs to the model. Descriptive exploration of predictors for differences in time-trends between those with and without the event of interest were used to inform the computation of time trend indicators. Features for time trends were extracted using a variety of techniques, including regression, wavelet transform, and computation of simple mean differences.

Data Analysis

For Aim 1, logistic regression analysis was used the model the odds for homelessness and mortality as a function of demographic, military service, and clinical variables. Because the end of administrative follow-up for some veterans occurred prior to the completion of 90 days of clinical service usage, models were computed in two steps. In step one, all cases were included in the modeling, and outcomes were modeled using logistic regression as that were consistently available regardless of clinical follow-up length, including sex, age, race, education, marital status, military sexual trauma screening, rank, branch, and combat exposure. In the second step, the sample was subset to those veterans who had at least 90-days of clinical service usage in the analytic data, allowing for the computation of additional effects for clinical indicators, including level of service-connected disability, inpatient stays, diagnoses related to PTSD or legal problems, emergency department usage, and encounters at mental health, substance use,

social work, and primary care clinics.

For Aim 2, the random forest machine learning technique was used to develop algorithms to classify homelessness and mortality as a function of a demographic, military service, health status, and healthcare utilization characteristics. Random forest is an ensemble method in which many decision trees are grown from bootstrapped samples of the training data. At each node of a given decision tree, a random subset of predictor variables is selected, and the node is split based on the variable/split-point combination that results in the greatest gain in purity of the resulting nodes. This process is recursively repeated until the minimum node size is reached. When used for classification, a class vote is obtained from each tree for observations that were not used in the construction of that tree, and resulting prediction is based on the majority vote across the ensemble. This "out-of-bag" estimation is unbiased and prevents overfitting. Thus, a random forest can be fit in one sequence, and additional cross-validation or hold-out datasets are not required.[17,18] Random forest is well equipped to handle high dimensional data, correlated predictors, nonlinear effects, and complex interactions. In addition, it requires minimal tuning relative to alternative similarly performing algorithms, making it more easily adaptable to live data.

In order to address computational considerations pertinent to any future scaling-up of predictive algorithms, the tradeoff between accuracy and parsimony was evaluated by developing a range of models that were varied by number of variables, and the range of follow-up for which variables were included. Variable importance indices based on the Gini impurity index[17] were computed and used to identify well-performing variable

subsets. Models were optimized through cross-validated comparisons of ensemble sizes, and number of variables tested at each split. Due to the imbalanced nature of the outcomes, model-predicted probabilities were evaluated at various thresholds for prediction of the positive class, and final algorithms were selected based the Kappa statistic, AUC value, and sensitivity.

For each outcome, final models based on 4 different variable sets were selected for comparison. These variable sets included the following: (1) **12-month: All**, including static demographic and military service characteristics, clinical variables in 30-day intervals for all 12 months of follow-up, aggregated clinical variables, and trend indicators representing the difference between the first 9 months and the final 3 months of follow-up on the average rate of recorded encounters and diagnoses; (2) **12-month: Aggregation and Trends**, including static demographic and military service characteristics, clinical variables in 30-day intervals for the final 3 months of follow-up only, aggregated clinical variables, and trend indicators; (3) **3-Month,** including static demographic and military service characteristics and clinical variables in 30-day intervals for the final 3 months of follow-up; and (4) **1-Month**, including static demographic and military service characteristics and clinical variables for the final 30-day interval of follow-up. Using model-predicted probabilities, all observations were assigned into a low, medium, or high risk group, and predicted class membership was tabulated against actual housing or mortality status.

Results

Aim 1: Traditional Statistical Modeling

Homelessness models. Table 4.1 includes a descriptive overview of the sample, stratified by housing status. Overall, 6,871 veterans had administrative evidence of homelessness (26.9%). Descriptive statistics are provided for the entire sample, and for the subsample of veterans who had at least 90 days of follow-up available in the analytic dataset, thus allowing for computation of clinical characteristics. In both samples, Black veterans were overrepresented among the homeless, as were women, those without a high school diploma, and those who served in the Army, and those whose misconduct subtype was "alcohol/drugs" or "discreditable incidents" (all $p < .001$). Veterans who were exposed to combat were more likely to be homeless ($p < .001$). Veterans who were homeless were more likely to have been screened for MST, and those who responded "Yes" or "Decline" were particularly overrepresented among those who were homeless ($p < .001$). Rates of all clinical encounters and diagnoses were higher among those who were homeless, as were levels of service-connected disability (all $p < .001$).

Results from both logistic regression models predicting homelessness are presented in Table 4.2. In the first model, Black relative to White race/ethnicity was associated with increased risk for homelessness (adjusted odds ratio [AOR] = 1.6), while odds for Hispanic or other/unknown race/ethnicity did not significantly differ from White race/ethnicity. Highest level of education attained at the time of discharge was also a significant predictor of homelessness. Relative to a high school diploma, high school equivalency or no high school diploma was associated with 1.5 times higher risk for

Table 4.1. Demographic, Military Service, and Clinical Characteristics of Misconduct-Discharged Veterans Who Use VHA Services, Stratified by Housing Status

Variable	Overall[a]			At Least 90 days of VHA Follow-up[a]		
	Not Homeless $N = 18,639$	Homeless $N = 6,871$	t / χ^2 p-value	Not Homeless $N = 14,510$	Homeless $N = 5,284$	t / χ^2 p-value
Demographic Characteristics						
Sex			<.001			<.001
Male	17,283 (92.7%)	6,241 (90.8%)		13,414 (92.4%)	4,794 (90.7%)	
Female	1,356 (7.3%)	630 (9.2%)		1,096 (7.6%)	490 (9.3%)	
Age at First Encounter	27.00 (5.05)	26.71 (4.83)	<.001	26.99 (4.92)	26.52 (4.64)	<.001
Race			<.001			<.001
White	11,135 (59.7%)	3,661 (53.3%)		8,849 (61.0%)	2,883 (54.6%)	
Black	4,250 (22.8%)	2,242 (32.6%)		3,340 (23.0%)	1,677 (31.7%)	
Hispanic	1,996 (10.7%)	662 (9.6%)		1,530 (10.5%)	500 (9.5%)	
Other/Unknown	1,258 (6.7%)	306 (4.5%)		791 (5.5%)	224 (4.2%)	
Education			<.001			<.001
No Diploma/HS Equiv.	3,498 (17.1%)	1,827 (26.6%)		2,791 (19.2%)	1,385 (26.2%)	
HS Diploma	13,821 (74.2%)	4,675 (68.0%)		10,761 (74.2%)	3,627 (68.6%)	
Any College	1,310 (8.5%)	369 (5.4%)		958 (6.6%)	272 (5.1%)	
Marital Status			.274			.464
Never Married	12,633 (67.8%)	4,720 (68.7%)		9,753 (67.2%)	3,600 (68.1%)	
Married	5,716 (30.6%)	2,053 (29.9%)		4,518 (31.1%)	1,602 (30.3%)	
Divorced/Other	300 (1.6%)	98 (1.4%)		239 (1.6%)	82 (1.6%)	
Military Service Characteristics						
Misconduct Subtype			<.001			<.001
Alcohol/Drugs	6,511 (34.9%)	2,606 (37.9%)		5,164 (35.6%)	2,035 (38.5%)	

(*table continues*)

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	Overall[a]			At Least 90 days of VHA Follow-up[a]		
Variable	Not Homeless N = 18,639	Homeless N = 6,871	t / χ^2 p-value	Not Homeless N = 14,510	Homeless N = 5,284	t / χ^2 p-value
Civil Court Conviction	814 (4.4%)	101 (1.5%)		548 (3.8%)	67 (1.3%)	
Discharge in Lieu of Court Martial	1,151 (6.2%)	368 (5.4%)		762 (5.3%)	264 (5.0%)	
Discreditable Incidents	3,462 (18.6%)	1,565 (22.8%)		2,734 (18.8%)	1,184 (22.4%)	
Other	1,497 (8.0%)	383 (5.6%)		1,177 (8.1%)	305 (5.8%)	
Minor Infractions	854 (4.6%)	195 (2.8%)		666 (4.6%)	154 (2.9%)	
Serious Offense	4,350 (23.3%)	1,653 (24.1%)		3,459 (23.8%)	1,275 (24.1%)	
MST Screen Result			<.001			<.001
No	15,103 (81.0%)	6,011 (87.5%)		12,884 (88.8%)	4,736 (89.6%)	
Decline	100 (0.5%)	61 (0.9%)		86 (0.6%)	48 (0.9%)	
Unknown	2,804 (15.0%)	282 (4.1%)		989 (6.8%)	107 (2.0%)	
Yes	632 (3.4%)	517 (7.5%)		551 (3.8%)	393 (7.4%)	
Rank			<.001			<.001
Unknown	2,804 (15.0%)	282 (4.1%)		989 (6.8%)	107 (2.0%)	
Enlisted	18,047 (95%)	6,849 (99.9%)		14,124 (97.3%)	5,264 (99.6%)	
Officer/Warrant	595 (3.2%)	22 (0.3%)		386 (2.7%)	20 (0.4%)	
Branch			<.001			<.001
Army	10,975 (58.9%)	4,840 (70.4%)		8,970 (61.8%)	3,781 (71.6%)	
Navy	3,723 (20.0%)	1,131 (16.5%)		2,702 (18.6%)	815 (15.4%)	
Marines	1,761 (9.4%)	473 (6.9%)		1,200 (8.3%)	352 (6.7%)	
Air Force	2,180 (11.7%)	427 (6.2%)		1,638 (11.3%)	336 (6.4%)	
Combat Exposed			<.001			<.001
Yes	5,001 (26.8%)	2,494 (36.3%)		4,141 (28.5%)	1,944 (36.8%)	
Clinical Characteristics (Aggregated Over 90 days)						
Emergency Dept.						<.001
Yes	-	-		2,001 (13.8%)	1,492 (28.2%)	

(*table continues*)

	Overall[a]			At Least 90 days of VHA Follow-up[a]		
Variable	Not Homeless N = 18,639	Homeless N = 6,871	t / χ^2 p-value	Not Homeless N = 14,510	Homeless N = 5,284	t / χ^2 p-value
Mental Health Visit						
Yes	-	-		4,953 (34.1%)	3,353 (63.5%)	<.001
Substance Use Visit						
Yes	-	-		764 (5.3%)	1,219 (23.1%)	<.001
Social Work Visit						
Yes	-	-		2,328 (16.0%)	2,285 (43.2%)	<.001
Primary Care Visit						
Yes	-	-		6962 (48.0%)	3153 (59.7%)	<.001
Inpatient Stay						
Yes	-	-		378 (2.6%)	793 (15.0%)	<.001
PTSD Diagnosis						
Yes	-	-		3,589 (24.7%)	2,361 (44.7%)	<.001
Legal Problems Diagnosis						
Yes	-	-		211 (1.5%)	461 (8.7%)	<.001
Max SCD						
NSC	-	-		9,288 (64.0%)	1,052 (63.3%)	<.001
0-49%	-	-		2,184 (15.1%)	117 (17.3%)	
50-100%	-	-		3,038 (20.9%)	86 (19.0%)	

Notes: Veterans who did not have administrative evidence of homelessness were matched on follow-up period to those who did. Clinical characteristic variables are unavailable for the overall sample, as 5,716 veterans included in this sample had less than 90 days of clinical follow-up available in the analytic dataset. HS = High school, SCD = Service-connected disability.

[a] N (%) or M (SD)

Table 4.2. Results of Logistic Regression Analysis Predicting Initial Homelessness Episode as a Function of Demographic, Military Service, and Clinical Characteristics among Misconduct-Discharged Veterans Who Use VHA Services

Variable	Model 1 $N = 25{,}510$	Model 2 $N = 19{,}794$
	Adjusted Odds Ratio (95% CI)	
Demographic Characteristics		
Sex (Ref = Male)		
Female	1.03 (0.92, 1.16)	**1.22 (1.06, 1.41)**
Age First VHA Encounter	1.01 (1.00, 1.01)	1.00 (0.99, 1.01)
Race (Ref = White)		
Black	**1.64 (1.53, 1.75)**	**2.04 (1.88, 2.22)**
Hispanic	1.01 (0.91, 1.11)	1.13 (1.00, 1.27)
Other/Unknown	1.00 (0.87, 1.15)	1.20 (1.00, 1.42)
Education at Discharge (Ref = HS Diploma)		
No HS Diploma/Diploma Equivalent	**1.49 (1.39, 1.60)**	**1.40 (1.28, 1.52)**
Any College	**1.28 (1.11, 1.47)**	**1.20 (1.01, 1.42)**
Marital Status at Discharge (Ref = Never Married)		
Married	0.94 (0.89, 1.02)	1.00 (0.92, 1.08)
Divorced/Other	0.85 (0.67, 1.08)	1.01 (0.76, 1.35)
Military Service Characteristics Misconduct Subtype (Ref = Drug/Alcohol)		
Civilian Court Conviction	0.78 (0.61, 1.01)	**0.67 (0.48, 0.94)**
Discharge in Lieu of Court Martial	0.96 (0.84, 1.10)	0.92 (0.78, 1.09)
Discreditable Incidents	1.05 (0.98, 1.14)	**1.12 (1.02, 1.24)**
Other	**0.70 (0.62, 0.80)**	**0.81 (0.70, 0.95)**
Pattern of Minor Infractions	0.83 (0.68, 1.00)	0.98 (0.78, 1.23)
Commission of a Serious Offense	**0.92 (0.85, 0.99)**	0.96 (0.87, 1.05)
MST Screen (Ref = No)		
Yes	**2.09 (1.81, 2.38)**	**1.65 (1.40, 1.95)**
Decline	**1.53 (1.10, 2.11)**	1.22 (0.83, 1.84)
Unknown	**0.30 (0.26, 0.34)**	**0.42 (0.33, 0.52)**
Rank (Ref = Enlisted)		
Officer/Warrant	**0.13 (0.07, 0.21)**	**0.32 (0.18, 0.57)**
Branch (Ref = Army		
Navy	**0.78 (0.72, 0.84)**	**0.90 (0.82, 0.99)**
Marines	**0.87 (0.78, 0.98)**	0.92 (0.79, 1.06)
Air Force	**0.63 (0.55, 0.72)**	**0.71 (0.60, 0.84)**

(*table continues*)

Variable	Model 1 $N = 25{,}510$	Model 2 $N = 19{,}794$
	Adjusted Odds Ratio (95% CI)	
Combat Exposure		
Yes	**1.41 (1.33, 1.50)**	**1.33 (1.24, 1.44)**
Clinical Characteristics (Recorded Last 90 Days)		
Emergency Department		
Yes	-	**1.56 (1.42, 1.71)**
Mental Health Clinic		
Yes	-	**1.85 (1.69, 2.02)**
Substance Use Clinic		
Yes	-	**2.38 (2.12, 2.67)**
Social Work Services		
Yes	-	**1.97 (1.81, 2.15)**
Primary Care		
Yes	-	1.02 (0.95, 1.10)
Inpatient Stay		
Yes	-	**1.90 (1.63, 2.22)**
PTSD Diagnosis		
Yes	-	**1.25 (1.14, 1.36)**
Legal Problems Diagnosis		
Yes	-	**3.90 (3.23, 4.70)**
SCD (Ref = Not Service Connected)		
0 - 49 %	-	**0.88 (0.80, 0.97)**
50 - 100 %	-	**0.51 (0.46, 0.56)**
	Pseudo R^2 = .10	Pseudo R^2 = .25

Notes: Bold indicates statistical significance, $p < .05$. Model 1 sample includes all misconduct-discharged veterans who use VHA services. Model 2 sample includes all misconduct-discharged veterans who use VHA services, and had at least 90 days of follow-up in the analytic dataset. veterans who did not have administrative evidence of homelessness were matched on follow-up period to those who did. HS = High school, SCD = Service-connected disability.

homelessness, and any college was associated with 1.3 times higher risk for

homelessness. Relative to the "drugs/alcohol" misconduct subtype, "commission of a

serious offense" and "other" were associated with significantly lower odds for

homelessness (AOR = 0.92 and 0.70). Relative to a negative screen for MST, odds for

homelessness were significantly higher among those who screened positive and those who declined, but lower among those who did not have a screen on file (AOR = 2.1, 1.5, 0.3, respectively). Branch of service and rank were also significantly related to homelessness risk, with significantly lower odds for the Navy and Air Force relative to the Army (AOR = 0.8 and 0.6), and 9 times higher odds among enlisted service members relative to officers. Last, exposure to combat was associated with 1.4 times higher odds for homelessness.

