

Health and Health Care Utilization Among U.S. Veterans Denied VA

Disability Compensation: A Comparative Analysis

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ABSTRACT OF THE DISSERTATION

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By Dennis Adrian Fried, MPH, MBA

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Background: The general consensus in studies of individuals seeking federal disability compensation was that individuals *denied* disability compensation were healthier than those *awarded*. In contrast, studies of veterans seeking VA disability compensation suggest that *denied* applicants may be as impaired or more impaired than those *awarded*, and may use less health care. Because veterans *denied* VA disability compensation may have increased risks of poverty, homelessness, and poor long-term health, a more thorough understanding of their health, and health care utilization is warranted.

Methods: This dissertation used data from the 2001 National Survey of Veterans (NSV). Overall self-reported health, physical and mental functioning, and limitations in activities of daily living were used as subjective measures of health status, while VA and non-VA outpatient health care visit counts were used to measure service-use intensity. In study 2, logistic regression was used to analyze associations between VA disability compensation award status and four separate measures of health status. In study 3, zero-inflated negative binomial regression was used to examine associations between VA outpatient health care visit counts and VA disability compensation award status, while zero-inflated poisson regression and negative binomial regression were used separately to examine

associations between non-VA outpatient health care visit counts and VA disability compensation award status. All analyses were design-based.

Results: VA disability compensation award status (denied vs. awarded) was associated with *increased* odds of poor overall health (OR = 1.49, 95% CI = 1.27, 1.75), limitations in activities of daily living (OR = 1.10, 95% CI = 1.01, 1.19), and never using VA outpatient health care (OR = 4.79, 95% CI = 1.58, 922), and *decreased* odds of better physical functioning (OR = 0.96, 95% CI = 0.95, 0.98).

Conclusion: The broad picture of *denied* applicants that emerges from available data shows them, compared to *awarded* applicants, to have comparative poor health, and a greater likelihood of never using VA outpatient health care services.

DEDICATION

This dissertation is dedicated to my wife, *Cheryl Fried*, who believed in me long before I believed in myself.

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First and foremost, I wish to extend my most heartfelt thanks to my advisor and mentor, *Dr. William Halperin*. I first met Dr. Halperin in 2007 as a student in his *Introduction to Principles and Methods of Epidemiology* course. In the years since, he has dedicated countless hours to my scholastic development. He has served many roles: educator, epidemiologist, supervisor, advocate for veterans, and perhaps most importantly, a kind and gentle source of wisdom and guidance throughout the rigorous graduate school process.

I also owe a debt of gratitude to *Dr. Marian Passannante*, who has been a co-mentor for all of the years that I have been at the School of Public Health. Since no words of mine can sufficiently express my appreciation to her, I will confine myself to this: it is *impossible* to imagine having completed this program without her continuous advice and support.

I am also grateful to *Dr. Bart Holland*, and *Dr. Drew Helmer*, who both served on my doctoral committee. In particular, Bart provided invaluable guidance on complex methodological issues, while Drew, among his many contributions, was instrumental in helping shape a compelling, and carefully-considered narrative.

Finally, to my mother, *Risha Fried*, and my father, *Dr. Robert Fried* (Ph.D., Rutgers University, 1964) for their love and support - - my deepest and most enduring appreciation.

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INTRODUCTION

*“We go to gain a little patch of ground
That hath in it no profit but the name.”*

(Shakespeare, trans. 1994, IV.4. 18-19)

Background

The U.S. Department of Veterans Affairs (VA) is the largest single provider of health care in the United States and administers the nation’s second largest federal disability program (1). The VA provides an array of comprehensive benefits and services to millions of veterans to improve their health and well-being.

Two independent agencies within the Department of Veterans Affairs administer disability compensation and health care: The Veterans Benefits Administration (VBA) manages disability compensation through Regional Offices (2), while the Veterans Health Administration (VHA) provides medical care through a regionalized network of hospitals, clinics and community veterans centers (3).

VA disability compensation is intended to compensate losses in earnings resulting from service-connected diseases and injuries “and their residual conditions in civil occupations (4).” “Service-connected” means conditions that occurred during active-duty military service or those that were aggravated by it (5).

In the cohort of 24 million living veterans, about 3.7 million (15 percent) receive monthly tax-free disability compensation payments for a variety of service-connected disabilities (6); for veterans without dependents, monthly payments in 2013 ranged from \$130.94 to \$2,858.24 (7).

VA service-connected disability compensation paid to veterans is based on severity of medically-evaluated disability as well as number of dependents. A combined disability rating expresses service-related disability severity on a graduated scale from 10 percent to 100 percent in increments of 10 percent. Although a veteran may receive a zero percent disability rating, which entitles him/her to health care benefits for the noted condition, only combined ratings of 10 percent or more qualifies him/her for compensation (8, 9).

Access to VA Disability Compensation

A veteran seeking disability compensation benefits from the Department of Veterans Affairs must first file an application. In evaluating the claim, a specialty review team gathers medical and military service-related evidence. In the process, the VA confirms the existence of the disability, and subsequently determines whether the existing disability is service-connected. If so, the VA assigns a combined disability rating and establishes a date of award with payment based on the rating (10). For those veterans awarded service-connection, the VA can grant a full award, or a partial award (11). If no service connection is found, the claim is denied.

The VA disability compensation adjudication process which begins with a compensation application and ends with either an initial decision or a decision in response to an appeal, can be onerous: In 2011, the average claims processing time was 197 days, while the average appeals processing time was 747 days (12). Veterans denied service-connection receive no cash compensation while their access to health care is means-tested.

Access to VA Health Care

Veterans with disability ratings of at least 10 percent will receive both cash compensation as well as VA health care: higher disability ratings result in both, larger monthly compensation payments, as well as more extensive access to health care services. The extent to which health care services are provided is based on placement in one of eight health care priority groups, with the most access given to those in *priority group 1* and the least access extended to those in *priority group 8* (13). In Fiscal Year 2013, more than 5.7 million veterans were patients at the VHA (14).

Access to veterans health benefits begins with a VHA enrollment application, that is separate from the application for disability compensation. The VHA may also require some veterans to complete a financial assessment – “means test” – to establish eligibility for health care and to determine the individual's contribution to the costs or that of his/her private insurance company. Those veterans who, based on their gross household income, do not qualify for free care are responsible for copays (15).

The rules governing VA health care priority group assignment are set forth in 38 CFR §17.36. Based on regulations, enrollees are assigned to a health care priority group. Veterans with the least severe, *non-compensable* service-connected disabilities (zero percent ratings) may be placed in either priority group 5 or 6, subject to an income threshold for eligibility. Among veterans with *compensable* service-connected disabilities, those with the least severe disabilities (i.e., 10 percent and 20 percent ratings) are placed in *priority group 3*. Veterans with moderately severe disabilities (i.e., 30 percent and 40 percent ratings) are placed in *priority group 2*; whereas those with the most severe disabilities (ratings of 50 percent or more) are placed in *priority group 1*. The

remaining priority groups 4, 7 and 8 represent special categories that are separate from those defined solely by disability rating or income (13, 14, 15).

Access to non-VA Health Care

In terms of non-VA health care, veterans can be “dual users,” receiving inpatient and outpatient health care services from the VA as well as from sources outside of the VA (16, 17). However, despite being eligible for VA health care services, some uninsured veterans, nevertheless, do not use *any* VA health care services (17). According to Nelson et al., “[t]he extent of use of other health care coverage among veterans is of interest but has been difficult to quantify (17).”

VA Disability Compensation Award Status

The Social Security Administration (SSA) and the VA both administer large federal disability compensation programs. As of 2010, SSA and the VA combined served approximately 12 million disability compensation recipients (12). However, while much is known about the qualities of individuals who apply for Social Security, much less is known about veterans who seek VA disability compensation (18).

The extant literature suggests that the cohort of veteran compensation-seekers comprise heterogeneous subgroups which can be defined by their *award status* (e.g., denied applicant, awarded applicant) within the VA disability compensation system. These groups are differentiated by *unique* health, health care, socioeconomic, and psychosocial characteristics (19, 20). In considering *award status*, however, knowing what happens to veterans denied VA disability compensation may be more important than knowing what happens to those whose compensation claims have been awarded

“because the former leave the disability claims process with far fewer resources and a much thinner safety net (20).”

In view of the VA commitment to targeting subgroups of veterans with the most need, and given emerging evidence suggesting that *denied* applicants may be at increased risk of poverty and homelessness (20), a greater focus on the well-being of this potentially vulnerable subgroup is timely and justified.

Denied Applicants' Health and Health Care Utilization

The limited number of studies of health among *denied* applicants suggest that at least some of these applicants are burdened by severe health limitations (20, 21, 22, 23, 24, 25, 26). At the same time, while poorer health is associated with increased health care consumption in studies of the general population (27), studies relevant to compensation-seeking veterans suggest, in contrast, that veterans denied VA disability compensation may use less VA health care than comparably impaired awarded applicants (19, 28, 29).

If *denied* applicants do in fact have comparative poor health and yet use less VA health care services, then it is conceivable that these applicants may instead be using non-VA health care services paid for by other sources (e.g., Medicare). Unfortunately, no prior data exists on dual-use among veterans denied or awarded VA disability compensation.

Denied Applicants' Psychosocial Characteristics

Given widely-cited associations between low socioeconomic status, poor health and health-related resource use (30, 31, 32), an understanding of social conditions among veterans denied VA disability compensation is fundamental to our understanding of their well-being.

Social isolation, broadly defined as “disengagement from social ties, institutional connections, or community participation (33),” is an important determinant of health. Studies of the general population have consistently reported that individuals with few close personal relationships tend to have poorer health outcomes (30, 31, 32), and some studies have reported greater health-related resource use (34, 35, 36).

Among the few studies of post-deployment social structure, results suggest that veterans experience social isolation (37, 38); and this isolation can be “systematic (37).” These studies also indicate that social isolation can influence health through multiple pathways: For instance, homelessness (39), lower levels of encouragement, support and health-related feedback (40), poverty (20, 41), and poor social functioning (20, 42).

Denied Applicants’ Sociodemographics Characteristics

It is widely acknowledged that the adverse health effects of social isolation are often felt more acutely by individuals with low socioeconomic status (30, 34, 43, 44). Studies of compensation-seeking veterans suggest that *denied* applicants tend to have low socioeconomic status (20, 42, 45). Two separate comparative analyses conducted in 2005 found that compared to veterans *awarded* VA disability compensation, those *denied* had a higher probability of low income (42); a subsequent study similarly found poverty, and a greater likelihood of homelessness, and unemployment (20).

Rationale and Study Aims

Overall, the general consensus in studies of individuals seeking federal disability compensation was that denied applicants are healthier than those awarded. In contrast, studies of U.S. military veterans seeking VA disability compensation suggest that *denied* applicants may be sicker than *awarded* applicants, and yet use less health care. For this reason, our main research question was: compared to veterans “awarded” VA disability compensation, are veterans “denied” VA disability compensation sicker, and do they have differing patterns of health care utilization? Additionally, because social isolation is an important correlate of health and health-related resource use, a second research question was: are veterans denied VA disability compensation comparatively socially isolated?

The present doctoral dissertation, in analyzing the health and health care utilization of veterans denied VA disability compensation (“denied applicants”), primarily relies on comparisons with veterans awarded VA disability compensation (“awarded applicants”), who are considered by researchers to be the least-biased comparison group (20, 24).

Three comparative analyses were undertaken to address these questions and are briefly described below.

Study 1: Literature Review

In the first study, a review of the research literature relevant to health and health care utilization among veterans denied or awarded VA disability compensation, the research questions of interest were: (1) Does health differ between veterans denied VA disability compensation and those awarded VA disability compensation? (2) Does health

care utilization differ between veterans denied VA disability compensation and those awarded VA disability compensation? (3) Does social isolation differ between veterans denied VA disability compensation and those awarded VA disability compensation?

Study 2: Health Status

In the second study, a comparative analysis of subjective health status among veterans denied or awarded VA disability compensation, the research questions of interest were: (1) Is health status associated with VA disability compensation denial? (2) Is social isolation associated with VA disability compensation denial? (3) Are marital status or employment status significant effect modifiers of overall self-reported health, physical and mental functioning, and limitations in activities of daily living?