In the second regression model that included additional clinical characteristics, gender emerged as a significant predictor, with females at 1.2 times higher risk than males. Otherwise, effects for the variables common between the two models were largely similar. In terms of clinical characteristics in the 90 days preceding the end of follow-up, nearly all types of service usage were associated with higher odds for homelessness, including emergency department (AOR = 1.6), mental health services (AOR = 1.9), substance use services (AOR = 2.4), and social work services (AOR = 2.0). PTSD diagnoses and diagnoses related to legal problems were also associated with increased risk for homelessness (AOR = 1.3 and 3.9, respectively). Finally, service connected disability benefits were associated with reduced risk for homelessness. Relative to no service-connected disability, both low levels and high levels of service-connected disability benefits were protective against homelessness, with higher levels of benefits having a stronger protective effect (AOR = 0.9 and 0.5, respectively.)

Mortality models. Table 4.3 includes a descriptive overview of the entire sample, and for the subsample of veterans who had at least 90 days of follow-up available in the

Table 4.3. Demographic, Military Service, and Clinical Characteristics of Misconduct-Discharged Veterans Who Use VHA Services, Stratified by Vital Status

Variable	Overall[a]			With at Least 90 days of VHA Follow-up[a]		
	Living $N = 25,330$	Deceased $N = 491$	t / χ^2 p-value	Living $N = 24,056$	Deceased $N = 466$	t / χ^2 p-value
Demographic Characteristics						
Sex			0.032			0.042
Male	23,352 (92.2%)	466 (94.9%)		22,180 (92.2%)	442 (94.8%)	
Female	1,978 (7.8%)	25 (5.1%)		1,876 (7.8%)	24 (5.2%)	
Age at First Encounter	26.92 (4.88)	27.17 (5.08)	0.278	26.91 (4.88)	27.11 (5.00)	0.405
Race			<.001			<.001
White	14,613 (57.7%)	348 (70.9%)		13,912 (57.8%)	334 (71.7%)	
Black	6,515 (25.7%)	79 (16.1%)		6,172 (25.7%)	76 (16.3%)	
Hispanic	2,656 (10.5%)	34 (6.9%)		2,504 (10.4%)	28 (6.0%)	
Other/Unknown	1,546 (6.1%)	30 (6.1%)		1,468 (6.1%)	28 (6.0%)	
Education			0.017			0.045
No Diploma/HS Equiv.	5,270 (20.8%)	128 (26.1%)		5,004 (20.8%)	119 (25.5%)	
HS Diploma	18,393 (72.6%)	332 (67.6%)		17,463 (72.6%)	318 (68.2%)	
Any College	1,667 (6.6%)	31 (6.3%)		1,589 (6.6%)	29 (6.2%)	
Marital Status			0.679			0.936
Never Married	17,227 (68%)	330 (67.2%)		16,372 (68.1%)	314 (67.4%)	
Married	7,709 (30.4%)	151 (30.8%)		7,305 (30.4%)	144 (30.9%)	
Divorced/Other	394 (1.6%)	10 (2.0%)		379 (1.6%)	8 (1.7%)	
Military Service Characteristics						
Misconduct Subtype			0.126			<.119
Alcohol/Drugs	9,047 (35.7%)	193 (39.3%)		8570 (35.6%)	186 (39.9%)	

(table continues)

Variable	Overall[a]			With at Least 90 days of VHA Follow-up[a]		
	Living N = 25,330	Deceased N = 491	t / χ² p-value	Living N = 24,056	Deceased N = 466	t / χ² p-value
Civil Court Conviction	912 (3.6%)	7 (1.4%)		868 (3.6%)	7 (1.5%)	
Discharge in Lieu of Court Martial	1,505 (5.9%)	31 (6.3%)		1434 (6.0%)	28 (6.0%)	
Discreditable Incidents	4,995 (19.7%)	92 (18.7%)		4741 (19.7%)	85 (18.2%)	
Other	1,858 (7.3%)	35 (7.1%)		1768 (7.3%)	30 (6.4%)	
Minor Infractions	1,052 (4.2%)	15 (3.1%)		988 (4.1%)	15 (3.2%)	
Serious Offense	5,961 (23.5%)	118 (24.0%)		5687 (23.6%)	115 (24.7%)	
MST Screen Result			0.023			0.040
No	20,995 (82.9%)	395 (80.4%)		19,942 (82.9%)	384 (82.4%)	
Decline	158 (0.6%)	8 (1.6%)		153 (0.6%)	8 (1.7%)	
Unknown	3,036 (12.0%)	68 (13.8%)		2,880 (12.0%)	55 (11.8%)	
Yes	1,141 (4.5%)	20 (4.1%)		1,081 (4.5%)	19 (4.1%)	
Rank			0.121			0.156
Enlisted	24,721 (97.6%)	485 (98.8%)		23,476 (97.6%)	460 (98.7%)	
Officer/Warrant	609 (2.4%)	6 (1.2%)		580 (2.4%)	6 (1.3%)	
Branch			0.363			0.347
Army	15,698 (62.0%)	321 (65.4%)		14,921 (62.0%)	305 (65.5%)	
Navy	4,817 (19.0%)	86 (17.5%)		4,567 (19.0%)	82 (17.6%)	
Marines	2,216 (8.7%)	43 (8.8%)		2,101 (8.7%)	41 (8.8%)	
Air Force	2,599 (10.3%)	41 (8.4%)		2,467 (10.3%)	38 (8.2%)	
Combat Exposed			<.001			<.001
Yes	7,401 (29.2%)	180 (36.7%)		7,015 (29.2%)	171 (36.7%)	
Clinical Characteristics (Aggregated Over 90 days)						
Homelessness						<.001
Yes				1,388 (5.8%)	55 (11.8%)	

(table continues)

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Variable	Overall[a]			With at Least 90 days of VHA Follow-up[a]		
	Living N = 25,330	Deceased N = 491	t / χ^2 p-value	Living N = 24,056	Deceased N = 466	t / χ^2 p-value
Emergency Dept.						
Yes	-	-		2,117 (8.8%)	112 (24.0%)	<.001
Mental Health Visit						
Yes	-	-		6,655 (27.7%)	244 (52.4%)	<.001
Substance Use Visit						
Yes	-	-		1,426 (5.9%)	79 (17.0%)	<.001
Social Work Visit						
Yes	-	-		3,676 (15.3%)	169 (36.3%)	<.001
Primary Care Visit						
Yes	-	-		7,645 (31.8%)	233 (50.0%)	<.001
Inpatient Stay						
Yes	-	-		554 (2.3%)	67 (14.4%)	<.001
PTSD Diagnosis						
Yes	-	-		4,215 (17.5%)	179 (38.4%)	<.001
Legal Problems Diagnosis						
Yes	-	-		420 (1.7%)	21 (4.5%)	<.001
Max SCD						
NSC	-	-		17,786 (73.9%)	263 (56.4%)	<.001
0-49%	-	-		2,304 (9.6%)	58 (12.4%)	
50-100%	-	-		3,966 (16.5%)	145 (31.1%)	

Notes: Veterans who were living at the end of follow-up were matched to those who were deceased on follow-up period. Clinical characteristic variables are unavailable for the overall sample, as 5,716 veterans included in this sample had less than 90 days of clinical follow-up available in the analytic dataset. HS = High school, SCD = Service-connected disability.

[a] *N* (%) or *M* (*SD*).

analytic dataset, stratified by vital status. Overall, 491 veterans were deceased (1.9%). In both samples, White veterans were overrepresented among the deceased ($p < .001$), as were those without a high school diploma ($p = .045$), and those who were exposed to combat. In addition, levels of service-connected disabilities and rates of all clinical encounters and diagnoses were higher among those who were deceased (all $p < .001$).

Results from both logistic regression models predicting mortality are presented in Table 4.4. In the first model, age was positively associated with mortality (AOR = 1.03), as was exposure to combat (AOR = 1.5). Relative White race/ethnicity, the odds for mortality associated with Black or Hispanic race/ethnicity were lower (AOR = 0.6, 0.5, respectively). Education level of high school equivalency or no high school diploma relative to high school diploma was also associated with 1.3 times higher risk for mortality. Misconduct subtype "civil court conviction" was associated with lower odds for mortality than "drugs/alcohol." Relative to a negative screen for MST, odds for mortality were 2.7 times higher among those who declined screening, and 1.4 times higher among those who did not have a valid screen on file.

In the second regression model that included additional clinical characteristics, education and rank were no longer significantly associated with mortality risk, but the remaining effects for variables common between the two models remained similar. In terms of clinical characteristics in the 90 days preceding the end of follow-up, usage of emergency department, mental health service services, social work services, and inpatient services were all associated with significantly higher odds for mortality (AOR = 1.5, 1.5, 1.6, and 2.5, respectively). Finally, high levels of service-connected disability relative to

Table 4.4. Results of Logistic Regression Analysis Predicting Mortality as a Function of Demographic, Military Service, and Clinical Characteristics Among Misconduct-Discharged Veterans Who Use VHA Services

Variable	Model 1 $N = 25,821$	Model 2 $N = 24,522$
	Adjusted Odds Ratio (95% CI)	
Demographic Characteristics		
Sex (Ref = Male)		
Female	0.69 (0.45, 1.08)	0.73 (0.46, 1.14)
Age First VHA Encounter	**1.03 (1.01, 1.05)**	1.02 (1.00, 1.04)
Race (Ref = White)		
Black	**0.51 (0.40, 0.65)**	**0.56 (0.43, 0.72)**
Hispanic	**0.52 (0.37, 0.75)**	**0.49 (0.33, 0.72)**
Other/Unknown	0.82 (0.56, 1.20)	0.92 (0.62, 1.38)
Education at Discharge (Ref = HS Diploma)		
No HS Diploma/Diploma Equiv.	**1.25 (1.01, 1.55)**	1.16 (0.92, 1.45)
Any College	1.21 (0.79, 1.83)	1.17 (0.76, 1.82)
Marital Status at Discharge (Ref = Never Married)		
Married	0.99 (0.81, 1.22)	0.99 (0.80, 1.22)
Divorced/Other	1.18 (0.61, 2.27)	0.93 (0.44, 1.94)
Military Service Characteristics		
Misconduct Subtype		
Civilian Court Conviction	**0.31 (0.11, 0.91)**	0.37 (0.13, 1.07)
Discharge in Lieu of Court Martial	0.93 (0.84, 1.37)	0.97 (0.64, 1.47)
Discreditable Incidents	0.91 (0.71, 1.17)	**0.91 (1.02, 1.24)**
Other	0.92 (0.63, 1.34)	0.93 (0.70, 1.19)
Pattern of Minor Infractions	0.77 (0.42, 1.40)	0.93 (0.62, 1.39)
Commission of a Serious Offense	0.96 (0.76, 1.21)	1.03 (0.81, 1.31)
MST Screen (Ref = No)		
Yes	1.14 (0.70, 1.87)	0.88 (0.53, 1.46)
Decline	**2.68 (1.30, 5.51)**	**2.36 (1.12, 4.97)**
Unknown	**1.35 (1.03, 1.77)**	**1.89 (1.37, 2.61)**
Rank (Ref = Enlisted)		
Officer/Warrant	0.82 (0.24, 2.82)	1.02 (0.30, 3.56)
Branch (Ref = Army		
Navy	0.90 (0.70, 1.15)	1.13 (0.87, 1.48)
Marines	0.95 (0.68, 1.32)	1.04 (0.74, 1.47)
Air Force	0.88 (0.63, 1.23)	1.07 (0.70, 1.63)
Combat Exposure		
Yes	**1.47 (1.22, 1.78)**	**1.34 (1.10, 1.63)**

(*table continues*

Variable	Model 1 $N = 25{,}821$	Model 2 $N = 24{,}522$
	Adjusted Odds Ratio (95% CI)	
Clinical Characteristics (Recorded Last 90 Days)		
Homeless		
Yes		0.83 (0.59, 1.16)
Emergency Department		
Yes	-	**1.54 (1.18, 2.02)**
Mental Health Clinic		
Yes	-	**1.48 (1.12, 1.96)**
Substance Use Clinic		
Yes	-	1.17 (0.86, 1.59)
Social Work Services		
Yes	-	**1.58 (1.21, 2.04)**
Primary Care		
Yes	-	1.12 (0.88, 1.41)
Inpatient Stay		
Yes	-	**2.49 (1.74, 3.56)**
PTSD Diagnosis		
Yes	-	1.20 (0.91, 1.59)
Legal Problems Diagnosis		
Yes	-	0.95 (0.59, 1.55)
SCD (Ref = Not Service Connected)		
0 - 49 %	-	1.18 (0.86, 1.61)
50 - 100 %	-	**1.41 (1.10, 1.82)**
	Pseudo R^2 = .02	Pseudo R^2 = .08

Notes: Bold indicates statistical significance, $p < .05$. Model 1 sample includes all misconduct-discharged veterans who use VHA services. Model 2 sample includes all misconduct-discharged veterans who use VHA services, and had at least 90 days of follow-up in the analytic dataset. veterans who were living at the end of follow-up were matched on follow-up period to those who were deceased. HS = High school, SCD = Service-connected disability.

no service-connected disability were associated with 1.4 times higher risk for mortality.

Aim 2: Machine Learning

Classification of homelessness. Table 4.5 includes homelessness classification model performance metrics for all 4 variable subsets. Model performance was similar across all subsets, with area under the receiver operating characteristic curve (AUC) values ranging from .792 to .802, and Kappa statistics ranging from .401 to .438. At the

Table 4.5. Random Forest Model Classifying Homelessness: Performance Across Variable Subsets and Probability a Range of Thresholds for Positive Class Prediction

Threshold	PCC	Sensitivity	Specificity	PPV	NPV	Kappa	AUC
			12 month: All (Number of Variables= 319)				
Threshold = .50	.796	.410	.938	.708	.812	.401	
Threshold = .40	.788	.542	.877	.619	.839	.436	.798
Threshold = .35	.773	.611	.833	.574	.853	.435	
							*.763
			12 month: Aggregation and Trends (Number of Variables = 100)				
Threshold = .50	.796	.433	.929	.692	.816	.401	
Threshold = .40	.783	.565	.864	.605	.843	.438	.802
Threshold = .35	.769	.637	.818	.563	.859	.437	
							*.760
			3 Month: All Variables (Number of Variables = 81)				
Threshold = .50	.796	.426	.932	.698	.815	.408	
Threshold = .40	.784	.556	.867	.609	.842	.437	.798
Threshold = .35	.769	.622	.834	.565	.855	.432	
							*.772
			1 Month: All Variables (Number of Variables = 43)				
Threshold = .50	.794	.434	.927	.687	.816	.409	
Threshold = .40	.781	.563	.862	.601	.843	.434	.792
Threshold = .35	.764	.621	.816	.555	.854	.422	
							*.776

Notes: PCC = Percent correctly classified; PPV = Positive predictive value; NPV = Negative predictive value; AUC = Area under the receiver operating characteristic curve. Threshold values represent the model-predicted probability at which cases were classified as homeless. *Denotes the AUC value for a classifier based on the 20 most important variables from the given variable subset.

default positive class prediction threshold of .5, sensitivity ranged from .410 to .434.

With a lower threshold of .35, the range of sensitivity improved considerably to a range

of .611 to .637, and generally corresponded to increases to the Kappa. Also included in

Table 4.5 are AUC values for simplified models that were re-estimated based on the 20

most important variables from the given variable subset as determined by the Gini

impurity index. AUC values for these simplified models were attenuated, but still all

exceeded .750.

The top 20 most important variables for each model are presented in Table 4.6.

Table 4.6. Variable Importance Ranks for Homelessness Models Based on Different Variable Subsets: Top 20 Variables for the Best Version of Each Model

Variable	12 Month: All	12 Month: Aggregation with Trends	3 Month	1 Month
	Rank Importance Based on Gini Index			
Age at First VHA Encounter	3	1	1	1
Follow-up Strata	4	2	2	3
Age at First Deployment	6	3	3	2
Other Encounters (Trend)	13	4		
Mental Health Encounters (Trend)	9	5		
Misconduct Subtype	8	6	6	5
Alcohol Diagnoses (12th Month)	1	7	4	4
Social Work Encounters (12th Month)	2	8	5	6
Alcohol Diagnoses (Trend)	5	9		
Primary Care Encounters (12 Months)	15	10		
Depression Diagnoses (Trend)	14	11		
Social Work Encounters (Trend)	10	12		
Mental Health Encounters (12th Month)	7	13	7	7
Diagnostic Encounters (12 Months)	16	14		
Race/ethnicity	11	15	9	10
Depression Diagnoses (12th Month)	12	16	8	8
Other Encounters (First 9 Months)		17		
Emergency Department Encounters (Trend)	18	18		
Other Encounters (12th Month)	19	19	10	9
Mental Health Encounters (First 9 Months)		20		
Primary Care Encounters (12th Month)			11	12
Branch of Service	20		12	13
Substance Abuse Diagnoses (12th Month)			13	15
Service Connected Disability (12th Month)			14	11
Diagnostic Encounters (12th Month)			15	14
MST Screen Result	17		16	16
PTSD Diagnoses (12th Month)			17	19
Education Level			18	17
Other Encounters (11th Month)			19	
Substance Abuse Encounters (12th Month)			20	
Service Connection for Depression				20

Despite the wide range of input variables included in each model, there was considerable agreement among the four models in terms of the variables determined to be important to the classification. In all four models, age at first VHA encounter, follow-up strata, age at first deployment, misconduct subtype, alcohol-related diagnoses, social work encounters, mental health encounters, depression diagnoses, and race/ethnicity were determined to be of high importance. In several cases, when variables that were not supplied to shorter-term models were identified as important in the longer-term models, theoretically similar indicators were identified as important in the shorter-term models. For example, in both 12-month models, aggregated representations of primary care encounters were identified as important, whereas in the 3- and 1-month models that did not include aggregated indicators, primary care encounters in the final month of follow-up were selected as important. Descriptive for all variables identified as important by any model are presented in Table 4.7. Relative to controls, cases had higher rates of utilization and clinical diagnoses, and trend indicators suggested utilization and diagnoses among cases increased more over the course of follow-up. While the majority of variables identified as important significantly differed between cases and controls, a few did not, including follow-up strata, age at first deployment, marital status, and percent service connected.

Comparison of predicted risk group and actual housing status is presented in Table 4.8. Individuals whose predicted probability for homelessness was less than .20 were classified as low-risk, those whose predicted probability was between .20 and .50 were classified as moderate-risk, and those whose predicted probability was greater than .50 were classified as high risk. In models based on original variable sets, 10-11% of

Table 4.7. High Importance Homelessness Algorithm Input Variables, Stratified by Discharge Type

Variable	Not Homeless Controls[a] $N = 18,639$	Homeless Cases [a] $N = 6,871$	t / χ^2 p-value
Follow-up Strata			0.214
1) 1st Month	3,014 (16.2%)	1,159 (16.9%)	
2) 2nd Month	642 (3.4%)	245 (3.6%)	
3) 3rd Month	473 (2.5%)	183 (2.7%)	
4) 4th Month	467 (2.5%)	178 (2.6%)	
5) 5th Month	415 (2.2%)	157 (2.3%)	
6) 6th Month	412 (2.2%)	156 (2.3%)	
7) 7th Month	360 (1.9%)	138 (2%)	
8) 8th Month	369 (2%)	140 (2%)	
9) 9th Month	388 (2.1%)	153 (2.2%)	
10) 10th Month	289 (1.6%)	110 (1.6%)	
11) 11th Month	327 (1.8%)	126 (1.8%)	
12) 12th Month	256 (1.4%)	97 (1.4%)	
13) 2nd Year	2981 (16%)	1,149 (16.7%)	
14) 3rd-4th Year	4352 (23.3%)	1,608 (23.4%)	
15) 5th-6th Year	2,424 (13%)	813 (11.8%)	
16) 7th-8th Year	1,039 (5.6%)	326 (4.7%)	
17) 9th + Year	431 (2.3%)	133 (1.9%)	
Demographic Characteristics			
Age at First Deployment	23.18 (4.3)	23.1 (4.2)	0.181
Age at First Encounter	27 (4.95)	26.71 (4.7)	<.001
Race			<.001
White	11,135 (59.7%)	3,661 (53.3%)	
Black	4,250 (22.8%)	2,242 (32.6%)	
Hispanic	1,996 (10.7%)	662 (9.6%)	
Other/Unknown	1,258 (6.7%)	306 (4.5%)	
Marital Status			0.274
Never Married	12,633 (67.8%)	4,720 (68.7%)	
Married	5,706 (30.6%)	2,053 (29.9%)	
Divorced/Other	300 (1.6%)	98 (1.4%)	
Education			<.001
No Diploma/Diploma Equivalency	3,498 (18.8%)	1,827 (26.6%)	
High School Diploma	13,831 (74.2%)	4,675 (68%)	
Any College	1,310 (7%)	369 (5.4%)	

(*table continues*)

Variable	Not Homeless Controls[a] $N = 18,639$	Homeless Cases [a] $N = 6,871$	t / χ^2 p-value
Military Service Characteristics			
Misconduct Subtype			<.001
Civilian Legal	814 (4.4%)	101 (1.5%)	
Court Martial	1,151 (6.2%)	368 (5.4%)	
Discreditable Incident	3,462 (18.6%)	1,565 (22.8%)	
Other	1,497 (8%)	383 (5.6%)	
Pattern Minor Infractions	854 (4.6%)	195 (2.8%)	
Commission of a Serious Offense	4,350 (23.3%)	1,653 (24.1%)	
Substance Abuse	6,511 (34.9%)	2,606 (37.9%)	
MST Screen			<.001
Yes	632 (3.4%)	517 (7.5%)	
Decline	100 (0.5%)	61 (0.9%)	
No	15,103 (81%)	6,011 (87.5%)	
Unknown	2,804 (15%)	282 (4.1%)	
Combat Exposure (Yes)	5,001 (26.8%)	2,494 (36.3%)	<.001
Branch			<.001
Army	10,975 (58.9%)	4,840 (70.4%)	
Navy/Coast Guard	3,723 (20%)	1,131 (16.5%)	
Marines	1,761 (9.4%)	473 (6.9%)	
Air Force	2,180 (11.7%)	427 (6.2%)	
Clinical Characteristics			
Alcohol Diagnosis Count	0.25 (2.21)	1.6 (5.95)	<.001
*Any Alcohol Diagnosis	1,318 (7.1%)	1,704 (24.8%)	<.001
Drug Diagnosis Count	0.26 (2.76)	2.63 (9.69)	<.001
*Any Drug Diagnosis	1,032 (5.5%)	1,917 (27.9%)	<.001
Drug Diagnosis (Trend)	0.08 (1.48)	1.05 (4.78)	<.001
Depression Diagnosis Count	0.62 (2.69)	2.64 (6.96)	<.001
*Any Depression Diagnosis	4,243 (22.8%)	3,466 (50.4%)	<.001
Depression Diagnosis (Trend)	0.18 (1.4)	1.08 (4.1)	<.001
PTSD Diagnosis Count	0.39 (2.19)	1.64 (5.2)	<.001
*Any PTSD Diagnosis	2,929 (15.7%)	2,445 (35.6%)	<.001
Social Work Encounter Count	0.16 (0.85)	0.96 (2.73)	<.001
*Any Social Work Encounter	1,586 (8.5%)	2,210 (32.2%)	<.001
Social Work Encounter (Trend)	0.04 (0.49)	0.4 (1.37)	<.001
Mental Health Encounter Count	0.62 (3.01)	2.78 (7.44)	<.001
*Any Mental Health Encounter	3,693 (19.8%)	3,337 (48.6%)	<.001
Mental Health Encounter (Trend)	0.18 (1.58)	1.18 (4.35)	<.001

(*table continues*)

Variable	Not Homeless Controls[a] N = 18,639	Homeless Cases[a] N = 6,871	t / χ^2 p-value
Other Encounter Count	0.79 (2.28)	2.18 (4.94)	<.001
*Any Other Encounter	5,893 (31.6%)	3,298 (48%)	<.001
Other Encounter Count (11th month)	0.51 (1.98)	1.19 (3.45)	<.001
*Any Other Encounter (11th month)	3,814 (20.5%)	2,149 (31.3%)	<.001
Other Encounter Count (First 9 months)	3.28 (8.56)	5.63 (13.3)	<.001
*Any Other Encounter (First 9 months)	9,117 (48.9%)	3,805 (55.4%)	<.001
Other Encounter (Trend)	0.22 (1.52)	0.84 (2.92)	<.001
Primary Care Count (12 months)	3.05 (4.41)	4.61 (6.26)	<.001
*Any Primary Care (12 months)	13,035 (69.9%)	5,074 (73.8%)	<.001
Diagnostic Encounter Count (12 months)	3.2 (5.24)	5.05 (7.29)	<.001
*Any Diagnostic Encounter (12 months)	11,761 (63.1%)	4,824 (70.2%)	<.001
Primary Care Count	0.49 (0.96)	0.86 (1.58)	<.001
*Any Primary Care	5,606 (30.1%)	2,687 (39.1%)	<.001
Diagnostic Encounter Count	0.54 (1.26)	1.05 (2.08)	<.001
*Any Diagnostic Encounter	4,765 (25.6%)	2,548 (37.1%)	<.001
Emergency Department (Trend)	0.03 (0.2)	0.11 (0.39)	<.001
Substance Use Encounter Count	0.22 (2.49)	1.73 (7.38)	<.001
*Any Substance Use Encounter	598 (3.2%)	1,188 (17.3%)	<.001
Percent Service Connected	12.29 (25.71)	12.37 (24.98)	0.835

Notes: As some algorithms contain more than 300 input variables, only those that were identified as among the top 20 most important variables in any of the 4 models are included in the table. *Indicates that variable was included in the model in count form (as seen directly above the variable) but is provided in dichotomized form in the table for ease of interpretation. Clinical indicators correspond to the 30 days immediately preceding end of follow-up unless otherwise parenthetically noted.

[a] N (%) or M (SD).

those who were predicted to be at low risk were found to be homeless (N = 1,204 to 1,358), 29-31% of those who were predicted to be at moderate risk were found to be homeless (N = 2,528 to 2,690), and 69-71% of those who were predicted to be at high risk were found to be homeless (N = 2,924 to 2,977). In simplified models based on the 20 most important variables in each variable set, classification performance was again only slightly attenuated.

Table 4.8. Homelessness Classification Algorithm Performance based on Reference Comparison to Low, Medium, and High Risk Group Assignments

Risk Group	Full Model		Simplified Model	
	N	%	*N*	%
12 Month: All Variables				
Low (PP <.20)	1,367	10.6	1,730	12.7
Moderate (PP .20 -.50)	2,684	30.9	2,473	31.4
High (PP >.50)	2,977	71.7	2,668	66.8
12 Month: Aggregation with Trends				
Low (PP <.20)	1,204	9.9	1,713	12.7
Moderate (PP .20 -.50)	2,690	29.7	2,533	31.3
High (PP >.50)	2,977	69.1	2,625	66.8
3 Month				
Low (PP <.20)	1,311	10.4	1,975	13.2
Moderate (PP .20 -.50)	2,636	30.2	2,149	32.5
High (PP >.50)	2,924	69.8	2,747	69.0
1 Month				
Low (PP <.20)	1,358	10.9	1,885	12.9
Moderate (PP .20 -.50)	2,528	29.1	2,226	32.0
High (PP >.50)	2,985	68.7	2,760	69.2

Note: Simplified models are based on the 20 most important input variables as determined by the Gini Index.

Classification of mortality. Table 4.9 includes mortality classification model performance metrics for all variable subsets. The AUC for these models ranged from .722 to .738. Due to the extremely imbalanced nature of the outcome, it was possible to obtain a nearly perfect classification by predicting majority class. However, because sensitivity was prioritized over overall error rate, positive class prediction thresholds were evaluated at levels .2, .1, and .05. The very low threshold of .05 resulted in sensitivity values

Table 4.9. Random Forest Model Classifying Mortality: Performance Across Variable Subsets and Probability a Range of Thresholds for Positive Class Prediction

Threshold	PCC	Sensitivity	Specificity	PPV	NPV	Kappa	AUC
12 month: All Variables (Number of Variables= 335)							
Threshold = .20	.976	.120	.993	.243	.983	.150	
Threshold = .10	.947	.275	.960	.118	.986	.143	.733
Threshold = .05	.876	.476	.883	.074	.989	.097	
							*.699
12 month: Aggregation and Trends (Number of Variables = 102)							
Threshold = .20	.976	.108	.993	.231	.993	.134	
Threshold = .10	.944	.261	.957	.106	.985	.127	.738
Threshold = .05	.873	.477	.881	.072	.989	.095	
							*.687
3 Month: All Variables (Number of Variables = 82)							
Threshold = .20	.981	.061	.999	.545	.985	.107	
Threshold = .10	.951	.232	.965	.114	.985	.131	.728
Threshold = .05	.886	.407	.896	.070	.987	.090	
							*.679
1 Month: All Variables (Number of Variables = 41)							
Threshold = .20	.977	.075	.995	.222	.982	.104	
Threshold = .10	.948	.208	.962	.096	.984	.108	.722
Threshold = .05	.877	.389	.887	.062	.987	.077	
							*.674

Notes: PCC = Percent correctly classified; PPV = Positive predictive value; NPV = Negative predictive value; AUC = Area under the receiver operating characteristic curve. Threshold values represent the model-predicted probability at which cases were classified as homeless. *Denotes the AUC value for a classifier based on the 20 most important variables from the given variable subset.

between .389 and .477. Unlike the homelessness models, models based on 12-month variable subsets were consistently more sensitive than those based on the 3-month and 1-month subset. AUC values for simplified models based on the 20 most important variables from the given variable were attenuated, but not dramatically different from full models.