Study 3: VA and non-VA Health Care Utilization

In the third study, a comparative analysis of VA and non-VA outpatient health care visit counts - also referred to as *service-use intensity* - during the previous 12 months, the research questions of interest were: (1) Is VA outpatient health care associated with VA disability compensation denial? (2) Is non-VA outpatient health care associated with VA disability compensation denial?

These research questions are addressed within this dissertation in the form of the three manuscripts that follow.

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Health, Health Care Utilization, and Social Isolation Among U.S. Veterans Denied VA Service-Connected Disability Compensation: A Review of the Literature

Abstract

The general consensus in studies of individuals seeking federal disability compensation was that individuals *denied* disability compensation were healthier than those *awarded*. In contrast, studies of veterans seeking VA disability compensation suggest that *denied* applicants may be as impaired as *awarded* applicants, and likely have critical, albeit unmet health care needs. Moreover, while post-deployment *social isolation* has been previously described, its broad influence on the health and health care service utilization of veterans *denied* VA disability compensation is not well understood. Because veterans *denied* VA disability compensation may be at increased risk of poor long-term health, a more thorough understanding of their unique health, socioeconomic, psychosocial and health care utilization characteristics is warranted.

This review addresses the following critical issues:

- Are veterans who have been *denied* VA disability compensation as impaired, or more impaired than veterans who have been *awarded* VA disability compensation?
- Do veterans who are *denied* VA disability compensation use less health care than veterans who have been *awarded* VA disability compensation?
- Does social isolation play a role in health and health care service use among veterans who have been *denied* VA disability compensation?

Here, we examine broad policy issues and suggest avenues for future research.

Introduction

The U.S. Department of Veterans Affairs (VA) is the largest single provider of health care in the United States and administers the nation's second largest federal disability program (1). There are three independent administrations within the VA: the National Cemetery Administration, the Veterans Benefits Administration (VBA) and the Veterans Health Administration (VHA). The latter two are both critical to the administration of compensation and health care: the VBA manages disability compensation through Regional Offices, while the VHA provides medical care to veterans through a regionalized network of hospitals, clinics and community veterans centers (2).

VA disability compensation is intended to compensate losses in earnings resulting from service-connected diseases and injuries "and their residual conditions in civil occupations (3)." "Service-connected" means conditions that occurred during active-duty military service or those that were aggravated by it (4).

VA service-connected disability compensation is based on severity of medically-evaluated disability as well as number of dependents. A combined disability rating expresses service-connected disability severity on a graduated scale from 10 percent (least disabling and least compensated) to 100 percent (most disabling and most compensated) in increments of 10 percent. Although a veteran may receive a zero percent disability rating, which entitles him/her to health care benefits for the noted condition, only combined ratings of 10 percent or more qualifies him/her for compensation (4, 5).

Access to VA Disability Compensation

A veteran seeking VA disability compensation benefits must first file an application. In evaluating the claim, a specialty review team gathers medical and military service-related evidence. In the process, the VA confirms the existence of the disability, and subsequently determines whether the existing disability is service-connected. If so, the VA assigns a combined disability rating and establishes a date of award with payment based on the rating (6). For those veterans awarded service-connection, the VA can grant a full award, or a partial award (7). If no service connection is found, the claim is denied.

The VA disability compensation adjudication process which begins with a compensation application and ends with either an initial decision or a decision in response to an appeal, can be onerous: In 2011, the average claims processing time was 197 days, while the average appeals processing time was 747 days (8). Veterans denied service-connection receive no cash compensation while their access to health care is means-tested.

Access to VA Health Care

Access to veterans health benefits begins with a VHA enrollment application, that is separate from the application for disability compensation. The VHA may also require some veterans to complete a financial assessment – “means test” – to establish eligibility for health care and to determine the individual's contribution to the costs or that of his/her private insurance company. Those veterans who, based on their gross household income, do not qualify for free care are responsible for copays (9).

VA Disability Compensation Award Status

The existing literature suggests that the cohort of veteran compensation-seekers comprise heterogeneous subgroups which can be defined by their *award status* (e.g., denied applicant, awarded applicant) within the Department of Veterans Affairs disability compensation system. These groups are differentiated by unique health, socioeconomic, psychosocial, and health care utilization characteristics (10, 11). In considering *award status*, however, knowing what happens to veterans *denied* VA disability compensation may be more important than knowing what happens to those whose compensation claims have been awarded “because the former leave the disability claims process with far fewer resources and a much thinner safety net (11).”

In view of the VA commitment to targeting subgroups of veterans with the most need, and given emerging evidence suggesting that *denied* applicants may be at increased risk of poverty and homelessness (11), a greater focus on this particularly vulnerable subgroup seems timely and justified.

The aim of the present review is to:

- Provide an overview of existing work on health and health care utilization “relevant” to U.S. Veterans *denied* VA disability compensation
- Provide an overview of existing work on the broad influence of social isolation on health and health care utilization “relevant” to U.S. Veterans *denied* VA disability compensation
- Highlight knowledge gaps, as well as key policy issues emerging from this research, and suggest avenues for future scholarship on this topic

Methods

Our review of prior work relating to health and health care utilization among U.S. Veterans denied VA disability compensation took place from 2012 to 2014. Electronic and non-electronic sources were used to gather English language literature, which included peer-reviewed journal articles, government reports, Congressional testimony, federal regulations and statutes, court decisions and legal opinions, as well as information provided by authoritative web-sites (e.g., www.va.gov). We initially reviewed 122 research items, ultimately citing those 45 items that can be found in the reference section.

Search Strategy

Research materials cited in this review cover a period from 1983 to 2014. Internet search engines that included Google and Google Scholar were used to identify relevant literature. We also used PubMed, a publicly available, open access database to expand our search.

A broad search began with the following individual and combined words: *veterans, deployment, service-connected, department of veterans affairs, disability compensation, federal, military, denied, awarded, compensation status, compensation-seeking, application, social security, health, health care, utilization, consumption, resource use, dual use, United States, American, comparative analysis, social isolation, psychosocial determinants, social capital, and social determinants*. In the process, the search widened using a "snowball search technique" where we followed-up references from reviewed materials until we could no longer find any additional relevant studies.

Results

Health

The limited number of studies of health status among *denied* applicants suggest that at least some of these applicants are burdened by severe health limitations. An early study of veterans conducted in 1983 found high levels of psychiatric impairment, regardless of whether they were receiving full, partial or no VA disability compensation (12). This finding was underscored by results from an analysis of Social Security disability compensation that led the author to speculate that some individuals suffering from schizophrenia or anxiety disorder may, in fact, be denied disability benefits because their psychiatric impairments are so severe that they are “not able to give a sufficiently coherent history [or] provide the necessary documentation for eligibility for disability (13).” A similar contention was expressed in a subsequent study of health among subjects who received or did not receive government disability payments (14).

In 1989, an analysis of Social Security Disability Compensation by the U.S. Government Accountability Office (GAO) found, similarly, that *awarded* applicants and *denied* applicants who were unemployed had comparably poor health: specifically, seventy-eight percent of *awarded* applicants and eighty percent of *denied* applicants reported fair or poor overall health, while 53 percent of *awarded* applicants and fifty-one percent of *denied* applicants also reported limitations in the performance of activities of daily living (15). Consistent with the GAO, Bound, in his 1989 seminal comparison of Social Security disability recipients with *denied* subjects, found that over 50 percent of *denied* “report important health limitations on their ability to work (16).”

Rosenheck, et al. (2000) analyzed "functional health" and "quality of life" among 280 homeless mentally ill veterans seeking Social Security disability benefits as part of the SSA-VA Joint Outreach Initiative. Overall, the study concluded that compared to *denied* applicants, *awarded* applicants "may have been no more disabled (17)." Comparison of Addiction Severity Index Scores revealed no significant differences between *awarded* and *denied* in psychiatric illness (27.20 vs. 27.41, $p = 0.953$) or medical illness (42.79 vs. 50.31, $p = 0.326$), although Quality of Life Index Scores revealed that *awarded* had significantly better quality of life (2.96 vs. 2.67, $p = 0.004$) (17).

Murdoch et al., examined symptom severity as well as physical functioning among veterans who had filed for VA disability compensation based on a claim of post-traumatic stress disorder. Overall, veterans *denied* service-connection were "not less disabled than those who obtained service connection (18)." Thus, compared to *awarded* applicants, *denied* had lower Penn Inventory Scores (43.4 vs. 39.6, $p < 0.0001$), indicating less PTSD symptom severity, but also lower RAND Revised Physical Functioning Scores (29.2 vs. 28.6, $p = 0.001$), indicating poorer physical functioning (18).

A longitudinal study subsequently reported post-traumatic stress disorder symptoms, mental and physical functioning, and subjective well-being among veterans who had been *awarded* or *denied* VA disability compensation. It found that while both *awarded* and *denied* applicants were clinically impaired, *awarded* had significantly higher PTSD Symptom Check-List Scores (60.18 vs. 52.66, $p < 0.01$), and were

significantly more disabled (38.98 vs. 31.39, $p < 0.05$), as measured by the WHO Disability Assessment Schedule II (19).

Finally, a recent cohort study analyzed overall health in a stratified nationally representative sample of VA disability compensation-seeking veterans with post-traumatic stress disorder. It was found that ten years after applying for disability benefits, both *awarded* and *denied* applicants continued to experience clinically relevant PTSD symptoms, as well as poor physical functioning (11).

Health Care Utilization

Poorer health is associated with increased health care consumption in studies of the general population (20). In contrast, while veterans *denied* VA disability compensation are burdened by poor health, studies nevertheless suggest that these individuals may consume less health care than comparably impaired *awarded* applicants (10).

The limited number of studies that examined health care utilization among veterans *denied* VA disability compensation report equivocal findings (10, 19, 21, 22). Two prospective cohort studies conducted in 2004, and in 2005, analyzed pre-claim and post-claim VA health care utilization patterns among veterans with post-traumatic stress disorder who had applied for VA disability compensation. In both studies, post-claim medical care service use rose equally among *awarded* and *denied* applicants, while post-claim mental health care service use increased only among the *awarded* (10).

A subsequent analysis examined the relationship between VA disability compensation status and VA health care service utilization among a sample of veterans with post-traumatic stress disorder who filed first-time disability compensation claims

between 1997 and 1999. It found that although *awarded* applicants did not use more post-claim *medical* health care services than *denied* applicants, they did use significantly more pre-claim ($p < 0.001$) and post-claim ($p < 0.001$) *mental* health care services (22).

Laffaye, et al. reviewed seven studies of VA health care utilization among veterans seeking VA disability compensation for post-traumatic stress disorder. Overall, the study found that *awarded* applicants generally utilized more medical and mental health care services than *denied* applicants (10).

Finally, a subsequent prospective study reported post-claim VA mental health care service use among a sample of veterans who had been *awarded* or *denied* VA disability compensation for post-traumatic stress disorder. The study found a significant increase in post-claim VA mental health care service use *only* among *awarded* applicants ($p < 0.01$) (19).

Social Conditions

Social isolation, narrowly defined as “the personal isolation of individuals from one another (23),” is an important determinant of health. Studies have consistently found that individuals with few close personal relationships and limited social support tend to have poorer health outcomes, higher mortality risk (23, 24, 25), and some studies have reported greater health-related resource use (26, 27, 28). Socially isolated individuals are also more likely to be disabled (27), and to suffer anxiety and depression (28, 29, 30); and, results from several studies suggest that mental illnesses may mediate the effects of social isolation on health (23, 27, 28, 29).

Undoubtedly, the pathways by which social isolation influences health are complex, and no single variable can measure all of its dimensions (30, 31). Nevertheless,

prior work has cited an array of factors which when considered together, may be useful in characterizing one's social circumstances. In addition to small social networks and infrequent contacts (28, 30), other oft-cited contributing factors have included rural residence (23, 25), inadequate transportation (23), living arrangements (23, 25), few family members or close friends (32), limitations in mobility (23, 27), limited access to health-related information and feedback (33), and being unmarried (23, 27, 28, 34, 35). While health challenges related to isolation may be particularly acute among the elderly (30), social isolation nevertheless remains strongly associated with poorer health status across all age groups (30).