The top 20 most important variables for each model are presented in Table 4.10.

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Table 4.10. Variable Importance Ranks for Mortality Models Based on Different Variable Subsets: Top 20 Variables for the Best Version of Each Model

	Variable Subsets			
Variable	12 Month: All Variables	12 Month: Aggregation with Trends	3 Month: All Variables	1 Month: All Variables
	Rank Importance Based on Gini Index			
Follow-up Strata	1	1	1	1
Age at First VHA Encounter	2	2	2	2
Age at First Deployment	3	3	3	3
Diagnostic Encounters (12 months)	4	4		
Misconduct Subtype	5	5	4	4
Other Encounters (Trend)	6	6		
Primary Care Encounters (12 months)	7	7		
Other Encounters (First 9 Months)	8	8		
Mental Health Encounters (Trend)	9	9		
Medical Specialty Encounters (12 Months)	18	10		
Mental Health Encounters (First 9 Months)	12	11		
Social Work Encounters (Trend)	13	12		
Depression Diagnoses (Trend)	11	13		
Branch of Service	10	14	5	6
Emergency Department Encounters (Trend)	16	15		
Race	15	16	6	8
PTSD Diagnoses (Trend)	19	17		
Depression Diagnoses (First 9 Months)	18	18		
Social Work Encounters (First 9 Months)		19		
Alcohol Diagnoses (Trend)	17	20		
MST Screen Result	14		9	14
Other Encounters (10th Month)	20		7	
Other Encounters (11th Month)			8	
Diagnostic Encounters (10th Month)			11	
Other Encounters (12th Month)			10	5
Primary Care Encounters (10th Month)			12	
Mental Health Encounters (11th Month)			13	
Diagnostic Encounters (12th Month)			14	10
Education Level			15	12
Service Connected Disability (12th Month)			16	7
Mental Health Encounters (12th Month)			17	9
Service Connected Disability (12th Month)			18	

(*table continues*)

	Variable Subsets			
Variable	12 Month: All Variables	12 Month: Aggregation with Trends	3 Month: All Variables	1 Month: All Variables
Service Connected Disability (11th Month)			19	
Primary Care Encounters (12th Month)			20	11
Honorable Discharge				13
Combat Exposure				15
Marital Status				16
Service Connected Depression				17
Depression Diagnoses (12th Month)				18
Medical Specialty Encounters (12th Month)				19
Social Work Encounters (12th Month)				20

The following variables were common among all four models: follow-up strata, age at first VHA encounter, age at first deployment, misconduct subtype, and branch of service were common among all four models. Aside from those, there were few similarities between the two 12-month models and the two shorter-term models, as many of the indicators identified as important in the 12-month models were based on aggregation or trends, and were thus not included as inputs to the 3- and 1-month models. In the shorter-term models, more demographic and military service characteristics were identified as important, including education level, combat exposure, and marital status. Descriptive statistics stratified by vital status for all variables identified as important by any of the four models are presented in Table 4.11. Cases had higher rates of all utilization and clinical diagnoses, and their usage increased more over the course of follow-up. Again, a few variables identified as important did not significantly differ between cases and controls, including follow-up strata, age at first deployment, marital status, and misconduct subtype, and branch of service.

Table 4.11. High Importance Mortality Algorithm Input Variables, Stratified by Discharge Type

Variable	Living Controls[a] N = 25,330	Deceased Cases[a] N = 491	t / χ^2 p-value
Follow-up Strata			0.214
1st Month	563 (2.2%)	11 (2.2%)	
2nd Month	356 (1.4%)	7 (1.4%)	
3rd Month	355 (1.4%)	7 (1.4%)	
4th Month	815 (3.2%)	16 (3.3%)	
5th Month	510 (2%)	10 (2%)	
6th Month	207 (0.8%)	4 (0.8%)	
7th Month	461 (1.8%)	9 (1.8%)	
8th Month	459 (1.8%)	9 (1.8%)	
9th Month	617 (2.4%)	12 (2.4%)	
10th Month	409 (1.6%)	8 (1.6%)	
11th Month	306 (1.2%)	6 (1.2%)	
12th Month	360 (1.4%)	7 (1.4%)	
2nd Year	3,949 (15.6%)	76 (15.5%)	
3rd-4th Year	8,028 (31.7%)	157 (32%)	
5th-6th Year	4,484 (17.7%)	86 (17.5%)	
7th-8th Year	2,691 (11.7%)	50 (10.2%)	
9th Year or Later	490 (1.9%)	16 (3.3%)	
Demographic Characteristics			
Age at First Deployment	23.14 (4.26)	23.82 (4.58)	0.001
Age at First Encounter	26.92 (4.88)	27.17 (5.08)	0.278
Race			<.001
White	14,613 (57.7%)	348 (70.9%)	
Black	6,515 (25.7%)	79 (16.1%)	
Hispanic	2,656 (10.5%)	34 (6.9%)	
Other/Unknown	1,546 (6.1%)	30 (6.1%)	
Marital Status			0.679
Never Married	17,227 (68%)	330 (67.2%)	
Married	7,709 (30.4%)	151 (30.8%)	
Divorced/Other	394 (1.6%)	10 (2%)	
Education			<.017
No Diploma/Diploma Equivalency	5,270 (20.8%)	128 (26.1%)	
High School Diploma	18,393 (72.6%)	332 (67.6%)	
Any College	1,667 (6.6%)	31 (6.3%)	

(*table continues*)

Variable	Living Controls[a] N = 25,330	Deceased Cases[a] N = 491	t / χ^2 p-value
Military Service Characteristics			
Misconduct Subtype			.126
Civilian Legal	912 (3.6%)	7 (1.4%)	
Court Martial	1,505 (5.9%)	31 (6.3%)	
Discreditable Incident	4,995 (19.7%)	92 (18.7%)	
Other	912 (3.6%)	7 (1.4%)	
Pattern Minor Infractions	1,505 (5.9%)	31 (6.3%)	
Commission of a Serious Offense	4,995 (19.7%)	92 (18.7%)	
Substance Abuse	912 (3.6%)	7 (1.4%)	
MST Screen			<.023
Yes	1,141 (4.5%)	20 (4.1%)	
Decline	158 (0.6%)	8 (1.6%)	
No	20,995 (82.9%)	395 (80.4%)	
Unknown	3,036 (12%)	68 (13.8%)	
Combat Exposure (Yes)	5,001 (26.8%)	2,494 (36.3%)	<.001
Honorable Discharge on File (Yes)	13,292 (52.5%)	275 (56%)	0.132
Branch			<.363
Army	15,698 (62%)	321 (65.4%)	
Navy/Coast Guard	4,817 (19%)	86 (17.5%)	
Marines	2,216 (8.7%)	43 (8.8%)	
Air Force	2,599 (10.3%)	41 (8.4%)	
Clinical Characteristics			
Alcohol Diagnoses (Trend)	0.02 (1.48)	0.16 (2.57)	0.227
Depression Diagnoses (First 9 Months)	3.72 (14.1)	10.81 (27.9)	<.001
*Any Depression Diagnoses (First 9 Months)	8,869 (35%)	276 (56.2%)	<.001
Depression Diagnoses (12th Month)	0.46 (2.53)	1.44 (3.83)	<.001
*Any Depression Diagnosis (12th Month)	3,371 (13.3%)	156 (31.8%)	<.001
Depression Diagnosis Trend (12th Month)	0.05 (2.13)	0.43 (3.95)	0.036
Service Connected for Depression	0.33 (0.47)	0.33 (0.47)	0.72
PTSD (Trend)	0.03 (1.58)	0.3 (3.27)	0.071
Primary Care Count (12 Months)	3.33 (5.5)	6.49 (8.39)	<.001
*Any Primary Care (12 Months)	15,789 (62.3%)	375 (76.4%)	<.001
Primary Care Count (10th Month)	0.3 (0.88)	0.67 (1.67)	<.001
*Any Primary Care (10th Month)	4,045 (16%)	137 (27.9%)	<.001
Primary Care Count (12th Month)	0.31 (0.93)	0.71 (1.72)	<.001
*Any Primary Care (12th Month)	4,179 (16.5%)	137 (27.9%)	<.001
Mental Health Encounter Count (First 9 Months)	4.82 (15.34)	12.76 (30.3)	<.001
*Any Mental Health Encounters (First 9 Months)	10,312 (40.7%)	306 (62.3%)	<.001

(*table continues*)

Variable	Living Controls[a] $N = 25{,}330$	Deceased Cases[a] $N = 491$	t / χ^2 p-value
Mental Health Encounters (11th Month)	0.61 (2.79)	2.01 (5.64)	<.001
*Any Mental Health Encounter (11th Month)	4,321 (17.1%)	178 (36.3%)	<.001
Mental Health Encounter Count (12th Month)	0.6 (2.67)	1.78 (4.94)	<.001
*Any Mental Health Encounters (12th Month)	4,289 (16.9%)	179 (36.5%)	<.001
Mental Health Encounters (Trend)	0.07 (2.28)	0.46 (4.28)	0.046
Social Work Encounter Count (First 9 Months)	1.62 (5.68)	4.62 (12.13)	<.001
*Any Social Work Encounters (First 9 Months)	7,018 (27.7%)	225 (45.8%)	<.001
Social Work Encounter Count (12th Month)	0.19 (0.97)	0.6 (1.57)	<.001
*Any Social Work Encounters (12th Month)	2160 (8.5%)	124 (25.3%)	<.001
Social Work Encounters (Trend)	0.02 (0.77)	0.11 (1.49)	0.185
Emergency Department (Trend)	0 (0.22)	0.07 (0.47)	0.002
Diagnostic Encounter Count (12 Months)	3.44 (5.9)	9.65 (15.21)	<.001
Any Diagnostic Encounters (12 Months)	14,459 (57.1%)	363 (73.9%)	<.001
Diagnostic Encounter Count (10th Month)	0.3 (0.98)	0.89 (2.43)	<.001
*Any Diagnostic Encounters (10th Month)	3,364 (13.3%)	137 (27.9%)	<.001
Diagnostic Encounter Count (12th Month)	0.31 (1.08)	0.98 (2.96)	<.001
*Any Diagnostic Encounters (12th Month)	3,410 (13.5%)	128 (26.1%)	<.001
Other Encounter Count (First 9 Months)	4.8 (13.09)	13.15 (29.69)	<.001
*Any Other Encounters (First 9 Months)	13,457 (53.1%)	346 (70.5%)	<.001
Other Encounter Count (10th Month)	0.58 (2.26)	2 (5.19)	<.001
*Any Other Encounters (10th Month)	4,973 (19.6%)	178 (36.3%)	<.001
Other Encounter Count (11th Month)	0.57 (2.23)	2.06 (6.34)	<.001
*Any Other Encounters (11th Month)	4,918 (19.4%)	186 (37.9%)	<.001
Other Encounter Count (12th Month)	0.57 (2.18)	1.87 (5.23)	<.001
*Any Other Encounters (12th Month)	5029 (19.9%)	176 (35.8%)	<.001
Other Encounters (Trend)	0.04 (1.8)	0.52 (4.27)	0.014
Medical Specialty Encounter Count (12 Months)	0.62 (2.05)	2.64 (10.31)	<.001
*Any Medical Specialty Encounters (12 Months)	5,494 (21.7%)	183 (37.3%)	<.001
Medical Specialty Encounter Count (12th Month)	0.06 (0.33)	0.44 (3.53)	0.015
*Any Medical Specialty Encounters (12th Month)	972 (3.8%)	43 (8.8%)	<.001
Service Connected Disability (10th Month)	9.65 (24.07)	18.94 (32.74)	<.001
Service Connected Disability (11th Month)	9.84 (24.25)	20.75 (33.56)	<.001
Service Connected Disability (12th Month)	9.83 (24.19)	21.34 (34.51)	<.001

Notes: As some algorithms contain more than 300 input variables, only those that were identified as among the top 20 most important variables in any of the 4 models are included in the table. *Indicates that variable was included in the model in count form (as seen directly above the variable) but is provided in dichotomized form in the table for ease of interpretation. The period of follow-up for each clinical indicator is parenthetically noted. 12th month = the 30 days immediately preceding end of follow-up, etc.

[a] *N* (%) or *M* (*SD*)

Comparison of predicted risk group and actual mortality status is presented in Table 4.12. Individuals whose predicted probability for mortality was less than .05 were classified as low-risk, those whose predicted probability was between .05 and .20 were classified as moderate-risk, and those whose predicted probability was greater than .20 were classified as high risk. In predictions based on original variable sets, at the end of follow-up, 1% of those who were predicted to be at low risk were deceased ($N = 257$ to 301), 5-6% of those who were predicted to be at moderate risk were deceased ($N = 155$ to 181), and 21% - 25% of those who were predicted to be at high risk were deceased ($N =$

Table 4.12. Mortality Classification Algorithm Performance based on Reference Comparison to Low, Medium, and High Risk Group Assignments

Risk Group	Full Model		Simplified Model	
	N	%	*N*	%
12 Month: All Variables				
Low (PP <.05)	286	1.2	315	1.4
Moderate (PP .05 -.20)	149	6.0	136	5.1
High (PP >.20)	56	21.3	40	25.2
12 Month: Aggregation with Trends				
Low (PP <.05)	257	1.1	321	1.4
Moderate (PP .05 -.20)	181	6.0	130	4.8
High (PP >.20)	53	22.8	40	26.8
3 Month				
Low (PP <.05)	292	1.3	342	1.5
Moderate (PP .05 -.20)	152	5.6	112	4.5
High (PP >.20)	47	24.5	37	25.9
1 Month				
Low (PP <.05)	301	1.3	351	1.5
Moderate (PP .05 -.20)	155	5.3	113	4.6
High (PP >.20)	35	20.5	27	23.9

Note: Simplified models are based on the 20 most important input variables as determined by the Gini Index.

35 to 56). Unlike models for homelessness, mortality models tended to perform better with longer-term follow-up.