At the same time, it is widely acknowledged that the adverse health effects of social isolation are often felt more acutely by individuals with low socioeconomic status (24, 26, 32, 36). According to Locher, et al., "poverty also is associated with other social conditions, such as lower educational levels, which contribute to social isolation and lesser ability and power to command and access community resources and services (23)." Commonly cited socioeconomic measures have included gender (28), minority status (27, 35, 36), unemployment (34), low income and high debt levels (23, 25, 35), limited educational attainment (23), and lack of health insurance (33).

Social Conditions Among Veterans

Studies of post-deployment social conditions suggest that when returning from active-duty service, many veterans experience increasing social isolation (34, 37); and this increase can begin "immediately upon returning home (37)." Veterans' studies further suggest that social isolation can influence health through multiple pathways: For instance, homelessness (38), lower levels of encouragement, support and health-related

feedback (39), reduced consumption of medical care and other services (31, 40, 41), and reduced labor force participation (11).

There is, unfortunately, a paucity of data on social isolation among veterans *denied* VA disability compensation. Nevertheless, results from prior studies lend support to our hypothesis that veterans *denied* VA disability compensation tend to be socially isolated and socioeconomically disadvantaged.

One such study analyzed a small sample of homeless veterans with mental illness who had applied for Social Security disability compensation benefits. Baseline comparisons revealed no significant differences in the proportions of *awarded* and *denied* who were unemployed (50 percent vs. 62 percent, $p = 0.24$), had a high school education or less (62 percent vs. 66 percent, $p = 0.81$), were single (28 percent vs. 29 percent, $p = 0.32$), or were divorced (54 percent vs. 62 percent, $p = 0.32$). However, compared to the *awarded*, the *denied* did have significantly lower monthly employment income (\$306 vs. \$132.71, $p = 0.08$), higher monthly food stamp income (\$34.18 vs. \$54.15, $p = 0.09$), and spent less monthly income on housing (\$196.67 vs. \$99.37, $p = 0.01$) or health care (\$6.67 vs. \$0.37, $p = 0.04$) (17).

Murdoch et al., examined physical and social functioning among a sample of veterans who were seeking VA disability compensation for post-traumatic stress disorder. The study used the Social Adjustment Scale (SAS) to measure social functioning across the following domains: social and family interactions, “work” role (e.g., employed, student), and economic self-sufficiency. Overall, compared to *awarded* applicants, *denied* applicants had significantly poorer social functioning (2.7 vs. 2.8, $p < 0.0001$), as indicated by higher SAS scores, as well as poorer physical functioning (29.2 vs. 28.6, $p =$

0.001) , as indicated by lower RAND Revised Physical Functioning scores. Mean social functioning scores among *denied* applicants were lower than those of individuals with schizophrenia, substance abuse, or clinical depression (18).

Finally, a cohort study by Murdoch et al., analyzed health and social functioning among veterans seeking VA disability compensation for post-traumatic stress disorder. Overall, *denied* and *awarded* applicants continued to exhibit comparably poor social functioning at six-years of follow-up. Moreover, compared to *awarded* applicants, *denied* applicants were more likely to have been homeless (12.0 percent vs. 20.0, $p = 0.02$) and impoverished (15.2 percent vs. 44.8 percent, $p < 0.001$), and less likely to have been married (61.7 percent vs. 49.1 percent, $p < 0.001$), leading the authors to conclude that *denied* applicants “might represent an appropriate group for targeted outreach (11).”

Discussion

Summary of findings

Veterans *denied* VA disability compensation do indeed comprise a subgroup of compensation-seeking veterans characterized by low socioeconomic status, social isolation, and unmet medical and psychiatric health care needs. Such characterizations are based primarily on comparisons with *awarded* applicants who are considered by researchers to be the least-biased comparison group (11, 16).

Considering overall health, existing studies have consistently reported that *denied* applicants are often burdened by poor health and disability that can hamper multiple aspects of functioning. In addition to limitations in activities of daily living and instrumental activities of daily living, widely-cited as valid measures of disability

severity, an overwhelming number of *denied* applicants report functional impairments and deteriorating overall subjective health, mental illness, poor physical functioning, and health-related work limitations. Such significant health challenges, exacerbated by poverty, may make *denied* applicants especially vulnerable to additional health-compromising burdens, including substance abuse, and homelessness.

However, whether *denied* applicants are, in fact, sicker than *awarded* applicants cannot be resolved by the existing research evidence. Unfortunately, existing work is sparse and among the relatively few studies which have analyzed health among compensation-seeking veterans, many have focused exclusively on post-traumatic stress disorder (4, 11, 18, 19), or compared outcomes across inherently different, and therefore, potentially inappropriate comparison groups (12, 20, 42, 43).

At the same time, results from limited health utilization analyses suggest that *denied* applicants utilize *less* VA health care than comparably impaired *awarded* applicants. However, reduced health care service use by veterans with poor overall health stands in stark contrast to studies of the general population that have consistently reported an association between poorer health and increased health care resources use. What might explain this contrast?

Most utilization studies restrict their analysis to VA health care service use. Absent data on “dual system use,” which is utilization of VA, and non-VA health care systems (e.g., VA and Medicare), it is conceivable that *denied* applicants may use less VA health care but not necessarily less *overall* health care. Future analyses of dual-use among *denied* applicants could be useful in resolving this critical issue.

Given existing evidence suggesting that *denied* applicants are in poor health, what factors - other than service-connection award, which is among the strongest predictors of VA health care service use (1, 18, 44) - might drive lower VA (and perhaps, non-VA) health care resource utilization?

Although studies have implicated a constellation of predictors, the question of which determinants *most* impede access to health care among *denied* applicants, remains unresolved. Undoubtedly, some *denied* applicants confront *financial barriers* to care (10). Thus, *denied* applicants who are poor, but whose income exceeds the VA's income threshold may respond to the loss of free VA health care by either foregoing any health care or, instead, by availing themselves of alternative sources of care. Additionally, strongly held *beliefs* or *attitudes* may further influence health-care seeking (33, 45). One example is that denial of a disability compensation claim may engender feelings of anger and hostility towards the VA, which may translate into less VA service use.

Finally, studies of the general population have long recognized the critical but complex role that social isolation plays in health and health care utilization. Among studies of social determinants of health, increasing social isolation, especially among people with low socioeconomic status, has consistently been associated with poorer health. In contrast, among studies of health resource utilization, however, the role of social isolation has been less clear: while some studies have reported an association between social isolation and increased health care use, other studies have reported associations with decreased use. This ambiguity underscores the complex nature of social isolation. For some it may act as a barrier to care, while serving as a facilitator of care for others (23, 26).

Unfortunately, no existing veterans study has specifically addressed the role of social isolation in the health and health care utilization patterns of veterans *denied* VA disability compensation. However, characterizations of samples of *denied* applicants suggest that veterans *denied* VA disability compensation are, indeed, socially isolated. Prior work by Sayer, et al., (21), and by Murdoch et al., (2005, 2011) (11, 18) reveals that *denied* applicants tend to be renters rather than home-owners, and are often unmarried with few if any dependents. In addition to low socioeconomic status (e.g., low income, limited education, low labor force participation), *denied* applicants exhibit dysfunction across a wide spectrum of social activities (e.g., occupational, economic self-sufficiency). Finally, they tend to use fewer VA health care services, and such reduced utilization may deprive them of an important, and reliable formal social support system (23, 26).

Strengths and limitations

This is the first comprehensive review of the research literature concerned with health, health care utilization and social isolation among American Veterans *denied* VA disability compensation. Our review was restricted to English language studies, because it focuses on U.S. military Veterans. Unfortunately, quantitative analysis was not possible. Thus, while it is conceivable that a meta-analysis might have produced different results, these findings were consistent across existing work and, therefore, we are confident that our conclusions would not differ significantly from such an analysis.

Conclusion

The broad picture of *denied* applicants that emerges from available data shows them, compared to *awarded* applicants, to have comparably poor health, lower VA health

service use, more severe poverty and long-term unemployment, and greater social isolation. Such burdens coupled with evidence of increased risks of homelessness and premature mortality support our hypothesis that *denied* applicants are indeed a particularly vulnerable subgroup.

In regard to their vulnerabilities, we emphasize that denial of disability compensation signifies *only* that a condition cannot be attributed to military service; it does not imply that a condition is not severe, or that it is not worthy of supportive services. Given this nation's obligation to serve the *neediest* veterans, future studies might explore new initiatives (e.g., case managers dedicated to exclusively assisting *denied* applicants; co-adjudication of VA disability compensation and Social Security disability compensation applications) that could be tailored to veterans who do not qualify for disability compensation, but who, nevertheless, are burdened by serious health-related challenges.

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Health and Functioning Among U.S. Veterans Denied VA Disability Compensation: A Cross-Sectional Study of Subjective Health Status

Abstract

The general consensus in studies of individuals seeking federal disability compensation is that individuals *denied* disability compensation are healthier than those *awarded*. In contrast, studies of military veterans seeking disability compensation from the Department of Veterans Affairs (VA) suggest that *denied* applicants may be as impaired, or more impaired than *awarded* applicants. Moreover, while social isolation has received some attention, its role in the health and functioning of veterans *denied* VA disability compensation is not well understood. Because veterans *denied* VA disability compensation may have increased risks of poor long-term health and poverty, a more thorough understanding of factors which influence their well-being is warranted.

Introduction

The U.S. Department of Veterans Affairs (VA) is the largest single provider of health care in the United States and administers the nation's second largest federal disability program (1). Within the VA, the Veterans Benefits Administration (VBA) administers disability compensation totaling \$50 billion annually through Regional Offices (2), while the Veterans Health Administration (VHA) provides medical care totaling almost \$45 billion through a regionalized network of hospitals, clinics and community veterans centers (3).

VA disability compensation is intended to compensate losses in earnings resulting from service-connected diseases and injuries “and their residual conditions in civil

occupations (4).” “Service-connected” means conditions that occurred during active duty military service or those that were aggravated by it (5). In the cohort of 24 million living veterans, about 3.7 million (15 percent) receive monthly tax-free disability compensation payments for a variety of service-connected disabilities (6); for veterans without dependents, monthly payments in 2013 ranged from \$130.94 to \$2,858.24 (7).

VA service-connected disability compensation paid to veterans is based on severity of medically-evaluated disability as well as number of dependents. A combined disability rating expresses service-related disability severity on a graduated scale from 10 percent (least disabling and least compensated) to 100 percent (most disabling and most compensated) in increments of 10 percent. Although a veteran may receive a zero percent disability rating, which entitles him/her to health care benefits for the noted condition, only combined ratings of 10 percent or more qualifies him/her for compensation (8, 9).

A veteran may seek a disability rating for more than one impairment (e.g., posttraumatic stress disorder and diabetes). In 2011, veterans who served in Iraq and/or Afghanistan claimed an average of 8.5 independent medical conditions (10). The combined disability rating is based on the disability rating for each individual condition. If service-connection is awarded for just one condition, then the combined disability rating is equal to the rating for that condition. If, on the other hand, service-connection is awarded for more than one condition, rather than summing the individual ratings, the combined disability rating is instead based on the combined ratings table as prescribed in 38 CFR §4.25 (11).

Access to VA Disability Compensation

A veteran seeking VA disability compensation benefits must first file an application. In evaluating the claim, a specialty review team gathers medical and military service-related evidence. In the process, the VA confirms the existence of the disability, and subsequently determines whether the existing disability is service-connected. If so, the VA assigns a combined disability rating and establishes a date of award with payment based on the rating (12).

Veterans with disability ratings of at least 10 percent will receive both cash compensation as well as VA health care: higher disability ratings result in both, larger monthly compensation payments, as well as reduced financial contribution for health care services. Veterans denied service-connection, on the other hand, receive no cash compensation while their access to health care is based on financial resources (i.e., means-tested).

VA Disability Compensation Award Status

The Social Security Administration (SSA) and the VA both administer large federal disability compensation programs. As of 2010, SSA and the VA combined served approximately 12 million disability compensation recipients (13). However, while much is known about the qualities of individuals who apply for Social Security, much less is known about veterans who seek VA disability compensation (14).

The extant literature suggests that the cohort of veteran compensation-seekers comprise heterogeneous subgroups which can be defined by their *award status* (e.g., denied applicant, awarded applicant) within the VA disability compensation system. These groups are differentiated by *unique* health, health care utilization, socioeconomic,

and psychosocial characteristics (15, 16). In considering *award status*, however, knowing what happens to veterans *denied* VA disability compensation may be more important than knowing what happens to those whose compensation claims have been *awarded* “because the former leave the disability claims process with far fewer resources and a much thinner safety net (16).”

In view of the VA commitment to targeting subgroups of veterans with the most need (17), and given emerging evidence suggesting that *denied* applicants may have increased risks of poverty, homelessness and poor long-term health (16), a greater focus on the well-being of this particularly vulnerable subgroup seems timely and justified.

Denied Applicants' Health

The limited number of studies of health among *denied* applicants suggest that at least some of these applicants are burdened by severe health limitations. An early study of veterans conducted in 1983 found high levels of psychiatric impairment, regardless of whether they were receiving full, partial, or no VA disability compensation (18). This finding was underscored by results from an analysis of Social Security disability compensation that led the author to speculate that some individuals suffering from schizophrenia or anxiety disorder may, in fact, be denied disability benefits because their psychiatric impairments are so severe that they are “not able to give a sufficiently coherent history [or] provide the necessary documentation for eligibility for disability (19).” A similar contention was expressed in a subsequent study of health among subjects who received or did not receive “disability payments from the government (20).”

In 1989, an analysis of Social Security Disability Compensation by the U.S. Government Accountability Office (GAO) found, similarly, that *awarded* applicants and

denied applicants who were unemployed had comparably poor overall health (21). Consistent with the GAO, a comparison of Social Security disability *recipients* with *denied* subjects revealed that a majority of those *denied* reported work-related health limitations (22).

Rosenheck et al., in their analysis of "functional health" and "quality of life" among homeless mentally ill veterans seeking Social Security disability benefits, found that *awarded* and *denied* applicants were comparably impaired (23). A similar finding was reached by Murdoch et al., in their study of veterans seeking VA disability compensation for post-traumatic stress disorder (24).

Subsequently, a longitudinal study of veterans seeking VA disability compensation for post-traumatic stress disorder found that both *awarded* and *denied* applicants were clinically impaired (25), while an analysis of health among a nationally representative sample of VA disability compensation-seeking veterans with post-traumatic stress disorder similarly found that ten years after applying for disability benefits, both *awarded* and *denied* applicants continued to experience clinically relevant PTSD symptoms, as well as poor physical functioning (16).

Overall, if *denied* applicants do in fact have comparative poor health, then given the widely-cited roles of poverty and social isolation in morbidity and premature mortality (26, 27, 28), a critically important question becomes: *are veterans denied VA disability compensation poor and socially isolated?*

Denied Applicants' Sociodemographics

It is widely acknowledged that the adverse health effects of social isolation are often felt more acutely by individuals with low socioeconomic status (26, 29, 30, 31).

Widely-cited socioeconomic measures have included male gender (32), minority status (31, 33, 34), unemployment (35), low income and high debt levels (23, 28, 34), limited educational attainment (28), and lack of health insurance (36).

Studies of compensation-seeking veterans suggest that veterans denied VA disability compensation tend to have low socioeconomic status (e.g., low income, unemployment) (16, 37). One such study, conducted in 2005 found that compared to veterans *awarded* VA disability compensation for post-traumatic stress disorder, those *denied* had a significantly higher probability of reporting low income (26.0% vs. 62.0%, $p < 0.0001$) (37).

A concurrent, separate analysis of VA disability compensation and post-traumatic stress disorder reached a similar conclusion (24). Finally, a more recent examination of VA disability compensation among veterans filing claims for post-traumatic stress disorder revealed that compared to *awarded* applicants, those *denied* were significantly more likely to be impoverished (15.2% vs. 44.8%, $p < 0.001$), and homeless (12.0% vs. 20.0%, $p = 0.02$). Additionally, both *awarded* as well as *denied* applicants had comparably low rates of labor force participation (13.2% vs. 19.0%, $p = 0.11$) (16).

Denied Applicants' Social Isolation

Social isolation, broadly defined as “disengagement from social ties, institutional connections, or community participation,” is an important determinant of health (38). Studies of the general population have consistently found that individuals with few close personal relationships and limited social support tend to have poorer health outcomes, and higher mortality risk (26, 27, 28); and some studies have reported greater health-related resource use (29, 32, 33). Socially isolated individuals are also more likely to be

disabled (33), to suffer anxiety and depression (32, 39, 40), and to have lower socioeconomic status (26, 29, 30, 31).

Prior studies of social structure have cited an array of factors which when considered together, may be useful in characterizing one's social circumstances. In addition to small social networks and infrequent contacts (32, 40), other oft-cited factors have included rural residence and inadequate transportation (23, 28), not owning a home (23, 28), few family members or close friends (28, 30), limitations in mobility (28, 33), limited access to health-related information and feedback (36), and being unmarried (28, 32, 33, 34, 35, 38).

Among the few studies of post-deployment social structure, results suggest that veterans *denied* VA disability compensation experience social isolation (35, 41); and this isolation, which can begin immediately upon returning from military service, can be "systematic (41)." These studies also indicate that social isolation can influence health through multiple pathways: For instance, homelessness (42), lower levels of encouragement, support and health-related feedback (43), poverty (16, 29), and poor social functioning (16, 25).

The Present Study

Unfortunately, extant work is sparse and among those few studies relevant to veterans which have examined health among disability compensation-seeking subjects, many have focused exclusively on post-traumatic stress disorder (5, 16, 25, 37). Other studies have compared health across inherently different, and therefore, potentially inappropriate comparison groups (18, 44, 45, 46): As one example, comparative analyses of *applicants* with *non-applicants* (e.g., awarded vs. not-awarded) may be inappropriate

because subjects who apply for disability compensation tend to be much sicker than those who have never applied (16). Finally, while some studies have analyzed social functioning (e.g., occupational functioning) among veterans *denied* or *awarded* VA disability compensation, few if any have analyzed correlates of social isolation.

The present study addresses these limitations. Using secondary, cross-sectional data from the 2001 National Survey of Veterans (NSV), we examine relationships between VA disability compensation denial and several different measures of health among a sample of compensation-seeking veterans with physical and mental impairments. We also model correlates of social isolation. In the process, because being unmarried or unemployed - strong correlates of social isolation - are both associated with poorer health (28, 32, 47), we explore the following: (a) *marital status* as a potential effect modifier of *overall health*, *physical functioning*, *mental functioning*, and *limitations in activities of daily living*; (b) *employment status* as a potential effect modifier of *overall health*, *physical functioning*, *mental functioning*, and *limitations in activities of daily living*; and (c) *marital status* as a potential effect modifier of *employment status*.

Hypotheses

We hypothesized that *denied* applicants would have poorer health compared to *awarded* applicants across several different health status measures: Specifically, those *denied* would have poorer overall self-reported health, physical and mental impairments, and limitations in the performance of activities of daily living, after adjusting for all other factors.

Methods

Data Set

The 2001 National Survey of Veterans (NSV) consists of 20,048 veteran-respondents, and was fifth in a series of comprehensive nationwide surveys intended to assist the VA in program planning. In addition to a wide array of questions regarding sociodemographics, prior military service, health and health care utilization, the NSV also asked veterans about the status of their most-recent VA disability compensation application.

The survey employed a dual frame sample design, consisting of a Random Digit Dialing (RDD) sample and a List (List) sample: The sampling frame for the *List* sample was constructed from the VHA health care enrollment and VBA compensation and pension frames, while the *Random Digit Dialing* frame consisted of a random sample of telephone numbers from a national telephone number sampling frame. Survey data were weighted based on the probability of selection, non-response and household size, making responses generalizable to the larger non-institutionalized U.S. Veteran population. The survey's response rate of 76.4% for the RDD sample, and 62.8% for the List sample "is an excellent response rate for epidemiological telephone-based surveys (46)." The final sample was demographically representative of the known veteran population collected in the 2000 U.S. Census.

Sample Selection

Using the 2001 NSV, we applied the specific inclusion and exclusion criteria described below to create a *final analytic sample* of 4,983 veterans denied or awarded VA disability compensation. A sample selection flow diagram is presented in **Figure 1**.

Among 20,048 veteran-respondents, we began by initially selecting a sample of 5,903 (29.4%) veterans whose *most recent* VA disability compensation application had been “denied” (915) or “approved” (4,988).

Among 915 subjects whose most recent VA disability compensation application had been “denied,” 520 (56.8%) of these subjects were excluded from the final analytic sample for the following reasons: 513 subjects reported having a previously approved service-connected disability rating, “refused to answer” or “did not know,” while 7 subjects were listed as having been assigned to VA health care priority group 3 (*veterans denied VA disability compensation cannot be assigned to VA health care priority group 3*). The remaining 395 (43.1%) subjects did not have a service-connected disability rating. These subjects were included in the final analytic sample and were designated as “denied applicants.”

In this study, we were interested in *denied* applicants who had not received VA disability compensation. There is no statute of limitations on the filing of VA disability compensation claims (48): Thus, a veteran can file a new claim for a potentially service-related condition at any time, even if he/she already has a disability rating based on some prior claim. To minimize the influence of previous VA disability and create a more homogeneous sample of *denied* applicants, we selected those *denied* whose most recent claim was rejected and who also did *not* have a disability rating on the basis of some other claim.

Among 4,988 subjects whose most recent VA disability compensation application had been “approved,” 400 (2.0%) of these subjects reported not having a service-connected disability rating, “refused to answer” or “did not know” and were excluded

from the final analytic sample. The remaining 4,588 (91.9%) subjects reported having a service-connected disability rating. These subjects were included in the final analytic sample, and were designated as “awarded applicants.”

Analytical Approach

When modeling several categorical variables, there is no need to differentiate variables as *dependent* or *independent* or to assume causality (49); for this reason, we herein refer to our outcome as the *response*, and all other variables as *factors*.

Factor Variables

Health Status

Four separate factor variables relating to health status were included in an initial exploratory bivariate analysis (*subsequently described*) conducted prior to multivariate modeling: *overall self-reported health*, *physical functioning*, *mental functioning*, and *limitations in activities of daily living*.

Overall self-reported Health. Global health perceptions are sensitive predictors of morbidity and mortality (50, 51, 52, 53), and have been found to be associated with disability and distress, number of annual physician visits, and socioeconomic status (50, 54), as well as chronic illness (55). In the 2001 NSV, veterans were asked to rate their “general health” on a scale of 1 to 5, with 1 representing excellent health and 5 representing poor health (*this widely applied measure of general health is referred to as the SF1*). Consistent with prior work, overall self-reported health was treated as an ordinal variable (56).

Physical and Mental Functioning. The Veterans SF-12 (VSF-12) is a generic measure of health status. Twelve items address eight concepts widely used in health

outcomes surveys: *physical functioning, role limitations due to physical health problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and mental health* (57). These twelve items can be used to compute a physical component summary score (PCS) and a mental component summary score (MCS).

Scoring of PCS and MCS in the VSF-12 is based on weights derived from the Veterans SF-36 administered to 877,775 respondents in the 1999 Large Health Survey of Veteran Enrollees (58). Compared to the Medical Outcomes Survey SF-12, the VSF-12 adds about 5% more precision to the PCS and MCS. Cronbach alpha estimates - a measure of internal consistency reliability - for the VSF-12 PCS and MCS are both 0.90 (58).

The 2001 NSV includes VSF-12 questions, permitting researchers to derive PCS and MCS scores using a publically-available scoring algorithm (57), with standardized scores ranging from 0 to 100, mean = 50, and standard deviation = 10 (*lower scores indicate greater impairment*). PCS and MCS scores evidence adequate reliability and validity against health criteria (59), and were cited in at least two prior studies of VA disability compensation award status (46, 59).

Limitations in Activities of Daily Living. Limitations in activities of daily living (ADLs) measure difficulties in the following seven aspects of daily functioning: *bathing, dressing, getting in/out of chairs or bed, walking, eating, using the toilet, and controlling one's bladder or bowels*. ADLs have been found to be associated with use of hospital and physician services, living arrangements, insurance coverage and mortality, as well as a wide-range of health-related behaviors (60, 61). In deriving an ADL limitations count variable, the seven binary ADL limitations measures were summed for each subject with resulting scores ranging from 0 ("no limitations in activities of daily living") to 7

(“limitations in all seven activities of daily living”). Mean ADL limitations scores were then derived for *denied* applicants and compared with those of *awarded* applicants.