Discussion

Results from this study further our understanding of the relationships between demographic characteristics, military service experiences and exposures, clinical diagnoses, and health service utilization and subsequent homelessness and mortality among veterans who were discharged from service due to misconduct, and demonstrate the utility of using these data to stratify risks for these outcomes among this already-vulnerable subgroup. These findings can inform efforts to better tailor services to the needs of misconduct-discharged veterans, and improve the targeted provision of timely care to those who imminently at risk for adverse outcomes.

In regression models, a wide variety of risk and protective factors for homelessness and mortality were identified. In the full models, while 25% of the variance in homelessness was accounted for, only 9% of the variance in mortality was accounted for. This is in part due to use of an all-cause mortality variable, as opposed to a one that differentiates between different causes of death. That said, most veterans included in this sample were 20-40 years old during their clinical follow-up. Thus, the majority of recorded deaths were preventable, and to some degree, related to several similar health and behavioral factors that are overrepresented among misconduct-discharged veterans, including serious mental illness, alcohol and substance use, and suicidal ideation and behaviors.

Homelessness and mortality had certain risk factors in common. Engagement in mental health care, social work services, and inpatient services were associated with increased risk for both outcomes. Usage of these services may reflect the deterioration of mental health or life circumstances that often precedes adverse events. This was particularly true for homelessness, which was related to additional types of clinical service usage, including emergency department services, and substance use services. These results indicate that many VHA-enrolled veterans who are at imminent risk for homelessness and mortality are actively engaged in care. Thus, there may be opportunities to integrate enhanced screening, referral services, or additional supports into the services that are already being used by at-risk veterans.

In addition to specialty service usage, recent clinical diagnoses of PTSD and diagnoses related to legal problems were associated with increased risk for homelessness. The nearly four times higher odds for homelessness among those with recent diagnoses related to legal problems was particularly striking. While these diagnoses are relatively uncommon in the larger veteran population, 8.2% misconduct-discharged veterans who become homeless had this diagnosis in the 90 days preceding their initial administrative evidence of homelessness. Increased provider awareness of potential housing instability among veterans who are experiencing legal problems may help facilitate appropriate referrals to the many active VHA programs in place that serve veterans who are at risk for becoming homeless.

Race/ethnicity played an opposite role in homelessness and mortality models. While white race/ethnicity was associated with lower risk for homelessness relative to

Black race/ethnicity, it was associated with increased risk for mortality relative to all both Black and Hispanic race/ethnicity. Considering the major underlying causes of death in this population—suicide, accidental overdose, and accidents—this is concordant with findings in non-veteran populations, in which White men have more than twice the rate of suicide as Black, Asian, or Hispanic men,[19] and rates of drug-induced deaths are highest among non-Hispanic Whites.[20] Similarly, research consistently indicates that Blacks are overrepresented in the homeless population, due to a variety of factors including socioeconomic status and residential segregation.[21,22]

Several factors that were protective against homelessness or mortality among misconduct-discharged veterans were similar to those that are generally seen among the larger OEF/OIF veteran population, including variables that can serve as proxies for socioeconomic status such as rank of officer, and completion of a high school diploma. Interestingly, having a service-connected disability rating was a protective factor against homelessness, but a risk factor for mortality. These benefits are intended to replace lost earning potential that is attributable to disabilities sustained or worsened by military service experiences. While these benefits helped to offset the health-related vulnerabilities experienced by many misconduct-discharged veterans, high levels of service-connected disability may also serve as a proxy for physical disabilities that increase risk for death, resulting in this counter-intuitive association with mortality.

Despite the protective effect of service-connected disability benefits against homelessness, the two service-related experiences measured in this study, MST and combat exposure, were both associated with higher risk for homelessness, suggesting that

either these benefits are only offering partial protection, or some veterans with potential service-connected disabilities are not receiving benefits. The finding of increased risk for homelessness among those who screened positive for MST corroborates recent findings regarding this association among the wider OEF/OIF population.[23] However, the finding of increased risk for both homelessness and mortality among those who declined screening for MST is novel. Declining screening could represent a lack of trust in VHA providers, an issue that may be more salient among misconduct-discharged veterans, as they may experience a sense of institutional betrayal due to the circumstances under which their military service ended. Lack of patient-provider trust can disrupt quality and continuity of care and increase risk for adverse outcomes.[24,25] It is also possible that declining MST screening reflects a tendency toward maladaptive coping mechanism such as experiential avoidance. These behaviors are associated with higher levels of distress, and may contribute the accumulation of psychiatric symptoms.[26] While the number of veterans who declined screening are small, these troubling outcomes suggest the need for follow-up research, including consideration of potential alternative procedures in the event of a declined MST screen.

Results from the machine learning models demonstrated that risk for certain adverse outcomes among a vulnerable population can be stratified using a limited number of indicators and relatively short period of administrative follow-up. Such a system offers practical utility in outreach and clinical care, as it allows for the targeted provision of prevention and intervention efforts. Similar to regression models, machine learning predictions of homelessness were more robust than those for mortality.

The machine learning models and regression models offered complementary views of risk for homelessness and mortality. While regression models provided odds ratios for readily interpretable indicators, machine learning models provided enhanced and stable predictions that made use of high dimensional data and higher-order interactions. This is illustrated by the variables identified as important to the machine learning models. For example, although cases and controls were matched on follow-up strata and there were no statistical differences between groups on this variable, in machine learning models, follow-up strata were consistently identified as a high-importance variable. By using this variable at multiple decision points in a given tree, the algorithm was effectively able to condition the effect of time-varying clinical variables on follow-up time, resulting in more sensitive indicators.

Comparisons across different machine learning models yielded several practical insights. First was the relative unimportance of pre-processing data for these classification tasks. While models that included aggregated variables or representation of time trends often identified these indicators as important, in their absence, very similar information was able to be extracted from the raw variables. Next, it was revealed that for homelessness, predictions based on 3 months or even 1 month of follow-up data are roughly as accurate as predictions based on 12 months of follow-up data. Finally, simplified models that were based on the 20 most important variables for each subset, while inferior, still provided useful stratification information. Finally, little tuning of the models was required. While classifications improved with a larger number of trees, adjustments to the number of variables tried at each split did not strongly affect

predictions. These are all attractive features, as they allow for simple retraining of the models, should additional indicators become available or of interest.

Predictive models for homelessness in particular indicate the potential to flag a large number of high-risk veterans. Based on the performance of the model that uses 3 months of data, among the 6,871 veterans who became homeless, 2,924 (44.6%) were predicted to be at high risk, 2,636 (38.4%) were predicted to be at moderate risk, and 1,311 (19.1%) were predicted to be at low risk. Thus, based on this model, over 80% of those who went on to become homeless were predicted to be at other than low risk. In practice, these risk tiers are flexible. For example, it may be sensible to include all veterans who were identified as moderate- or high-risk in the target group for a relatively simple to deploy and low-cost intervention. While a larger target group will necessarily result in a higher number of false positives, this may be acceptable due to the low cost of the intervention. Conversely, a more resource intensive intervention may be targeted to only those identified as high-risk.

The relative seriousness of the outcome also plays an important role in risk stratification. Mortality was a rare event, and mortality models had relatively low sensitivity. Among those in the high predicted risk groups, only 20-25% experienced the event of interest. Conversely, in homelessness models, 69-72% of those in the high predicted risk groups experienced the event of interest. However, a 25% predicted probability for death is much more serious and urgent than a 25% predicted probability for homelessness. Thus, predicted probabilities output by the model can used to define strata that reflect the seriousness of the outcome, as well as the scope of the intervention

to be deployed.

Limitations

This study has several limitations. Results are based on veterans who are seeking treatment at VHA facilities, and not all veterans choose to use VHA services. During the period of follow-up for the present study, 63-65% of VHA-enrolled veterans used services each year.[27] Certain characteristics common misconduct-discharged veterans are associated with a lower likelihood of dual and non-VHA service use (lower levels of income and education)[28,29] suggesting that these veterans may be even more likely to be represented in our sample. Nonetheless, it is unclear how these results might relate to misconduct-discharged veterans who do not use VHA care. Even among veterans who had at least one VHA encounter and were thus represented in our sample, some are not regular users. These veterans likely make up many of those who were classified as low-risk, but went on to experience an adverse outcome. This highlights a persistent challenge VHA faces in delivering prevention efforts to veterans who are vulnerable, but not regular users.

It is also not possible to draw direct causal inferences from these models. The documentation of events in the medical record do not necessarily correspond to the true chronicity of exposures, the manifestation of symptoms, and outcomes. Further, administrative data fails to capture many important variables that fall outside of the general medical context.

Due to the case control design used in this study, the ratio of cases to controls is higher in the analytic data than in live data. As a result, machine learning training set

performance metrics are specific to this sample. In future applications of these techniques

to live data, tuning may be required to optimize model performance for differently

balanced classes.

Policy and Clinical Practice Implications

While as a whole, misconduct-discharged veterans represent a vulnerable

population, they have diverse experiences, resources, and needs. Even in the context of

excellent patient-centered care, providers are unable to take in the vast amounts of

information available regarding every veteran's demographic and military service

background and clinical history, and subsequently accurately assess their needs across a

range of health and social domains. In this way, risk stratification tools can support the

provider. The integration of algorithmic analytic approaches into the clinical workflow is

an example of a learning health care system, an approach that has been comprehensively

described by the Institute of Medicine,[30] and is advocated by AHRQ and Veterans Affairs

leadership.[31,32]

This approach facilitates a shift from intervention toward prevention, which is

very applicable to addressing homelessness. For example, a veteran may experience

health or legal problems, leading them to fall behind on their rent. Based on that veteran's

profile and clinical history, an alert is generated, informing the front-line provider that the

veteran may be at-risk for homelessness. The provider may then engage the veteran in

conversation, assessing needs and discussing resources that may address those needs, and

resolve the current instability. In the absence this brief intervention, the veteran may not

be made aware of needed services, and their financial and health status may continue to

deteriorate, ultimately resulting in eviction. Exacerbation of symptoms and unemployment may follow, and the situation likely becomes much more difficult and costly to resolve. Importantly, targeted service provision through risk stratification would not place limitations on service usage based on results; rather, it would help to improve access among those who are in need of services but may not necessarily be identified as such in the absence of these tools.

Future Directions

While the present study relied entirely on administrative data to evaluate risk and protective factors for homelessness and mortality, there are many other important factors that require further examination. Direct engagement of misconduct-discharged veterans in primary research, including qualitative research, will provide more nuanced insights into health-related needs, as well as information on social, familial, and financial factors that contribute to adverse outcomes among this population. This information could then be used to enhanced the integration of appropriate social services into clinical settings. With regard to mortality, follow-up analyses that explore risk and protective factors for various causes of death can also help facilitate more tailored care.

Future research focusing on the implementation of risk management tools is also needed, including assessing provider and patient perspectives on adaptation of such a system, piloting and evaluating the algorithm performance on live data, and determining computational and systems requirements for broad adaptation. Ultimately, in a fully developed system, variations in treatment could be recorded and further analyzed to inform and improve care, leading to a continuous feedback cycle that encourages

constant quality improvement.

Conclusion

VHA administrative data contains many indicators that predict risk for homelessness and mortality among veterans discharged from recent conflicts due to misconduct. For both outcomes, usage of specialty clinical services was associated with increased risk, suggesting that there may be opportunities to integrate relevant services into the care these veterans are already receiving. Several other indicators emerged as important risk factors, including exposure to combat and a positive or declined MST screen. These findings underscore the importance of health-related vulnerabilities in the pathway to adverse outcomes among this population. In predictive modeling using machine learning methods, risk for homelessness, and to a lesser extent, mortality, was stratified using a limited number of indicators and relatively short period of administrative follow-up. Findings suggest the viability of risk stratification techniques to facilitate the targeting of prevention or intervention strategies among this population, and the potential success of their integration into more targeted clinical care.

References

1. Gundlapalli AV, Fargo JD., Metraux S, et al. Military misconduct and homelessness among us veterans separated from active duty, 2001-2012. *JAMA*. 2015; 314(8), 832-4.

2. Reger MA, Smolenski DJ, Skopp NA, et al. Risk of suicide among US military service members following Operation Enduring Freedom or Operation Iraqi Freedom deployment and separation from the US Military. *JAMA Psychiatry*. 2015; 72(6), 561-9.

3. Brignone EB, Fargo JD, Blais RK, Gundlapalli AV. *Military misconduct and post-discharge mortality risk*. Manuscript in Preparation. 2017.

4. Highfill-McRoy RM, Larson GE, Booth-Kewley S, Garland, CF. Psychiatric diagnoses and punishment for misconduct: the effects of PTSD in combat-deployed Marines. *BMC Psychiatry*. 2010;10:88. http://doi.org/10.1186/1471-244X-10-88

5. Hoge CW, Tobani HE, Messer SC, et al. The occupational burden of mental disorders in the U.S. Military: psychiatric hospitalization, involuntary separation, and disability. *Am J Psychiat*. 2005;3(162):585-92.

6. Ommaya A, Salazar A, Dannenberg A, et al. Outcome after traumatic brain injury in the U.S. Military medical system. *J Trauma*, 1996;41(6):972-5.

7. Brignone E, Fargo JD, Blais RK, Carter ME, Samore MH, Gundlapalli AV. Non-routine discharge from military service: mental illness, substance use disorders, and suicidality. *Am J Prev Med*. 2017;52(5):557-565.

8. Liu HL, Chen LH, Huang SM. Outpatient health care utilization of suicide decedents in their last year of life. *Suicide Life-Threat*. 2012; 42(4):445-52.

9. Tran T, Luo W, Phung D, et al. Risk stratification using data from electronic medical records better predicts suicide risks than clinician assessments. *BMC Psychiatry*. 2014; 14(1):1-9.

10. Boscarino JA, Kirchner HL, Pitcavage JM, et al. Factors associated with opioid overdose: a 10-year retrospective study of patients in a large integrated health care system. *Subst Abuse Rehabil*. 2016;7:131-141.

11. Wan JJ, Morabito DJ, Khaw L, Knudson MM, Dicker RA. Mental illness as an independent risk factor for unintentional injury and injury recidivism. *J Trauma*. 2006;61(6):1299-1304.

12. Gundlapalli AV, Carter ME, Divita G, et al. Extracting concepts related to homelessness from the free text of VA electronic medical records. *AMIA Annual Symposium Proceedings*. 2014;2014:589-598.

13. Peterson R, Gundlapalli AV, Metraux S, et al. Identifying homelessness among Veterans using VA administrative data: opportunities to expand detection criteria. *PLoS ONE*. 2015;10(7):e0132664.

14. Quan H, Sundararajan V, Halfon P, Fong A, Burnand B, Luthi JC, Saunders LD, Beck CA, Feasby TE, Ghali WA. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Med Care* 2005;43(11):1130-1139.

15. Fargo JD, Brignone E, Metraux S, et al. Homelessness following disability-related discharges from active duty military service in Afghanistan and Iraq. *Disabil Health J*. 2017:1-8.

16. Gundlapalli AV, Redd A, Carter ME, Palmer M, Peterson R, Samore MH. Exploring patterns in resource utilization prior to the formal identification of homelessness in recently returned veterans. *Stud Health Technol Inform. 2014;*202:265-8.

17. Random Forests. Berkeley Department of Statistics. http://www.stat.berkeley.edu/~breiman/RandomForests/cc_home.htm. Accessed April 13, 2017.

18. Friedman J, Hastie T, Tibshirani R. *The elements of statistical learning*. Vol. 1. Springer, Berlin, Germany. Springer Series in Statistics; 2009.

19. WISQARS™ Fatal Injury Reports. Centers for Disease Control and Prevention. https://webappa.cdc.gov/sasweb/ncipc/mortrate.html. Accessed April 14, 2017.

20. Rudd RA, Aleshire N, Zibbell JE, Gladden M. Centers for Disease Control and Prevention. Increases in drug and opioid overdose deaths-United States, 2000-2014. *Am J Transplant*. 2016;64(50):1378-82.

21. Elliott M, Krivo LJ. Structural determinants of homelessness in the United States." *Soc Probl*. 1991;38(1):113-31.

22. Carter GR. From exclusion to destitution: race, affordable housing, and homelessness. *Cityscape*. 2011;13(1): 33-70.

23. Brignone E, Gundlapalli AV., Blais RK, et al. Differential risk for homelessness among US male and female Veterans with a positive screen for military sexual trauma. *JAMA Psychiatry*. 2016;73(6):582-9.

24. Thom DH, Hall MA, Pawlson LG. Measuring patients" trust in physicians when assessing quality of care. *Health Aff*. 2004;23(4):124-32.

25. Van Walraven C, Oake N, Jennings A, Forster AJ. The association between continuity of care and outcomes: a systematic and critical review. *Journal of evaluation in clinical practice*. 2010;16(5):947-56.

26. Kashdan TB, Barrios V, Forsyth JP, Steger MF. Experiential avoidance as a generalized psychological vulnerability: Comparisons with coping and emotion regulation strategies. *Behav Res Therapy*. 2006;44(9):1301-20.

27. Bagalman E. *The Number of Veterans That Use VA Health Care Services: A Fact Sheet* (CRS Report No. R43579). Washingon, DC: Congressional Research Service, 2014.

28. Ross JS, Keyhani S, Keenan PS, et al. Dual Use of Veterans Affairs Services and Use of Recommended Ambulatory Care. *Med Care*. 2008;46(3):309-316.

29. Borowsky SJ, Cowper DC. Dual use of VA and non-VA primary care. *J Gen Intern Med*. 1999;14(5):274-280.

30. Best care at lower cost: The path to continuously learning health care in America. Institute of Medicine of the National Academies. https://www.nap.edu/read/13444/chapter/1. Accessed April 13, 2017.

31. Slutsky JR. Moving closer to a rapid-learning health care system. *Health Aff*. 2007;26(2):2-5.

32. Atkins, D. Making VA a learning health care system. https://www.va.gov/RAC-GWVI/meetings/nov2016/03_Atkins.pdf. Accessed April 14, 2017.

CHAPTER 5

SUMMARY AND CONCLUSIONS

This chapter begins with a summary of key findings from the dissertation,

followed by a discussion of the policy implications of those findings, and notes on study

limitations. Last, suggestions for future research are made.

Summary of Key Findings

Misconduct-Discharged Veterans Have
Complex Health-Related Vulnerabilities

Collectively, results from this dissertation underscore the many health-related

vulnerabilities and needs of veterans who are discharged from service for misconduct.

Building upon previous reports of increased rates of in-service mental health issues

among this group,[1-3] the patterns of service-connected disability assignments described in

Chapter 2 suggest that the overrepresentation of mental health issues among misconduct-

discharged veterans may be, in-part, attributable to service-related experiences.

Following discharge, the divide between routinely discharged and misconduct-discharged

veterans in terms of mental health problems becomes even more apparent. As seen in

Chapter 3, within 1 year after initiating VHA care, misconduct-discharged veterans had

two times higher odds for diagnoses related to depression/PTSD, three times higher odds

for depressions related to psychosis, and 6-10 times higher odds for diagnoses related to

alcohol and drug abuse. These differences persisted though 5-years of follow-up,

indicating that they were likely not attributable to delayed symptom manifestation or

service-seeking among routinely discharged veterans.

In addition to mental health vulnerabilities, misconduct-discharged veterans had higher risk for several chronic physical conditions, including peptic ulcer disease, hypertension, and liver disease. These findings correspond with considerable evidence that individuals with mental health conditions are at increased risk for physical health problems, thought to be largely due to a higher prevalence of modifiable risk factors, such as smoking, poor nutrition, lack of exercise, and risky sexual behaviors, and intravenous drug use.[4,5] Increased risk for chronic health conditions among misconduct-discharged veterans is particularly concerning given the relatively young age of the study sample at the time of administrative follow-up. In the absence of intervention, the progression of chronic health conditions may become a serious source of morbidity and mortality in this population over the long-term.

The mental and physical health vulnerabilities of this population also confer risk for adverse circumstances that can further worsen health, including victimization, incarceration, social isolation, and homelessness. This was borne out in results from Chapter 4 of this dissertation, in which variables indicative of health-related vulnerabilities were found to be associated with higher risk for homelessness.

Health-related vulnerabilities appear at multiple points in the proposed theoretical framework and the results of these studies support that conceptualization. Health-related military experiences, including service-connected mental health conditions and exposure to MST, were linked to discharge from service due to misconduct. Subsequently, immediate post-discharge consequences associated with misconduct included

comorbidities and health deterioration. Finally, their accumulation contributed to emergent outcomes of homelessness and mortality.

**Demographic Characteristics Are Related to
Misconduct Discharge and Its Associated
Outcomes**

Results from Chapter 2 indicate that risk for misconduct discharge is related to several demographic characteristics. Younger service members and those who did not have a high-school diploma were at higher risk for misconduct discharge. In addition, independently of age, education, and other demographic and military service characteristics, Black, and to a lesser degree, American Indian/Alaska Native service members, were at higher risk for a misconduct discharge.

These demographic factors are related the resources/vulnerabilities described in the theoretical framework as impacting military experiences and risk for misconduct discharge. With regard to age, recruits may join the military at age 18, while the areas of the brain that underlie planning and impulse control continue to mature up through the mid-20s.[6,7] Thus, immaturity due to age represents a cognitive and behavioral vulnerability that may precipitate misconduct. Education level and race/ethnicity are also related to unmeasured resource/vulnerabilities, including socioeconomic status and social capital. Finally, given the high degree of discretion that commanding officers have in disciplinary and discharge procedures,[8] lack of cultural competence and implicit or explicit biases has the potential to create additional vulnerability among service members of Black or American Indian/Alaska Native race/ethnicity in the form harsher disciplinary treatment.

Results from Chapter 4 indicate that demographic factors continue to play a role in the development of adverse outcomes following discharge. These included higher risk for homelessness among veterans of Black relative to White race/ethnicity, and lower risk for mortality among veterans of Black and Hispanic relative to White race/ethnicity. For the most part, these results correspond with those seen among the larger non-veteran population. While overall mortality rates are lower among White relative to Black Americans, considering the predominant causes of death among this young population—suicide, accidental overdose, and accidents,[9] this is concordant with findings in non-veteran populations, in which White men have more than twice the rate of suicide as Black, Asian, or Hispanic men,[10] and rates of drug-induced deaths are highest among non-Hispanic Whites.[11]

Misconduct-Discharged Veterans Have
Unique Patterns of Care

Results from Chapter 3 demonstrate that Veterans who were discharged from service for misconduct use VHA services at a much higher rate than their routinely discharged counterparts. Over 5 years of follow-up, the adjusted incremental cost associated with a misconduct discharge was $14,422 for women, and $16,106 for men— double the costs of routinely discharged Veterans and representing a total excess cost of over $360 million for this sample alone. This greatly disproportionate rate of health-service utilization illustrates the weight of health-related needs among this subpopulation, and underscores the finding of post-discharge health deterioration following discharge from service as implied in the theoretical framework.

Given the disproportionately high rates of mental and physical health diagnoses among misconduct-discharged veterans, higher rates of service utilization were expected. However, compared to routinely-discharged veterans whose healthcare needs and usage included similar treatment types (eg, substance use, mental health, social work, and even homeless services), misconduct-discharged veterans had significantly higher rates of encounters and incurred significantly higher costs. This may indicate more severe symptomology among misconduct-discharged veterans even as compared to routinely-discharged veterans with similar diagnoses. Greater symptom severity could be a product of higher rates of co-occurring disorders among this population, as individuals with co-occurring disorders report greater severity of symptoms than individuals with a single disorder.[12,13]

Not only were there differences in the amount of care received by misconduct-discharged veterans relative to routinely discharged veterans, there were differences in the type of care. While misconduct-discharged veterans were more likely to access nearly every type of specialty services, they were less likely to access primary care services. Given their already-heightened risk for several chronic health conditions, regular primary care is of particular importance. Thus, strategies designed to transition the post-discharge care of misconduct-discharged veterans toward primary and preventive services may help to mitigate health deterioration that often precipitates the development of emergent outcomes such as mortality.

**Specialty Service Usage is Associated with
Higher Risk for Adverse Outcomes**

In the absence of appropriate intervention, the many health-related vulnerabilities associated with misconduct-discharge can lead to emergent outcomes such as homelessness and mortality. In Chapter 4, it was found that for both of these outcomes, usage of most types of specialty care was associated with increased risk. This finding suggests that at the time that many misconduct-discharged veterans became homeless or died, they had recently used specialty services. Notably, usage of primary care services was not significantly associated with risk for either homelessness or mortality.

These findings have several potential implications. First, for many veterans who went on to become homeless or die, the care they received was insufficient to prevent the outcome that followed. However, that many veterans are engaged in VHA services in the period leading up to these events suggests there may be additional opportunities to enhance existing care with the goal of more effectively interrupting the progression of immediate outcomes toward emergent outcomes.

**Risk for Adverse Outcomes Can Be Stratified
Using Administratively Available Data**

While as a whole, misconduct-discharged veterans are at significantly higher risk for emergent outcomes such as homelessness and mortality, this group is not homogenous, and the range of vulnerability between individuals is wide. In chapter 4, machine-learning techniques were used to predict risk for homelessness and mortality using variables described in Chapters 2 and 3, including demographic and military service characteristics, service-connected exposures or disabilities, and post-discharge

health status and healthcare utilization.

In best-performing machine learning models, among those predicted to be at high-risk for homelessness, 70% become homeless (43% among all homeless); among those predicted to be at moderate-risk, 30% became homeless (38% among all homeless). Among those among those predicted to be at high-risk for mortality, 23% died (11% among all deaths); among predicted to be at moderate-risk for mortality, 6% died (37% among all deaths). These results, particularly those for homelessness models, suggest the viability of risk-stratification techniques to identify vulnerable veterans, thus facilitating the targeting of prevention and intervention efforts.

Implications for Policy

Implications for the Department of Defense

For the more than 26,000 service members discharged for misconduct among this sample, military occupational specialty-specific skills and experience were lost, personnel stability was negatively impacted, and excess administrative costs related to discharge processing and replacement recruiting were incurred. Thus, although strategies to address misconduct discharge require the investment of additional resources, their potential returns are much higher when attrition costs are considered.

Developmental programs for risky recruits. The finding of increased risk for misconduct discharge among recruits who are relatively young or have less than a high school diploma is not novel. In fact, this has been reported since the 1980s.[14] One potential existing resource for reducing post-deployment attrition among recruits who are

risky due to their age or education level is the Delayed Entry Program (DEP). Under the

DEP, new recruits sign an enlistment contract, but do not enter training for up to a year

later. During the waiting period, recruits maintain contact with their recruiter, attend

meetings and classes, and continue in civilian jobs or educational pursuits before entering

training.[15] While some reports indicate that the rate of attrition among DEP recruits

during the waiting period exceeds that of recruits who enter training immediately,[16]

among those who do enter training, retention is better among those entered through the

DEP.[14,17] Attrition from the DEP during the waiting period represents a smaller

investment on the part of the Department of Defense than attrition during or following

training. Further, if vulnerable recruits are more likely to attrite during the waiting period,

exposure to military stressors is avoided. Thus, minimum DEP waits among these recruits

may reduce costs to the Department of Defense, and adverse outcomes among potential

recruits.

Increased attention on race/ethnicity in misconduct. In an effort to decrease

racial/ethnic disparities in the administration of misconduct discharge, current procedures

for bringing charges against service members and initiating the misconduct discharge

process should be evaluated, including consideration of alternative procedures that

provide a greater degree of objectivity and transparency. In addition, increased emphasis

on cultural competence during training may help to reduce racial/ethnic disparities in

misconduct discharge. Specifically, officers may benefit from training that attunes them

to the diverse cultures represented in their units, and recruits may benefit from training on

the norms of military society.

Better recognition and treatment of health-related determinants of misconduct. Efforts to educate service members and unit leaders about the health-related determinants of misconduct may improve recognition of misconduct-related symptoms of mental health disorders or TBI, and promote timely referrals for appropriate evaluation and treatment. A key component of any rehabilitative approach to misconduct is the promotion of a climate in which service members do not feel stigmatized for receiving mental health services.[18] Several approaches to achieving this have been identified in recent research, including multimedia campaigns, education and training programs, changing policy to reduce discriminatory behavior, and exposing service members to peers who are in recovery from a mental health disorder.[19]

Enhanced coordination with VHA. Even under ideal conditions, the early reintegration period following discharge from service is stressful for many veterans. Service members were discharged for misconduct may be particularly vulnerable at this time. They may be less prepared to navigate the reintegration process due to the premature nature of their discharge, and many have immediate health-related needs. Despite these needs, on average, misconduct discharged veterans are slower to engage in VHA care than routinely discharged veterans.[20] Thus, a greater emphasis on coordinated case management during the transition between the Department of Defense and Veterans Health Administration healthcare system may help to ease this transition, and to eliminate unnecessary gaps in care.

Implications for VHA

Although VHA has little control over the health status of veterans who enroll and

seek services in its facilities, findings from this dissertation indicate that there are several

opportunities for VHA to improve the care of misconduct-discharged veterans.

Assessment for potential service-connected disabilities. Misconduct-discharged

veterans are more likely than routinely discharged veterans to receive a mental health-

related service-connected disability designation. Results from chapter 4 indicate that

these benefits provide a strong buffer against homelessness among this population. Thus,

it is important that steps are taken to ensure that veterans apply for and receive any

benefits that they are entitled to in a timely manner. This may be facilitated through

education efforts or case management.

Establish strong primary care connections. Given misconduct-discharged

veterans" lower propensity for accessing primary care despite their high usage of

specialty services, efforts to transition care from specialty clinical settings to integrated

primary care settings is an important point of focus. Relatedly, due to the increased risk

for behaviorally-linked chronic health conditions among this population, integrated

primary care should include an emphasis on the reduction of risky lifestyle factors. This

shift towards primary care, including Patient Aligned Care Teams, may result in

improved patient outcomes as well as reduced healthcare expenditures.

Integration of risk stratification and additional supports into the clinical

workflow. The integration of risk stratification tools in the clinical workflow has the

potential to prevent incidents of homelessness or even mortality while improving the

efficiency of care provision. Because these adverse events are often preceded and even

predicted by engagement in services, there may be opportunities to integrate additional

supports, referrals, or brief interventions into the care that high-risk veterans are already receiving. Accordingly, providers can respond to clinical alerts of moderate or high-risk status by engaging veterans in discussion about their current needs and preferences, and making responsive care recommendations.