Combat or War Zone Exposure

Because published studies of veterans report an association between experience in a combat zone and poorer health (35, 41), a dichotomous “yes/no” variable representing combat or war zone exposure was included in an initial bivariate analysis.

Sociodemographics

Because the adverse health effects of social isolation are often felt more acutely by individuals with low socioeconomic status (26, 29, 30, 31), older age (40), male gender (32), minority race (31, 33, 34), receipt of public assistance income, limited educational attainment and lack of health insurance were all operationalized as dichotomous factors and included in our initial bivariate analysis (32, 34, 35).

Social Isolation

Because social isolation is an important determinant of health (23, 26, 28, 38), being unmarried and unemployed (32, 34, 35), living in a rural area (28, 33, 41), not owning a home (e.g., renting or dwelling) (28, 33, 35, 40), and having no dependent children (62) were all operationalized as dichotomous factors and included in an initial bivariate analysis.

In addition, because individuals who are socially isolated, in contrast to those who are socially supported are more likely to have limited sources of health-related information (23), a six-level variable asking veterans to characterize their overall knowledge of VA health-related benefits and services was transformed into a

dichotomous factor and coded as “Little or no overall knowledge/At least some overall knowledge.” This variable was also included in the initial bivariate analysis.

Finally, because lack of participation in VA provided services may be an indicator of social isolation (28, 29), responses to questions regarding use of a wide array of VA health-related benefits and services were transformed into the single count variable described below.

We constructed a count variable to capture past use of an array of VA health-related benefits and services (47). This was done by starting with dichotomous “yes/no” variables reflecting veterans’ *use* in the previous twelve-months or *ever use* of the following seven types of benefits: *VA Life Insurance*, *VA Education or Training*, *VA Hospital*, *VA Pharmacy*, *VA Psychological Counseling*, *or Substance Abuse Treatment*, *VA in-home Healthcare*, and *VA Prosthetics*.

These seven binary variables were summed for each subject with resulting scores ranging from 0 (“no services used”) to 7 (“all services used”). Mean overall VA health-related benefits and services utilization scores were then derived for *denied* applicants and compared with those of *awarded* applicants. The following VA health-related benefits and services, however, were excluded from this count variable: (a) *VA Emergency room use previous 12 months* (64.78% missing), *VA Mortgage ever use* (41.82% missing), and *VA outpatient health care use previous 12 months* (13.6% missing) were all excluded due to excessive missing values; (b) *VA Burial Services use* was excluded because it measures potential future use, rather than past use; and (c) *VA Vocational Rehabilitation use* was excluded because only veterans *awarded* VA disability compensation qualify for this benefit.

Response Variable

The response, *VA Disability Compensation Award Status* (denied vs. awarded), was a dichotomous variable consisting of those veterans whose most recent VA disability compensation application had been denied and who had not been awarded a service-connected disability rating on the basis of any other condition (“denied applicants”), and a comparison group of veterans whose most recent VA disability compensation application had been approved and who had been awarded a service-connected disability rating (“awarded applicants”).

Analysis

This study, based on publicly-available, de-identified data, was approved by the Rutgers University Institutional Review Board. All design-based analyses included the survey’s sampling weights, were two-tailed, conducted with $\alpha = 0.05$ significance level, and performed with Stata version 13.1 (Stata Corp: College Station, Texas).

Univariate and Bivariate Analysis

Prior to bivariate analysis, we analyzed summary statistics for all initial variables (**Table 1**). Subsequently, bivariate analysis (**Table 2**) was conducted to explore initial associations between the response, VA disability compensation award status and each individual candidate factor, taking survey sampling weights and design into account. A p-value criterion of $\alpha = 0.25$ was applied, excluding any variable from initial multivariate modeling that exceeded this criterion. On this basis, *health insurance status* ($p = 0.66$) was the only factor excluded.

Discharge Status. Because veterans who have been dishonorably discharged are not eligible for VA benefits and services (38 C.F.R §3.12), we examined discharge status

(dishonorable vs. honorable) among *denied* applicants. Given that only 3 (0.62%) veterans *denied* VA disability compensation had been dishonorably discharged, we concluded that discharge status likely had minimal effect on the health-related service use of *denied* applicants.

Multivariate Analyses

For multivariate regression analysis, we ran three separate logistic regression models: *Model 1* modeled the relationship between VA disability compensation award status and overall self-reported health, adjusting for all other factors. *Model 2* modeled the relationship between VA disability compensation award status and physical and mental functioning, adjusting for all other factors. *Model 3* modeled the relationship between VA disability compensation award status and limitations in activities of daily living, adjusting for all other factors. Stata's algorithms, which automatically check for multicollinearity, detected none.

Missing Data

Missing variable responses were deleted through an automated process of *listwise deletion*. Although listwise deletion can result in larger standard errors, these estimated standard errors are “usually accurate estimates of the true standard errors (63).” In multivariate modeling of overall self-reported health and VA disability compensation award status, missing data resulted in the listwise exclusion of 577 (11.5%) observations; separate multivariate modeling of physical and mental functioning and VA disability compensation award status resulted in listwise exclusion of 2,305 (46.2%) observations; separate multivariate modeling of limitations in activities of daily living and VA

disability compensation award status resulted in listwise exclusion of 403 (8.08%) observations.

Given substantial numbers of missing values for physical and mental functioning, we sought to analyze the effect of this *missingness* on relationships between physical and mental functioning and the response, VA disability compensation award status. Because low socioeconomic status is strongly associated with poorer health (26, 39), we assessed the potential effect of *missing* data (versus *complete* data) on sample PCS and MCS scores by comparing sociodemographics between subjects with missing values to those with complete values within: (a) *overall sample* of subjects with missing and non-missing values; (b) *subset of denied* applicants with missing and non-missing values; and (c) *subset of awarded* applicants with missing and non-missing values. Sociodemographic differences between those with missing data and those with complete data would suggest potential bias (e.g., under-estimates, or over-estimates) in relationships between physical and mental functioning and the response.

Unbalanced Data

Our outcome, which consists of 395 *denied* applicants, and 4,588 *awarded* applicants, is inarguably “unbalanced.” In logistic regression where the response variable is dichotomous, data are considered “unbalanced” when one event/group ($y = 1$, or $y = 0$) occurs much more infrequently than the other event/group. According to Agresti, modeling unbalanced data “limits the number of predictors for which effects can be estimated precisely (64).” In logistic regression, a general approach to handling unbalanced data is to have at least 10 outcomes for each predictor modeled (64). In

applying this guideline to our models (given that $(y = 1) = 395$), we therefore restricted the total number of predictors modeled to fewer than 39.

Variable Selection

To achieve the best-fitting models, we applied the following *manual backward elimination* variable selection procedure to all multivariate models: *first*, we fit an initial multivariate logistic regression model with all factors that had been retained during bivariate analysis, as well as interaction terms; *second*, any of the interactions terms which failed to attain statistical significance in the initial model were removed and the model was re-fit; *third*, we removed the factor with the highest p-value and re-fit the model; *fourth*, we continued this “remove and re-fit” procedure until all remaining factors had attained statistical significance (p-values at or below $\alpha = 0.05$); *fifth*, to assess goodness-of-fit for each model, we ran design-based Archer-Lemeshow (A-L) goodness-of-fit tests for all models; *sixth*, we selected that model with the *largest* A-L goodness-of-fit test *p-value*.

Overall Goodness-of-Fit

Once a model has been fitted, in an effort to assess the model’s adequacy, a subsequent goodness-of-fit test can be used to compare the fitted model with the observed data (64, 65). Small differences between observed and fitted values indicate model *adequacy*, while large differences indicate large residuals, and suggest *inadequacy* (65). Although a variety of procedures exist for examining goodness-of-fit in logistic regression (e.g., Pearson’s chi-square test), most are not intended for use with complex survey data (66).

Archer and Lemeshow, however, have developed a procedure for testing the overall adequacy of logistic regression models' based on complex survey data. The Archer and Lemeshow design-adjusted goodness-of-fit test, a modification of the Hosmer and Lemeshow test, "takes the sampling weights and the stratification and clustering features of the complex sample design into account when assessing the residuals...based on the fitted model (49)." P-values exceeding $\alpha = 0.05$ significance level (i.e., failure to reject the null hypothesis) suggest goodness-of-fit.

Results

Weighted Descriptive Summary Statistics

Weighted descriptive statistics are provided for the sample of veterans *denied* or *awarded* VA disability compensation (**Table 1**). All descriptive summary statistics have been weighted to reflect the population of all U.S. Veterans. Table values are, therefore, expressed as weighted mean (and weighted 95% confidence interval for the weighted mean) or weighted proportion (and weighted 95% confidence interval for the weighted proportion).

Descriptive, unadjusted results reveal compared with *awarded* applicants, those *denied* had higher mean overall self-reported health scores (3.25 vs. 3.76, $p = 0.001$), indicating poorer overall health. They also had lower mean physical functioning scores (38.6 vs. 32.8, $p < 0.001$), and a higher mean number of limitations in activities of daily living (1.27 limitations vs. 1.94 limitations, $p < 0.001$).

In terms of sociodemographic characteristics, compared with *awarded* applicants, *denied* applicants were older (57 years vs. 62 years, $p < 0.001$), more likely to be male

(93.4% vs. 97.1%, $p = 0.002$), and more likely to be minorities (17.6% vs. 22.2%, $p < 0.001$). They were also more likely to have a high school degree or less (35.6% vs. 49.2%, $p = 0.001$), and to be recipients of public assistance income (1.73% vs. 10.1%, $p < 0.001$).

In terms of correlates of social isolation, compared with *awarded* applicants, those *denied* were significantly more likely to be unmarried (24.4% vs. 37.2%, $p < 0.001$), unemployed (50.8% vs. 70.0%, $p < 0.001$), non-home owners, rather than home-owners (20.0% vs. 28.5%, $p < 0.001$), and to have no dependent children (63.8% vs. 74.0%, $p = 0.004$). They were also more likely to report little or no overall knowledge of VA health-related benefits and services (35.9% vs. 60.2%, $p < 0.001$), and to have utilized a lower mean number of VA health-related benefits and services (1.44 services vs. 1.21 services, $p < 0.001$).

Multivariate Analysis

Table 3 presents results of three separate design-based multivariate models of health. In *model 1*, logistic regression was used to model associations between VA disability compensation award status and *overall self-reported health*, adjusting for all other factors. In *model 2*, logistic regression was used to model associations between VA disability compensation award status and *physical* and *mental functioning*, adjusting for all other factors - modeling physical and mental functioning in separate models, rather than within the same model produced few, if any differences (*results not shown*). In *model 3*, logistic regression was used to model associations between VA disability compensation award status and *limitations in activities of daily living*, adjusting for all

other factors. **Figure 2** provides a diagrammatic view of factors significantly associated with VA disability compensation award status across models.

Overall, modeling uncovered a number of health factors significantly associated with VA disability compensation award status (**Table 3**): *poor overall self-reported health* (OR = 1.49, 95% CI: 1.27: 1.75), and *limitations in activities of daily living* (OR = 1.10, 95% CI: 1.01: 1.19) were associated with increased odds of denial, while *improved physical functioning* (OR = 0.96, 95% CI: 0.91: 0.98) was associated with decreased odds of denial.

Modeling uncovered a number of sociodemographic factors significantly associated with VA disability compensation award status across models (**Table 3**): *increased age* in years was associated with 1.02 (95% CI: 1.01: 1.03) times higher odds of VA disability compensation denial in models 1, 2 and 3, while *public assistance income* - one of the strongest factors - was associated with 5.67 (95% CI: 2.84: 11.3), 4.61 (95% CI: 2.34: 9.10) and 5.84 (95% CI: 3.07: 11.0) times higher odds of VA disability compensation denial in models 1, 2 and 3 respectively.

Modeling further revealed significant associations between several correlates of social isolation and VA disability compensation award status across models (**Table 3**): being *unmarried* was associated with 2.06 (95% CI: 1.53: 2.78), 2.69 (95% CI: 1.92: 3.77), and 1.97 (95% CI: 1.41: 2.74) times higher odds of VA disability compensation denial in models 1, 2 and 3 respectively. In addition, while increased *overall knowledge of VA benefits and services* was associated with 2.31 (95% CI: 1.69: 3.17), 2.34 (95% CI: 1.52: 3.59), and 2.36 (95% CI: 1.70: 3.28) times higher odds of VA disability compensation denial in models 1, 2 and 3 respectively, increased *overall utilization of VA*

benefits and services was associated with 0.81 (95% CI: 0.71: 0.92), 0.82 (95% CI: 0.72: 0.95), and 0.83 (95% CI: 0.73: 0.96) times lower odds of VA disability compensation denial in models 1, 2 and 3 respectively.

Effect Modification

We also tested for interactions between (a) *marital status* (unmarried/married) and *overall self-reported health, physical functioning, mental functioning, and limitations in activities of daily living*; (b) *employment status* (unemployed/employed) and *overall self-reported health, physical functioning, mental functioning, and limitations in activities of daily living*; and (c) *marital status* (unmarried/married) and *employment status* (unemployed/employed). None of the interactions attained statistical significance in any of the models (data not shown).

Missingness

Analysis of the potential effect of *missingness* on relationships between physical and mental functioning, and VA disability compensation award status revealed some significant sociodemographic differences, though the impact of these differences remains unclear. Thus, among the *overall sample*, compared to subjects with *complete* data, those with *missing* data were older (56.4 years vs. 59.5 years, $p < 0.001$), more likely to be male (92.6% vs. 95.8%, $p = 0.002$), and less likely to be unemployed (57.6% vs. 49.1%, $p = 0.001$), recipients of public assistance income (3.9% vs. 1.9%, $p < 0.001$), or minorities (21.6% vs. 14.3%, $p < 0.001$). Among the *subset of denied*, those with *missing* values were *similarly* older (60 years vs. 65 years, $p = 0.036$), and less likely to be minorities (27.9% vs. 13.0%, $p = 0.012$). Finally, among the *subset of awarded*, those with *missing* values were *similarly* older (55.6 years vs. 58.6 years, $p < 0.001$), more

likely to be male (91.9% vs. 95.3%, $p = 0.003$), and less likely to be unemployed (54.2% vs. 46.1%, $p < 0.001$), recipients of public assistance income (2.2% vs. 1.1%, $p = 0.041$) or minorities (20.2% vs. 14.5%, $p < 0.001$). The similar patterns of missingness among *denied* and *awarded* subsets reduces the risk of a bias in survey item completion that would meaningfully impact our conclusions.

Discussion

In this study, we compared the health and functioning of U.S. Veterans *denied* VA disability compensation to those *awarded* VA disability compensation. In the process, given widely-cited associations between low socioeconomic status, social isolation and poor health (23, 26, 28, 29, 39), we further sought to explore *denied* applicants' social circumstances. Consistent with existing work, we found that veterans *denied* VA disability compensation have comparative poor health. We also found evidence of poverty and comparative isolation. Importantly, our findings are based on comparisons with *awarded* applicants who are considered by researchers to be the least-biased comparison group (16, 22).

General Health

Overall, our data uncovered evidence of comparative poor general health among *denied* applicants. Among our sample, increasingly poorer overall self-reported health was associated with almost 1.5 times higher odds of VA disability compensation denial. Although the *SF1* measures *subjective* well-being, responses have nevertheless been found to be strongly associated with increased demand and utilization of physician services (52), as well as mortality (67). Against this background, our findings suggest that

veterans *denied* VA disability compensation may have considerable general health care needs. Future analyses of health care utilization might indicate the extent to which these needs are being met.

Physical Functioning

In terms of the physical health of our sample, reduced physical functioning and limitations in activities of daily living were all significantly associated with VA disability compensation denial. These findings are consistent with results from several cross-sectional studies (21, 22, 23), as well as findings in a recent comparative longitudinal analysis of health, in which *denied* applicants' physical functioning was poorer than those *awarded*, as well as the general population (16).

Given that "service-connection" is the sole determinant of a VA disability compensation award, what might explain a presumably non-causal association between poor physical health and VA disability compensation denial?

One likely possibility is that at least some veterans with serious physical impairments apply for VA disability compensation, even though their conditions are not in fact service-related, or alternatively, perhaps they are unable to provide sufficient evidence of service-connection. Another possibility is that some individuals may be too impaired to successfully navigate the complex and lengthy disability compensation application process (19, 68, 69, 70). Further research into VA disability compensation seeking could further our understanding of those factors - beyond a lack of service-connection - which may explain VA disability compensation denial.

Mental Functioning

Overall, while the data did reveal comparative poor physical health among *denied* compared to *awarded* applicants, the data *did not* uncover significant differences in mean mental functioning scores (42.48 vs. 44.01, $p = 0.114$). Nevertheless, given that mental composite summary scores “are standardized to the U.S. population,” both *denied* as well as *awarded* applicants were below U.S. population norms (mean = 50) (71). Poorer mental functioning among veterans *denied* VA disability compensation was not surprising since studies relevant to compensation-seeking veterans have reported that some *denied* applicants are burdened by mental impairments (16, 19, 24, 25).

Given that studies relevant to veterans have reported associations between disability compensation denial and poor mental health, what factors might explain the observed lack of difference in mental functioning among our sample of veterans *denied* or *awarded* VA disability compensation? To begin with, because some of the poorest and sickest veterans (e.g., homeless) are likely “underrepresented in the NSV,” it is possible that selection bias resulted in a sample of veterans with better-than expected mental functioning (46). Alternatively, fear of stigma, and/or the belief that mental illness denotes weakness (70) may explain why some veterans may be willing to report physical impairments, while being reluctant to report impairments that are psychiatric in nature.

Social Conditions

Overall, our results provide some evidence of low socioeconomic status. Compared to *awarded* applicants, those *denied* had almost 6 times higher odds of being public assistance income recipients. This finding is strongly suggestive of poverty, since public assistance programs such as Welfare, or Social Security Supplemental Insurance

(similar to Welfare) provide benefits only to those individuals who can demonstrate low income and limited resources. Results also provide some evidence of comparative isolation. Compared to *awarded* applicants, those *denied* were more likely to be unmarried, to have little or no overall knowledge of VA health-related benefits and services and to use fewer overall VA health-related benefits and services.

Our finding of poverty and comparative isolation among *denied* applicants is consistent with prior analyses of compensation-seeking veterans (16, 37), and begs the following question: *does poverty and isolation among compensation-seeking veterans make it more difficult to receive a VA disability compensation award?*

The literature implicates a constellation of factors in the disability compensation application process: For instance, the nature/severity of the impairment (19), low socioeconomic status (16, 29, 37), attitudes (72), and patience (23). Unfortunately, the extent to which these and other factors impact VA disability compensation award status is not well-understood. Given the VA's commitment to an equitable and transparent disability compensation process, further study is warranted.

Strengths and Limitations

To our knowledge, this is the first comparative analysis of multiple domains of health among veterans with wide-ranging physical and mental impairments who were *awarded* or *denied* VA disability compensation. Our study, however, has a number of limitations.

To begin with, the cross-sectional study design means we cannot establish temporality between response and factors (e.g. does poor health precede VA disability compensation denial, or does VA disability compensation denial precede poor health?).

Also, subjective health measures may be subject to misclassification.

Nevertheless, subjective health measures such as overall health, and physical and mental composite summary scores based on the Veterans SF-12 are widely acknowledged as valid and reliable indicators of actual health. We are, therefore, satisfied that such misclassification, if any, had minimal effect on our conclusions.

As an additional limitation, the potential exclusion of the poorest and sickest veterans due to selection bias, coupled with the small unbalanced sample, may explain why a number of factors related to social isolation did not attain statistical significance.

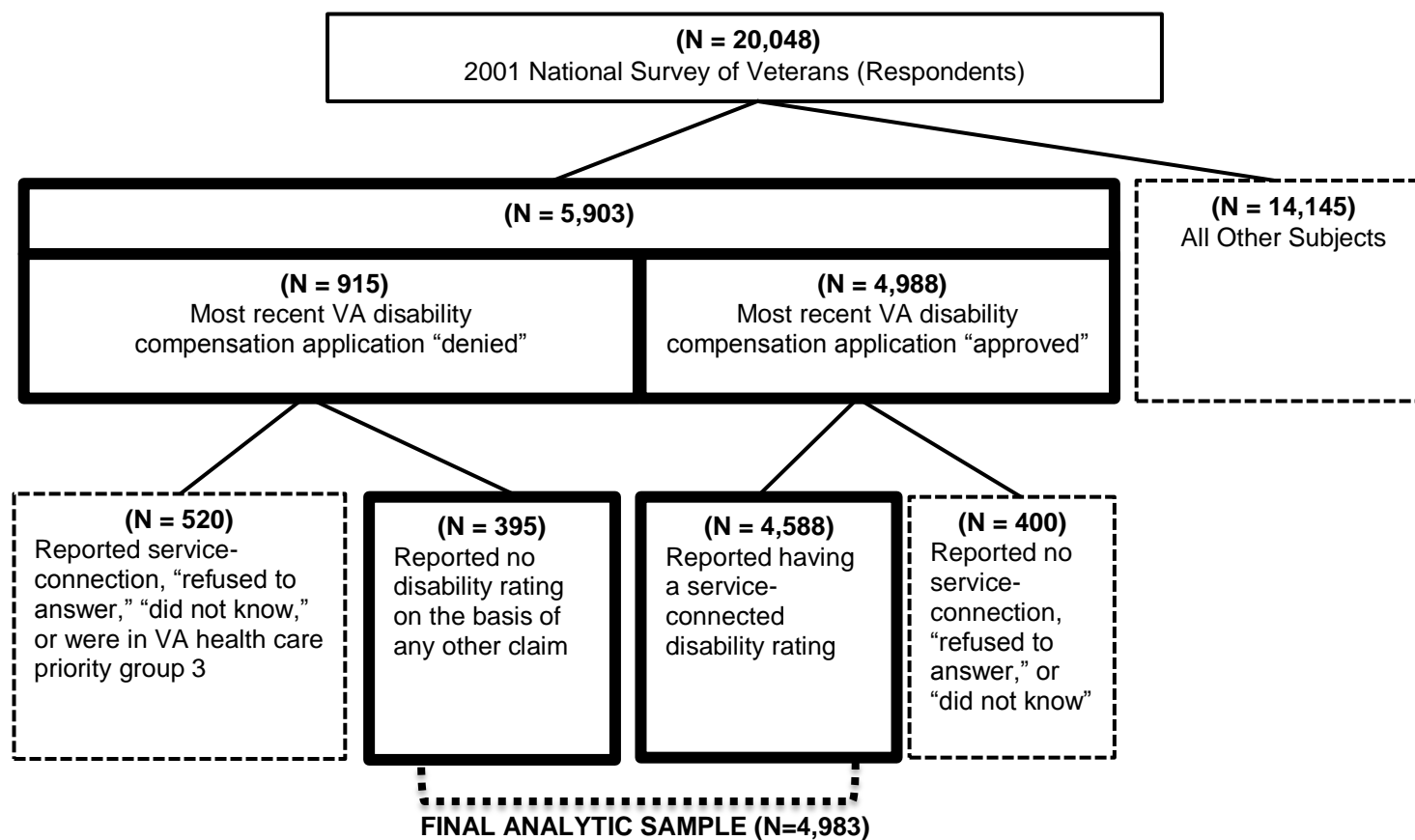
Finally, we did not have access to the specific condition(s) presented in the *denied* or *awarded* claim. We presumed that the factors we examined would have similar impact on claim award or denial status regardless of the claimed condition. This may or may not be true, although as we discussed in the introduction, criteria for awarding service connection for a condition are primarily focused on a link between a current condition and onset or exacerbation during active-duty military service and not on physical or mental functioning or social conditions. Subanalysis of different conditions might be worth exploring in a larger sample.