Limitations

Having described the key findings and policy implications of this dissertation, there several limitations that are important to point out. First, the samples used in each of these studies are comprised of VHA-enrolled veterans. As some veterans seek treatment outside the VHA, this likely results in underestimation of certain outcomes such as homelessness. It may also limit generalizability to eligible veterans who choose not to seek VHA-care, and veterans who are ineligible for VHA-services. Notably, some instances of misconduct are deemed severe enough that the veteran receives a character of discharge of "other than honorable," "bad conduct," or "dishonorable," resulting in loss of eligibility for VHA care. While it is hypothesized that these veterans share many characteristics with their misconduct-discharged counterparts who retain VHA eligibility, this hypothesis cannot be directly evaluated given the available data.

It is also not possible to draw direct causal inferences using these data. Several factors that may play an important role in the pathway to misconduct are unavailable in these data. These include individual and community-level variables that, while related to health and social outcomes, fall outside of the general medical context and are, therefore, not represented in administrative data. In addition, information regarding pre-service and

in-service experiences, symptoms, diagnoses, and treatment is largely unavailable. While some of this information can be inferred from post-discharge documentation, such as service-connected disability benefits and MST screening results, these indicators depend on service-seeking and disclosure, which may vary as a function of discharge type. Finally, the documentation of events in the medical record does not necessarily correspond to the true chronicity of exposures, symptom manifestation, and outcomes.

Directions for Future Research

There are several directions for future research to build upon these findings and address many of the previously noted limitations. One of the most significant limitations of this study was the lack of documentation from major Department of Defense sources, including more detailed information regarding service experiences and exposures, and in-service mental health treatment and diagnoses. This additional information would allow for a clearer understanding of the emergence of health-related needs, and the potential identification of earlier points of intervention. Alternate sources of data regarding in-service experiences, such as the Post-Deployment Health Assessment and the Post-Deployment Health Reassessment would also provide additional valuable insights.

Another potential avenue for future research in this area is engagement of misconduct-discharged veterans in primary research, including qualitative research. As discussed in the limitations, there are many important factors related to misconduct that are not represented in administrative datasets. Research that uses primary data collection can provide more nuanced insights into health-related needs, as well as information on

social, familial, and financial factors that contribute to adverse outcomes among this population. Under ideal circumstances, primary data could be linked to administrative data sources, forming a rich set of indicators that informs factors across multiple contexts.

Only veterans who deployed to OEF/OIF conflicts and were eligible for VHA services were included in the present study. However, there are many more misconduct-discharged veterans who did not deploy to these conflicts. A comparison between deployed and non-deployed veterans may shed additional light on the service-connected components of misconduct. In 2017, it was announced that veterans with a discharge characterized as "Other Than Honorable" will be made eligible for certain VHA services. This incoming cohort allows for new comparisons across groups based on characterization of discharge, including comparison of health status between misconduct-discharged veterans who were always eligible for services, and those who are newly eligible for services.

Finally, the ultimate goal of this and related research is the implementation of prevention and intervention strategies that will improve outcomes among this vulnerable population. This is a multistep process that will include pilot, implementation, and evaluation studies.

Conclusion

This dissertation represents an important step forward in understanding the pre- and post-discharge experiences and characteristics of misconduct-discharged veterans.

Collectively, results provide several insights that can inform the development of

prevention, treatment, and case management strategies to better meet the needs of this

vulnerable population. Targeted counter-attrition efforts and an increased focus on

health-related determinants of misconduct, including rehabilitative approaches to

behavioral problems, may help to reduce misconduct-related attrition. Strategies to

transition post-discharge care from specialty settings to integrated primary care settings

may be successful in preventing the accumulation of symptoms toward adverse

outcomes, as well as reducing costs. Finally, risk stratification techniques can facilitate

the efficient targeting of VHA resources to those who are most at-risk.

References

1. Booth-Kewley S, Highfill-McRoy RM, Larson GE, Garland CF. Psychosocial predictors of military misconduct. *J Nerv Ment Dis*. 2010; 198(2), 91-8. http://doi.org/10.1097/NMD.0b013e3181cc45e9

2. Highfill-McRoy RM, Larson GE, Booth-Kewley S, & Garland, CF. Psychiatric diagnoses and punishment for misconduct: the effects of PTSD in combat-deployed Marines. *BMC Psychiatry*. 2010;10:88. http://doi.org/10.1186/1471-244X-10-88

3. Hoge CW, Tobani HE, Messer SC, et al. The Occupational Burden of Mental Disorders in the U.S. Military: Psychiatric Hospitalization, Involuntary Separation, and Disability. *Am J Psychiat*. 2005; 3(162), 585-92.

4. Parks J, Svendsen D, Singer P. *Morbidity and mortality in people with serious mental illness.* National Association of State Mental Health Program Directors (NASMHPD) Medical Directors Council; 2006.

5. De Hurt M, Correll CU, Bobes J, et al. Physical illness in patients with severe mental disorders. I. Prevalence, impact of medications and disparities in health care. *World Psychiatry*. 2011;10(1):52-77.

6. Johnson SB, Blum RW, Giedd JN. Adolescent Maturity and the Brain: The Promise and Pitfalls of Neuroscience Research in Adolescent Health Policy. *J Adolescent Health*. 2009;45(3):216-221.

7. Arain M, Haque M, Johal L, et al. Maturation of the adolescent brain. *Neuropsych Dis Treat*. 2013;9:449-461.

8. Verdugo N. Crimes and punishment: Blacks in the Army's criminal justice system. *Mil. Psychol*. 1998;10(2), 107-25

9. Brignone EB, Fargo JD, Blais RK, Gundlapalli AV. *Military misconduct and post-discharge mortality risk*. Manuscript in Preparation. 2017.

10. WISQARS™ Fatal Injury Reports. Centers for Disease Control and Prevention. https://webappa.cdc.gov/sasweb/ncipc/mortrate.html. Accessed April 14, 2017.

11. Rudd RA, Aleshire N, Zibbell JE, Gladden M. Centers for Disease Control and Prevention. Increases in drug and opioid overdose deaths-United States, 2000-2014. *Am J Transplant*. 2016;64(50):1378-1382.

12. Heltemes KJ, Clouser MC, MacGregor AJ, Norman SB, Galarneau MR. Co-occurring mental health and alcohol misuse: Dual disorder symptoms in combat injured veterans. *Addict Behav*. 2014;39:392-398.

13. Read JP, Brown PJ, Kahler CW. Substance use and posttraumatic stress disorders: Symptom interplay and effects on outcome. *Addict Behav*. 2004;29:1665-1672.

14. Hosek JR, Antel J, Peterson CE. Who Stays, Who Leaves? Attrition Among First-Time Enlistees. *Armed Forces Soc*. 1989;15(3):389-409.

15. Delayed Entry and Delayed Training Program. United States Army Recruiting Program. http://www.usarec.army.mil/im/formpub/REC_PUBS/r601_95.pdf. Accessed April 16, 2017.

16. Buddin RJ. *Success of First-Term Soldiers: The Effects of Recruiting Practices and Recruit Characteristics*. 2005. http://www.rand.org/content/dam/rand/pubs/monographs/2005/RAND_MG262.pdf. Accessed April 16, 2017.

17. Cooke TW, Quester AO. What Characterizes Successful Enlistees in the All-Volunteer Force : A Study of Male Recruits in the U.S. Navy *Soc Sci Q*. 2016;73(2):238-252.

18. Gould M, Adler A, Zamorski M, et al. Do stigma and other perceived barriers to mental health care differ across Armed Forces? *J R Soc Med*. 2010;103(4):148-56.

19. Acosta JD, Becker A, Cerully JL, Fisher MP, Martin LT, Vardavas R, Slaughter ME, Schell T. *Mental Health Stigma in the Military*. 2014. http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR426/RAND_RR426.pdf. Accessed April 6, 2017.

20. Brignone E, Fargo JD, Blais RK, Carter ME, Samore MH, Gundlapalli AV. Non-routine discharge from military service: mental illness, substance use disorders, and suicidality. *Am J Prev Med*. 2017;52(5):557-565.

APPENDIX

SUPPLEMENTAL TABLES

Table A1. Description of Study Variables

Variables	Data Source	Columns/Variables from Source	Final Variables in Analytic Dataset
Study 1			
Outcome Variables*			
Discharge Type	OEF/OIF Roster File (Department of Defense Manpower Data Center)	Interservice Separation Code	Binary variable with levels "Routine" and "Misconduct"
Misconduct Discharge Subtypes			Categorical variable with levels "drug/alcohol," "discreditable incidents/pattern minor infractions," "legal/serious offense," "other"
Predictor Variables			
Combat Exposure	Patient 2.0 Domain of the Corporate Data Warehouse	Combat Flag	Binary variable with levels "exposure," "no exposure"
Deployment		Deployment Dates	Number of Deployments, Months Deployed
Service Connected Disability		Service Connected Condition	Binary variables with levels "Present" and "Absent" for service-connected PTSD, TBI, and mood disorders.
Military Sexual Trauma		Military Sexual Trauma	Categorical variable with levels "Yes," "No," and "Unknown."
Covariates	OEF/OIF Roster File (Department of Defense Manpower Data Center)	Age, Race/ethnicity, Marital Status, Education, Branch of Service	Variables included as represented in source file.
Study 2			
Outcome Variables*			
Encounter Counts	VHA Clinical Data: National Data Systems Managerial Cost Accounting Data Sets. Tables Master_DSS_Out (Ouapatient Encounters) and DSS_Disch (Inpatient Encounters)	Clinic Stop Codes, Treatment Specialty Codes	Cumulative encounter counts within each follow-up period, stratified by treatment type (see Table 3).
Encounter Costs		Clinic Stop Codes, Treatment Specialty Codes, Total VHA Production Costs	Cumulative encounter costs within each follow-up period, stratified by treatment type (see Table 3).
Mental Health and Medical Comorbidities		Primary ICD-9 Codes	31 binary variables based on categories of ICD-9 codes as classified by the Elixhauser comorbidity Index (see Table 2)

(*table continues*)

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Variables	Data Source	Columns/Variables from Source	Final Variables in Analytic Dataset
Predictor Variables			
Discharge Type	OEF/OIF Roster File (Department of Defense Manpower Data Center)	Interservice Separation Code	Binary variable with levels "Routine" and "Misconduct"
Covariates		Age, Race/ethnicity, Marital Status, Education, Branch of Service	Variables included as represented in source file.
Study 3			
Outcome Variables*			
Homelessness	VHA Clinical Data Domain: National Data Systems Managerial Cost Accounting Data Sets Tables: Master_DSS_Out (Ouipatient Encounters), DSS_Disch (Inpatient Encounters)	ICD-9 Codes (V60.0 indicating homelessness) Clinic Stop Codes and Treatment Specialty Codes (511, 522, 528, 529, 530, 590; 28, 37) indicating homeless services received), Date evidence was recorded	For each 60-day period, binary flags indicating whether or not the given outcome occurred.
Mortality		Date of Death	
Predictor Variables			
Combat Exposure	Patient 2.0 Domain of the Corporate Data Warehouse	Combat Flag	Binary variable with levels "exposure," "no exposure'
Service Connected Disability		Service Connected Condition	Binary variables with levels "Present" and "Absent" for service-connected disabilities based on Elixhauser Comorbidity Index Categories (see Table 2).
Military Sexual Trauma		Military Sexual Trauma	Categorical variable with levels "Yes," "No," and "Unknown".
Encounter Counts	VHA Clinical Data: National Data Systems Managerial Cost Accounting Data Sets. Tables Master_DSS_Out (Outpatient Encounters) and DSS_Disch (Inpatient Encounters)	Clinic Stop Codes, Treatment Specialty Codes	Cumulative encounter counts within each follow-up period, stratified by treatment type (see Table 3).
Encounter Costs		Clinic Stop Codes, Treatment Specialty Codes, Total VHA Production Costs	Cumulative encounter costs within each follow-up period, stratified by treatment type (see Table 3).

(*table continues*)

Variables	Data Source	Columns/Variables from Source	Final Variables in Analytic Dataset
Mental Health and Medical Comorbidities		Primary ICD-9 Codes	31 frequency variables based on categories of ICD-9 codes as classified by the Elixhauser comorbidity Index (see Table A2)
Demographic and Military Service Characteristics	OEF/OIF Roster File (Department of Defense Manpower Data Center)	Age, Race/ethnicity, Marital Status, Education, Branch of Service	Variables included as represented in source file.

* Computed separately for male and female veterans.

Table A2. Classification of ICD-9 Diagnoses in Accordance with the Elixhauser Comorbidity Index

Category	ICD-9 Codes
Congestive Heart Failure	426.0, 426.13, 426.7, 426.9, 426.10, 426.12, 427.0-427.4, 427.6-427.9, 785.0, 996.01, 996.04, V45.0, V53.3
Cardiac Arrhythmias	426.0, 426.13, 426.7, 426.9, 426.10, 426.12, 427.0-427.4, 427.6-427.9, 785.0, 996.01, 996.04, V45.0, V53.3
Valvular Disease	093.2, 394.x-397.x, 424.x, 746.3-746.6, V42.2, V43.3
Pulmonary Circulation Disorders	415.0, 415.1, 416.x, 417.0, 417.8, 417.9
Peripheral Vascular Disorders	093.0, 437.3, 440.x, 441.x, 443.1-443.9, 447.1, 557.1 557.9, V43.4
Hypertension, Uncomplicated	401.x
Hypertension, Complicated	402.x-405.x
Paralysis	334.1, 342.x, 343.x, 344.0-344.6, 344.9
Other Neurological Disorders	331.9, 332.0, 332.1, 333.4, 333.5, 333.92, 334.x-335.x, 336.2, 340.x, 341.x, 345.x, 348.1, 348.3, 780.3, 784.3
Chronic Pulmonary Disease	416.8, 416.9, 490.x-505.x, 506.4, 508.1, 508.8
Diabetes, Uncomplicated	250.0-250.3
Diabetes, Complicated	250.4-250.9
Hypothyroidism	240.9, 243.x, 244.x, 246.1, 246.8
Renal Failure	403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 585.x, 586.x, 588.0, V42.0, V45.1, V56.x
Liver Disease	070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 070.6, 070.9, 456.0-456.2, 570.x, 571.x, 572.2-572.8, 573.3, 573.4, 573.8,573.9, V42.7
Peptic Ulcer Disease	531.7, 531.9, 532.7, 532.9, 533.7, 533.9, 534.7, 534.9
AIDS/HIV	042.x-044.x
Lymphoma	200.x-202.x, 203.0, 238.6
Metastatic Cancer	196.x-199.x
Solid Tumor without Metastasis	140.x-172.x, 174.x-195.x
Rheumatoid Arthritis /Collagen Vascular Diseases	446.x, 701.0, 710.0-710.4, 710.8, 710.9, 711.2, 714.x, 719.3, 720.x, 725.x, 728.5, 728.89, 729.30
Coagulopathy	286.x, 287.1, 287.3-287.5
Obesity	278.0
Weight Loss	260.x-263.x, 783.2, 799.4
Fluid and Electrolyte Disorders	253.6, 276.x
Blood Loss Anemia	280.0
Deficiency Anemia	280.1-280.9, 281.x
Alcohol Abuse	265.2, 291.1-291.3, 291.5-291.9, 303.0, 303.9, 305.0, 357.5, 425.5, 535.3, 571.0-571.3, 980.x, V11.3
Drug Abuse	292.x, 304.x, 305.2-305.9, V65.42
Psychoses	293.8, 295.x, 296.04, 296.14, 296.44, 296.54, 297.x, 298.x
Depression	296.2, 296.3, 296.5, 300.4, 309.x, 311

Table A3. Classification of Treatment Types for Utilization and Cost Variables

Category	Illustrative Examples
Outpatient	
Mental Health	Psychiatric Consultation, Mental Health-Individual/Group, PTSD-Individual/Group, Psychological Testing
Substance Use	Substance Use Disorder-Individual/Group, Opioid Substitution
Primary/Preventive	Preventive Screening, Telephone Primary Care, Women's Health Primary Care, Primary Care Medicine
Emergency	Emergency Department, Urgent Care
Social Work	Social Work
Homeless Services	Grant & Per Diem, HUD/VASH-Group, Telephone Homeless Care
Polytrauma	Polytrauma Rehab-Individual, Polytrauma Rehab-Group, Traumatic Brain Injury
Diagnostic	Radiology, Laboratory, Pathology
Medical Specialty	Cardiology, Dermatology, Infectious Disease, Pulmonary
Other	Ancillary, Dental, Telephone, Physical Rehab
Inpatient	
Mental Health	PSTD Residential Rehab, Acute/Long Term Psychiatry, Psychiatric Observation
Substance Use	Domiciliary Substance Abuse, Drug Dependence Treatment Unit, Alcohol Dependence Treatment Unit
Medical	Cardiology, Internal Medicine, Surgery, Neurology, Spinal Cord Injury

CURRICULUM VITAE

EMILY BRIGNONE

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EDUCATION

Ph.D., Experimental and Applied Psychology, Expected May 2017
Emphasis: Sociobehavioral Epidemiology. Department of Psychology, Utah State University, Logan, UT
Dissertation: Misconduct-Related Discharge from Active Duty Military Service: An Examination of Precipitating Factors and Post-Deployment Health Outcomes
Advisor: Jamison D. Fargo, PhD

B.S., Psychology; Minor: Family Studies, December 2013.
Weber State University, Ogden, UT

RESEARCH POSITIONS

Research Associate
Informatics, Decision-Enhancement and Analytic Sciences Center. (IDEAS 2.0),
VA Salt Lake City Health Care System, Salt Lake City, UT, July 2014-present.
> Lead research studies relating to health and social outcomes among vulnerable veteran populations, including those who are homeless or at risk for becoming homeless, those with a history of military sexual trauma, and those discharged from service under non-routine conditions.
> Collaborate with research team on studies and grants. Contribute to study development, construction of analytic datasets from administrative databases, data analysis, and writing and revision of manuscripts.
> 20-40 hrs./week. Supervised by Adi Gundlapalli and Jamison Fargo.

Research Assistant (Project Manager)
Next Step Project. Utah State University, Logan, UT, January 2014-April 2015.
> Designed and implemented an educational intervention for homeless youth at three sites. Prepared curriculum and survey instruments, oversaw interventionists and volunteers, managed data collection, analysis, and reporting to grant funder.
> 20 hrs./week. Supervised by Jamison Fargo.

Research Assistant
Ogden United Promise Neighborhood Project for the Center for Community
Engaged Learning-Community Research Extension. Weber State University,
Ogden, UT, April 2013-June 2015.

> Led data management and analysis for community needs assessment.
> Prepared presentations and reports to grant agency and community
> stakeholders. Developed statistical training seminars for new research
> assistants.
> 30 hrs./week. Supervised by Azenett Garza.

PEER-REVIEWED PUBLICATIONS

Brignone E, Gundlapalli AV, Blais RK, Carter ME, Suo Y, Samore MA, Kimerling
R, Fargo JD. Differential Risk for Homelessness among U.S. Male and
Female Veterans with a Positive Screen for Military Sexual Trauma. *JAMA
Psychiatry.* 2016;73(6), 582-9.

Gilmore AK, **Brignone E**, Painter JM, Lehavot K, Fargo JD, Suo Y, Simpson T,
Carter ME, Blais RK, Gundlapalli AV. Military Sexual Trauma and Co-
Occurring Posttraumatic Stress Disorder, Depressive Disorders, and
Substance Use Disorders among Returning Iraq and Afghanistan Veterans.
Women's Health Issues. 2016;26(5):546-54.

Brignone E, Fargo JD, Blais RK, Carter ME, Samore MA, Gundlapalli AV (2017).
Non-Routine Discharge from Military Service: Mental Illness, Substance
Use Disorders, and Suicidality. *American Journal of Preventive Medicine*.
In Press.

Brignone E, Fargo JD, Blais RK, Carter ME, Samore MA, Gundlapalli AV (2017).
Response to Letter to the Editor: Veterans and the National Tragedy of
Suicide. *American Journal of Preventive Medicine*. In Press.

Byrne T, Nelson RE, Montgomery AE, Fargo JD, **Brignone E,** Carter ME,
Gundlapalli AV (2017). Comparing Health and Behavioral Health Service
Utilization Costs Among Veterans Experiencing Short-Term and Long-
Term Episodes of Homelessness. *Journal of Urban Health*. In Press.

Painter JM, **Brignone E**, Gilmore AK, Lehavot K, Fargo JD, Suo Y, Simpson T,
Carter ME, Blais RK, Gundlapalli AV (2017). Gender Differences in
Service Utilization Among Operations Enduring Freedom, Iraqi Freedom,
and New Dawn Veterans Affairs Patients with Severe Mental Illness and
Substance Use Disorders. *Psychological Services.* In Press.

Fargo JD, Montgomery AE, Bryne T, **Brignone E**, Cusack M, Gundlapalli AV (2017). Needles in a Haystack: Screening and Healthcare System Evidence for Homelessness. *Studies in Health Technology and Informatics.* In Press.

Blais RK, **Brignone E**, Maguen S, Carter ME, Fargo JD, Gundlapalli AV (2017). Military Sexual Trauma is Associated with Increased Risk for Eating Disorders among Afghanistan and Iraq Veterans. *International Journal of Eating Disorders*. In Press.

Fargo JD, **Brignone E**, Barrett, TS, Peterson R, Metraux S, Carter ME, Redd A, Samore M, Gundlapalli AV (2017). Homelessness Following Disability-Related Separation from Active Duty Military Service. *Disability and Health*. In Press.

Barrett TS, **Brignone E** (2017). Furniture for Quantitative Scientists. *The R Journal*. In Press.

Divita G, **Brignone E,** Carter ME, Suo Y, Blais RK, Fargo JD, Gundlapalli AV (2017). Extracting Sexual Trauma Mentions from VA Electronic Medical Notes Using Natural Language Processing. *Studies in Health Technology and Informatics.* In Press.

MANUSCRIPTS IN SUBMISSION

Brignone E, Fargo JD, Barrett TS, Blais RK, Kimerling R, Nelson RE, Carter ME, Samore MA, Gundlapalli AV (2017). *Increased Health Care Utilization and Costs among Male and Female Veterans with a Positive Screen for Military Sexual Trauma.* Revisions underway.

Blais RK, **Brignone E**, Fargo JD, Gundlapalli AV (2017). *Assailant Identity and Self-Reported Nondisclosure of Military Sexual Trauma Experienced by Women Service Members/Veterans.* Manuscript under review.

Nelson RE, Gundlapalli AV, Carter ME, **Brignone E,** Petty W, Byrne T, Montgomery AE, Rupper R, Fargo JD (2017). *How Does Rurality or Distance to Care Influence the Risk of Homelessness*? Revisions under review.

PRESENTATIONS

INVITED SPEAKER

Brignone E, Fargo JD, Barrett TS, Blais RK, Nelson RE, Carter ME, Gundlapalli AV (2016, August). *Healthcare Utilization among Male and Female*

Veterans with a Positive Screen for Military Sexual Trauma. Invited Speaker for the University of Utah Office of Health Equity and Inclusion Lessons Learned Seminar.

Brignone E, Gundlapalli AV, Blais RK, Carter ME, Suo Y, Samore MH, Kimerling R, Fargo JD (2016, July). *Differential Risk for Homelessness among U.S. Male and Female Veterans with a Positive Screen for Military Sexual Trauma.* Invited Speaker for the Veterans Homelessness Research Interest Group Virtual Conference Series.

PEER REVIEWED CONFERENCE PRESENATIONS

Blais RK, **Brignone E**, Levin ME (2017, June). *Experiential Avoidance is Associated with Military Sexual Trauma Non-disclosure in Female Service Members/Veterans.* Paper to be presented at the Association for Contextual Behavioral Science World Conference, Seville, Spain.

Livingston WS, **Brignone E**, Fargo JD, Gundlapalli, AV, Maguen S, Blais RK (2017, April). *Homelessness and eating disorders among a sample of OEF/OIF recently returned U. S. veterans.* Paper presented at Utah State University's Student Research Symposium, Logan, UT

Brignone E, Gundlapalli AV, Blais RK, Carter ME, Suo Y, Samore, MH, Kimerling R, Fargo JD (2016, August). Military Sexual Trauma and Differential Risk for Homelessness among U.S. Male and Female Veterans. In R.K. Blais (Chair), *Novel Research Identifying Risk Factors for Homelessness in US Veterans.* Paper presentation. American Psychological Association, Denver, CO.

Fargo JD, Gundlapalli AV, Metraux S, Carter ME, **Brignone E**, Redd A, Samore MH, Kane V, Culhane DP (2016, August). Military Misconduct and Homelessness among US Veterans Separated from Active Duty, 2001-2012. In R.K. Blais (Chair), *Novel Research Identifying Risk Factors for Homelessness in US Veterans.* Paper presentation. American Psychological Association, Denver, CO.

Brignone E, Fargo JD, Barrett, TS, Blais RK, Nelson RE, Carter ME, Gundlapalli AV (2016, July). *Healthcare Utilization among Male and Female Veterans with a Positive Screen for Military Sexual Trauma.* Poster presented at the annual meeting of the International Conference of Psychology, Yokohama, Japan.

Blais RK, **Brignone E**, Fargo JD, Gundlapalli AV (2016, July). *Military sexual trauma in U.S. women service members/Veterans: Associations of rank,*

ethnicity, assault by fellow unit members with inaccurate disclosure of sexual assault. Paper presented at the annual meeting of the International Congress for Psychology, Yokohama, Japan.

Blais RK, **Brignone E**, Fargo JD, & Gundlapalli AV (June, 2016). *Assailant identity and nondisclosure of Military Sexual Trauma experienced by women service members/Veterans: Implications for inventions.* Poster presented at the meeting of the World Congress of Behavioral and Cognitive Therapies, Melbourne, Australia

Brignone E, Fargo JD, Blais RK, Carter ME, Gundlapalli AV (2016, June). *Mental Health Risks among Veterans with Non-Routine Separation from Military Service.* Paper presented at the annual meeting of the Society for Prevention Research, San Francisco, CA.

Blais RK, **Brignone E,** Fargo JD, Gundlapalli AV (2015, July). *Assailant Identity and Self-Reported Nondisclosure of Military Sexual Trauma Experienced by Women Service Members/Veterans.* Poster presented at the annual meeting International Society for Traumatic Stress Studies, New Orleans, LA.

Brignone E, Gundlapalli AV, Blais RK, Carter ME, Suo Y, Samore MA, Fargo JD (2015, July). *Differential Risk for Homelessness among Veterans with a Positive Screen for Military Sexual Trauma.* Poster Presented at the HSR&D/QUERI National Conference, Philadelphia, PA.

Gilmore AK, **Brignone E**, Painter JM, Lehavot K, Fargo JD, Suo Y, Simpson T, Carter ME, Blais RK, Gundlapalli AV (2015, July). *Military Sexual Trauma and Co-Occurring Posttraumatic Stress Disorder, Depressive Disorders, and Substance Use Disorders among OEF/OEF Veterans.* Poster Presented at the HSR&D/QUERI National Conference, Philadelphia, PA.

Peterson R, Taylor K, **Brignone E,** Prante M, Fargo JD (2014, November). *Experiences of Homelessness among Students at a Rural University.* Poster Presented at the annual meeting of the American Public Health Association, New Orleans, LA.

Brignone E, Marquit JD (2013, April). *Social Identity Model of Deindividuation Effects (SIDE) in computer-mediated communication environments.* Poster Presented at the annual meeting of the Rocky Mountain Psychological Association Denver Conference, Denver, CO.

OTHER PROJECTS

Tyson Barrett and **Emily Brignone** (2017). furniture: Furniture for Health, Behavioral, and Social Scientists. R package version 1.5.0.

SELECTED NEWS MEDIA REPORTS

"Military sexual trauma tied to increased risk of homelessness," *Fox News*, April 21, 2016.

"A Staggering Number of Vets End Up Homeless After Experiencing Sexual Violence in the Military," *Mother Jones*, April 21, 2016.

"Sexual assault in military tied to veterans" homelessness," *Military Times*, April 21, 2016.

"Study: One in 10 vets with military sexual trauma end up homeless," *Deseret News*, April 20, 2016.

"Study: Military sexual assault makes veterans twice as likely to become homeless," *Southern California Public Radio*, April 20, 2016.

GRANTS

Health Equity Student Research Award, University of Utah Office of Health Equity and Inclusion: $2,500. June 2016.

TEACHING

Co-Instructor, PSY 7810: R for the Social Sciences. Summer 2016.
    Co-developed and taught a 7-week intensive graduate-level course covering the fundamentals of R programming, including data summarization, reshaping, plotting, user-defined functions, modeling, and markdown.

Guest Lecturer, EDUC/PSY 6570: Qualitative and Mixed Method Research Design. Summer 2016.
    Independently prepared and delivered lectures to a graduate-level research methods course covering a wide variety of qualitative and mixed method techniques.

COMPUTER PROGRAMMING AND SOFTWARE SKILLS

Computer Languages: R, SQL, Latex

Computer Software: R/Rstudio, Microsoft SQL Server Management Studio, Stata, SPSS, Excel, Word, PowerPoint, Qualtrics, Visio

RELEVANT COURSEWORK

Research Design and Analysis I & II, Literature Reviews, Program Evaluation, Public Policy Analysis, Advanced Survey Techniques, Analysis of Demographic Data, Categorical Data Analysis, Applied Multivariate Statistics, Statistical Learning, Statistical Methods: Big Data, Advanced Measurement Theory and Practice, Epidemiological Study Design and Analysis, Multilevel and Marginal Modeling, Advanced R Programming, Data Visualization, Oral and Visual Communication of Scientific Findings

CONTINUING EDUCATION

Write Winning Grant Proposals Seminar. Utah State University. September 2015.

PROFESSIONAL MEMBERSHIPS AND AFFILIATIONS

Affiliate, American Psychological Association
Division 19: Military Psychology

Member, Society for Prevention Research