Conclusion

The broad picture of *denied* applicants that emerges from available data shows them, compared to *awarded* applicants to have comparative poor overall health, low income and social isolation. Such characterizations coupled with evidence of increased risks of homelessness and premature mortality support our contention that *denied* applicants are indeed a particularly vulnerable subgroup. While the VA service-connected disability compensation program may accurately compensate veterans whose

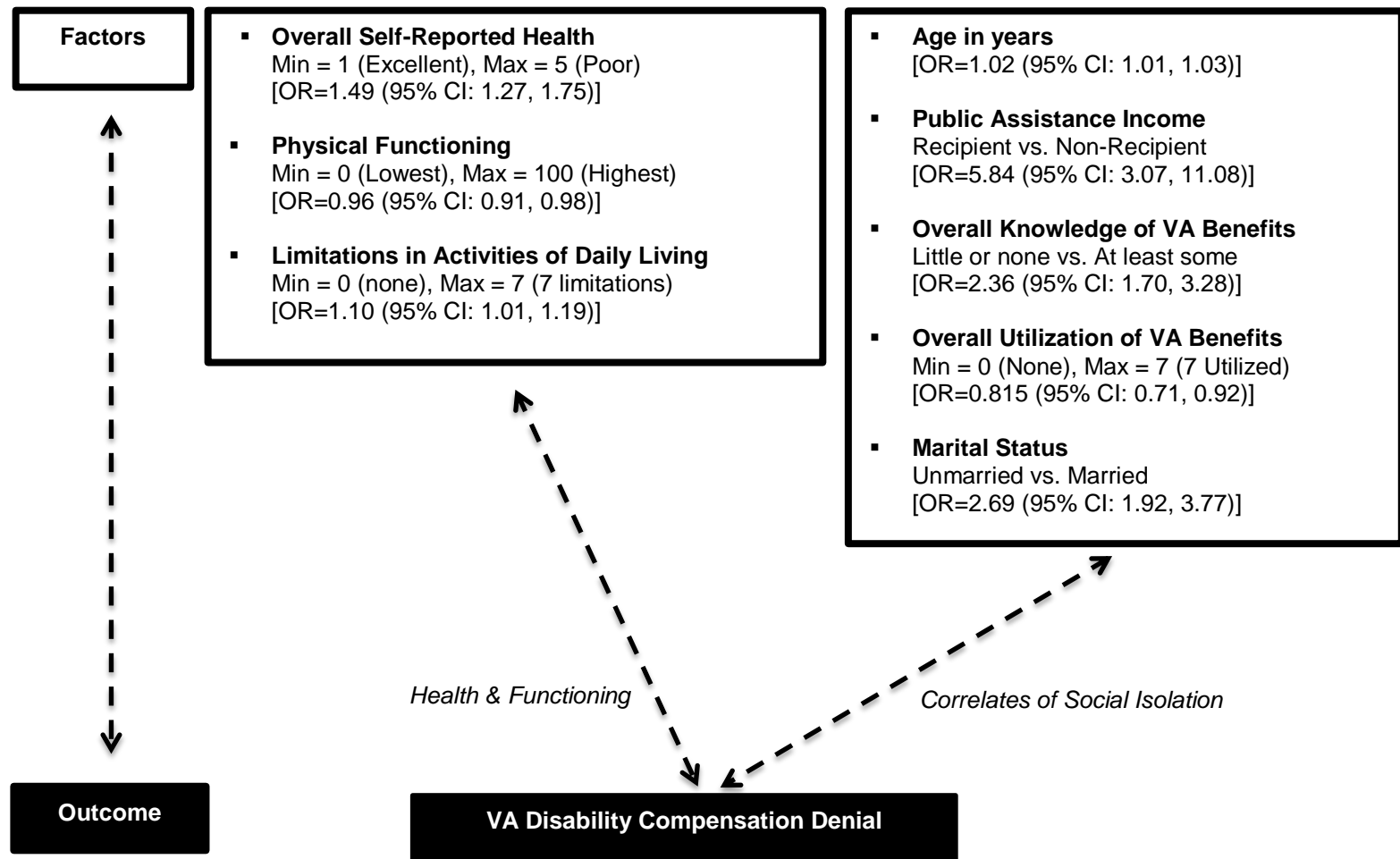
health conditions began or worsened during active-duty military service, the system may leave some extremely vulnerable veterans without necessary financial support. VA and veteran advocates may use the results of this analysis to explore other ways to assist these veterans.

Figure 1: Sample flow diagram of final analytic sample of veterans denied or awarded VA disability compensation



Notes: Boxes with dashed-lines represent "excluded" subjects
Boxes with thick continuous lines represent "included" subjects

Figure 2: Diagrammatic view of factors significantly associated with VA disability compensation denial across models



Notes: Double-sided arrows indicate that for some factors the causal association cannot be specified in this cross-sectional analysis; for the outcome, awarded applicants used as a comparison group; Odds Ratios and 95% CI's presented here represent those OR's and 95% CI's in Table 2 with the strongest associations

Table 1: Weighted descriptive summary statistics for the sample of 4,983 veterans denied or awarded VA disability compensation. Values expressed as weighted mean (and weighted 95% confidence interval for the weighted mean) or weighted proportion (and weighted 95% confidence interval for the weighted proportion)

VARIABLES	Overall (95% CI) % or mean	Denied (95% CI) % or mean	Awarded (95% CI) % or mean	*p
<u>Health Status</u>				
Overall Health (min=1, max=5)	3.33 (3.28: 3.73)	3.76 (3.62: 3.91)	3.25 (3.20: 3.29)	< 0.001
Physical Functioning (min=0, max=100)	37.6 (37.0: 38.2)	32.8 (30.8: 34.4)	38.6 (38.0: 39.3)	< 0.001
Mental Functioning (min=0, max=100)	43.7 (43.2: 44.2)	42.4 (40.7: 44.2)	44.0 (43.4: 44.6)	0.114
ADL Limitations (min=0, max=7)	1.38 (1.30: 1.46)	1.94 (1.65: 2.24)	1.27 (1.20: 1.34)	< 0.001
<u>Sociodemographics</u>				
Age (per year)	57.7 (57.1: 58.3)	61.8 (60.1: 63.5)	57.0 (56.3: 57.6)	< 0.001
Sex (%)				
Male	94.0 (93.1: 94.9)	97.1 (95.2: 99.0)	93.4 (92.4: 94.5)	0.002
Female	5.93 (5.03: 6.82)	2.80 (0.09: 0.47)	6.53 (5.47: 7.59)	0.002
Race/Ethnicity (%)				
Non-white races	18.4 (17.0: 19.7)	22.2 (17.5: 26.9)	17.6 (16.1: 19.2)	< 0.001
White race	81.5 (80.2: 82.9)	77.7 (73.0: 82.4)	82.3 (80.7: 83.8)	< 0.001
Educational Attainment (%)				
High school or less	37.8 (36.0: 39.6)	49.2 (42.1: 56.2)	35.6 (33.7: 37.6)	0.001
At least some college	62.1 (60.3: 63.9)	50.7 (43.7: 57.8)	64..3 (62.3: 66.2)	0.001
Health Insurance Status (%)				
No Insurance	11.6 (10.3: 12.9)	11.1 (7.26: 14.9)	11.8 (10.4: 13.1)	0.730
Insurance	88.3 (87.0: 89.6)	88.8 (85.0: 92.7)	88.1 (86.8: 89.5)	0.730
Public Assistance Income (%)				
Recipient	3.08 (2.31: 3.85)	10.1 (6.22: 14.0)	1.73 (1.10: 2.36)	< 0.001
Non-recipient	96.9 (96.1: 97.6)	89.8 (85.9: 93.7)	98.2 (97.6: 98.8)	< 0.001

Table 1 (continued)

VARIABLES	Overall (95% CI) Mean or %	Denied (95% CI) Mean or %	Awarded (95% CI) Mean or %	*p
<u>Active-duty Stressor</u>				
Combat/War Zone (%)				
Exposed	56.4 (54.6: 58.3)	53.0 (46.5: 59.5)	57.1 (54.9: 59.2)	0.267
Not Exposed	43.5 (41.6: 45.3)	46.9 (40.4: 53.4)	42.8 (40.7: 45.0)	0.267
<u>Social Isolation</u>				
Marital Status (%)				
Unmarried	26.5 (24.6: 28.4)	37.2 (31.2: 43.1)	24.4 (22.6: 26.3)	< 0.001
Married	73.4 (71.5: 75.3)	62.7 (56.8: 68.7)	75.5 (73.6: 77.3)	< 0.001
Employment Status (%)				
Unemployed	53.9 (52.0: 55.8)	70.0 (63.1: 76.8)	50.8 (49.0: 52.7)	< 0.001
Employed	46.0 (44.1: 47.9)	29.9 (23.1: 36.8)	49.1 (47.2: 50.9)	< 0.001
Geographic Residence (%)				
Rural	22.3 (20.8: 23.7)	25.3 (20.1: 30.5)	21.7 (20.1: 23.2)	0.207
Urban	77.6 (76.2: 79.1)	74.6 (69.4: 79.8)	78.2 (76.7: 79.8)	0.207
Living Arrangements (%)				
Non-home owner	21.3 (19.9: 22.7)	28.5 (21.8: 35.2)	20.0 (18.5: 21.5)	< 0.001
Home owner	78.6 (77.2: 80.0)	71.4 (64.7: 78.1)	79.9 (78.4: 81.4)	< 0.001
Number of Dependent Children (%)				
None	65.4 (63.7: 67.2)	74.0 (67.6: 80.5)	63.8 (62.0: 65.6)	0.004
At least 1 dependent child	34.5 (32.7: 36.2)	25.9 (19.4: 32.3)	36.1 (34.3: 37.9)	0.004
Overall Knowledge of VA Benefits (%)				
Little or no overall knowledge	39.8 (38.0: 41.6)	60.2 (54.4: 65.9)	35.9 (34.2: 37.6)	< 0.001
At least some overall knowledge	60.1 (58.3: 61.9)	39.7 (34.0: 45.5)	64.0 (62.3: 65.7)	< 0.001
Overall Utilization of VA Benefits (min=0, max=7)	1.40 (1.35: 1.44)	1.21 (1.08: 1.34)	1.44 (1.39: 1.48)	< 0.001

Notes: *p = statistical significance of difference between denied applicants and awarded applicants
 Weighting based on National Survey of Veterans 2001

Table 2: Design-based bivariate analysis of initial candidate factors and response, VA disability compensation award status. Values expressed as weighted odds ratio (and weighted 95% confidence interval for the weighted odds ratio), and weighted p-value

VARIABLES	OR (95% CI)	p
<u>Health Status</u>		
Overall Health (min=1, max=5)	1.54 (1.34: 1.78)	< 0.001
Physical Functioning (min=0, max=100)	0.96 (0.94: 0.97)	< 0.001
Mental Functioning (min=0, max=100)	0.99 (0.97: 1.00)	0.112
ADL Limitations (min=0, max=7)	1.18 (1.11: 1.26)	< 0.001
<u>Sociodemographics</u>		
Age (per year)	1.02 (1.01: 1.03)	< 0.001
Sex (Male)	2.39 (1.08: 5.26)	0.031
Race/Ethnicity (Minority)	1.33 (0.97: 1.82)	0.072
Educational Attainment (High school or less)	1.78 (1.30: 2.44)	< 0.001
Health Insurance Status (Uninsured)	0.92 (0.60: 1.40)	0.699
Public Assistance Income (Recipient)	6.36 (3.42: 11.8)	< 0.001
<u>Active-Duty Stressor</u>		
Combat/War Zone (Exposed)	0.82 (0.61: 1.11)	0.204
<u>Social Isolation</u>		
Marital Status (Unmarried)	1.82 (1.39: 2.39)	< 0.001
Employment Status (Unemployed)	2.25 (1.60: 3.17)	< 0.001
Geographic Residence (Rural)	1.20 (0.89: 1.63)	0.216
Living Arrangements (Non-home owner)	1.59 (1.10: 2.29)	0.013
Number of Dependent Children (No dependent children)	1.59 (1.12: 2.26)	0.010
Overall Knowledge of VA benefits (Little or no overall knowledge)	2.71 (2.08: 3.53)	< 0.001
Overall Utilization of VA benefits (min=0, max=7)	0.85 (0.77: 0.94)	0.003

Notes: Reference for categorical factors are: sex (female), race (caucasian), educational attainment (at least some college), health insurance status (insured), public assistance income (non-recipient), combat/war zone exposure (no combat exposure), marital status (married), employment status (employed), geographic residence (urban), living arrangements (home-owner), number of dependent children (at least 1 dependent child), overall knowledge of VA benefits (at least some overall knowledge)

Table 3: Design-based multivariate logistic regression: Health among veterans denied or awarded VA disability compensation

	Model 1 Main Factor: Overall Health	Model 2 Main Factor: Physical Functioning	Model 3 Main Factor: Limitations in Activities of Daily Living
Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)
<u>Health Status</u>			
Overall self-reported Health (min=0, max=5)	1.49 (1.27: 1.75)	--	--
Physical Functioning (min=0, max=100)	--	0.96 (0.95: 0.98)	--
ADL Limitations (min=0, max=7)	--	--	1.10 (1.01: 1.19)
<u>Sociodemographics</u>			
Age (per year)	1.02 (1.01: 1.03)	1.02 (1.01: 1.03)	1.02 (1.01: 1.03)
Sex (Male)	N/S	N/S	3.25 (1.13: 9.37)
Race/Ethnicity (Minority)	N/S	1.80 (1.11: 2.91)	1.54 (1.04: 2.28)
Educational Attainment (High School or less)	N/S	N/S	N/S
Public Assistance Income (Recipient)	5.67 (2.84: 11.3)	4.61 (2.34: 9.10)	5.84 (3.07: 11.08)
<u>Active-Duty Stressor</u>			
Combat/War Zone Exposure (Combat Exposure)	N/S	N/S	0.68 (0.48: 0.98)
<u>Social Isolation</u>			
Marital Status (Unmarried)	2.06 (1.53: 2.78)	2.69 (1.92: 3.77)	1.97 (1.41: 2.74)
Employment Status (Unemployed)	N/S	N/S	N/S
Geographic Residence (Rural)	N/S	N/S	1.42 (1.04: 1.95)
Living Arrangements (Non-home owner)	N/S	N/S	N/S
Number of Dependent Children (No dependent children)	N/S	N/S	N/S
Overall Knowledge of VA Benefits (Little or no overall Knowledge)	2.31 (1.69: 3.17)	2.34 (1.52: 3.59)	2.36 (1.70: 3.28)
Overall Utilization of VA Benefits (min=0, max=7)	0.81 (0.717: 0.92)	0.82 (0.72: 0.95)	0.83 (0.73: 0.96)

Notes: Table presents best fitting models based on Archer-Lemeshow design-based goodness-of-fit test; Columns weighted to reflect the population of all U.S. Veterans. N/S – variable not significant in best fitting model

Reference for categorical factors are: sex (female), race (caucasian), educational attainment (at least some college), health insurance status (insured), public assistance income (non-recipient), combat/war zone exposure (no combat exposure), marital status (married), employment status (employed), geographic residence (urban), living arrangements (home-owner), number of dependent children (at least 1 dependent child), overall knowledge of VA benefits (at least some overall knowledge)

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Cross-Sectional Study of VA and Non-VA Outpatient Health Care Service Use Intensity Among U.S. Veterans Denied VA Disability Compensation

Abstract

Background: Poorer health is associated with greater health care use among the general population. In contrast, while veterans *denied* VA disability compensation may have poor health, studies nevertheless suggest that they may utilize less health care. In examining VA and non-VA outpatient health care utilization among veterans *denied* VA disability compensation (“denied applicants”), we used veterans *awarded* VA disability compensation (“awarded applicants”) as the comparison group.

Methods: We analyzed data from the 2001 National Survey of Veterans (NSV 2001). We modeled two separate responses - VA and non-VA outpatient health care visit counts during the previous 12 months - in veterans *denied* VA disability compensation versus those *awarded*, adjusting for overall self-reported health, sociodemographics and correlates of social isolation. Zero-inflated negative binomial regression was used to model VA outpatient visit counts, while zero-inflated poisson regression and negative binomial regression were used for separate modeling of non-VA outpatient visit counts.

Results: Compared with *awarded* applicants, those *denied* had significantly higher odds of never using VA outpatient health care services during the previous 12 months.

Additionally, while not attaining statistical significance, *denied* applicants may be more likely than *awarded* applicants to use non-VA outpatient health care services.

Conclusion: If veterans *denied* VA disability compensation are in fact forgoing VA health care services in favor of non-VA health care services, then unrecognized barriers to VA health care may exist. Further research into these potential barriers could be valuable.

Introduction

The U.S. Department of Veterans Affairs (VA) is the largest single provider of health care in the United States and administers the nation's second largest federal disability program (1). Within the VA, the Veterans Benefits Administration (VBA) manages disability compensation totaling more than \$50 billion annually through Regional Offices (2), while the Veterans Health Administration (VHA) provides medical care to veterans through a regionalized network of hospitals, clinics and community veterans centers (3). In FY 2013, the VA provided health care services to more than 5.7 million veterans at a total annual cost of \$44.8 billion (4).

VA disability compensation is intended to compensate losses in earnings resulting from service-connected diseases and injuries "and their residual conditions in civil occupations (5)." "Service-connected" means conditions that occurred during active-duty military service or those that were aggravated by it (6).

VA service-connected disability compensation paid to veterans is based on severity of medically-evaluated disability as well as number of dependents. A combined disability rating expresses service-related disability severity on a graduated scale from 10 percent (least disabling and least compensated) to 100 percent (most disabling and most compensated) in increments of 10 percent. Although a veteran may receive a zero percent

disability rating, which entitles him/her to health care benefits for the noted condition, only combined ratings of 10 percent or more qualifies him/her for compensation (7, 8).

A veteran may seek a disability rating for more than one impairment (e.g., posttraumatic stress disorder and diabetes). In 2011, veterans who served in Iraq and/or Afghanistan claimed an average of 8.5 independent medical conditions (9). The combined disability rating is based on the disability rating for each individual condition. If service-connection is awarded for just one condition, then the combined disability rating is equal to the rating for that condition. If, on the other hand, service-connection is awarded for more than one condition, rather than summing the individual ratings, the combined disability rating is instead based on the combined ratings table as prescribed in 38 CFR §4.25 (10).

Access to VA Disability Compensation

A veteran seeking disability compensation benefits from the VA must first file an application. In evaluating the claim, a specialty review team gathers medical and military service-related evidence. In the process, the VA confirms the existence of the disability, and subsequently determines whether the existing disability is service-connected. If so, the VA assigns a combined disability rating and establishes a date of award with payment based on the rating (11).

Veterans with disability ratings of at least 10 percent will receive both cash compensation as well as VA health care: higher disability ratings result in both, larger monthly compensation payments, as well as reduced financial contribution for health care services. Veterans denied service-connection, on the other hand, receive no cash

compensation while their access to health care is based on financial resources (i.e., means-tested).

Access to VA Health Care

Access to veterans health care services begins with a VHA enrollment application, that is separate from the application for disability compensation. The VHA may also require some veterans to complete a financial assessment - “means test” - to establish eligibility for health care and to determine the individual's contribution to the costs or that of his/her private insurance company. Those veterans who, based on their gross household income, do not qualify for free care are responsible for copays (12). Based on regulations, enrollees are assigned to one of eight health care priority groups, with the most access given to those in *priority group 1* and the least access extended to those in *priority group 8* (13).

The rules governing VA health care priority group assignment are set forth in 38 CFR §17.36. Based on these regulations, veterans with the least severe, *non-compensable* service-connected disabilities (zero percent ratings) may be placed in either *priority group 5* or *6*, subject to an income threshold for eligibility. Among veterans with *compensable* service-connected disabilities, those with the least severe disabilities (i.e., 10 percent and 20 percent ratings) are placed in *priority group 3*. Veterans with moderately severe disabilities (i.e., 30 percent and 40 percent ratings) are placed in *priority group 2*; whereas those with the most severe disabilities (ratings of 50 percent or more) are placed in *priority group 1*. The remaining *priority groups 4, 7* and *8* represent special categories that are separate from those defined solely by disability rating or income (12, 13, 14).

VA Disability Compensation Award Status

The Social Security Administration (SSA) and the VA both administer large federal disability compensation programs. As of 2010, SSA and the VA combined served approximately 12 million disability compensation recipients (15). However, while much is known about the qualities of individuals who apply for Social Security, much less is known about veterans who seek VA disability compensation (16).

The extant literature suggests that the cohort of veteran compensation-seekers comprise heterogeneous subgroups which can be defined by their *award status* (e.g., denied applicant, awarded applicant) within the Department of Veteran Affairs disability compensation system (17, 18). These groups are differentiated by *unique* health, health care utilization, socioeconomic, and psychosocial characteristics (17, 18). In considering *award status*, however, knowing what happens to veterans *denied* VA disability compensation may be more important than knowing what happens to those whose compensation claims have been *awarded* “because the former leave the disability claims process with far fewer resources and a much thinner safety net (18).”

In view of the VA’s commitment to targeting subgroups of veterans with the most need (19), and given emerging evidence suggesting that veterans *denied* VA disability compensation may have increased risks of poverty, homelessness and poor long-term health (18), a greater focus on the well-being of this particularly vulnerable subgroup seems timely and justified.

Denied Applicants’ Health

The limited number of studies of health among *denied* applicants suggest that at least some of these applicants are burdened by severe health limitations. An early study

of veterans conducted in 1983 found high levels of psychiatric impairment, regardless of whether they were receiving full, partial, or no VA disability compensation (20). This finding was underscored by results from an analysis of Social Security disability compensation which led the author to speculate that some individuals suffering from schizophrenia or anxiety disorder may, in fact, be denied disability compensation benefits because their psychiatric impairments are so severe that they are “not able to give a sufficiently coherent history [or] provide the necessary documentation for eligibility for disability (21).” A similar contention was expressed in a subsequent study of federal disability compensation and health (22).

In 1989, an analysis of Social Security disability compensation by the U.S. Government Accountability Office (GAO) found, similarly, that *awarded* applicants and *denied* applicants who were unemployed had comparably poor overall health (23). Consistent with the GAO, a comparison of Social Security disability recipients with *denied* subjects revealed that a majority of those *denied* reported work-related health limitations (24).

Rosenheck et al., in their analysis of “functional health” and “quality of life” among homeless mentally ill veterans seeking Social Security disability benefits, found that *awarded* and *denied* applicants were comparably impaired (25). A similar finding was reached in a subsequent study of veterans seeking VA disability compensation for post-traumatic stress disorder (26).

Finally, a longitudinal study of veterans seeking VA disability compensation for post-traumatic stress disorder found that both *awarded* and *denied* applicants were clinically impaired (27), while an analysis of health among a nationally-representative

sample of VA disability compensation-seeking veterans with post-traumatic stress disorder similarly found that ten years after applying for disability benefits, both *awarded* and *denied* applicants continued to experience clinically relevant PTSD symptoms, as well as poor physical functioning (18).

Denied Applicants' Health Care Utilization

Poorer health is associated with increased health care consumption in studies of the general population (28). In contrast, while veterans *denied* VA disability compensation are burdened by poor health, studies nevertheless suggest that these individuals *may* consume less VA health care than comparably impaired *awarded* applicants (17).

Two prospective cohort studies conducted in 2004, and in 2005, analyzed pre-claim and post-claim VA health care utilization patterns among veterans with post-traumatic stress disorder who had applied for VA disability compensation. In both studies, post-claim mental health care service use increased only among the *awarded* (17).

A subsequent analysis of VA disability compensation award status and VA health care service utilization among a sample of veterans with post-traumatic stress disorder produced a similar finding: compared with *denied* applicants, *awarded* used more pre-claim and post-claim *mental* health care services (29).

Laffaye et al. reviewed seven studies of VA health care utilization among veterans seeking VA disability compensation for post-traumatic stress disorder. Overall, the study found that *awarded* applicants generally utilized more medical and mental health care services than *denied* applicants (17).

A subsequent prospective study of post-claim VA mental health care service utilization among a sample of veterans seeking VA disability compensation for post-traumatic stress disorder similarly revealed an increase in post-claim VA mental health care service use *only* among *awarded* applicants (30).

Overall, if *denied* applicants do in fact have comparative poor health and lower VA health care service utilization, then given widely-cited associations between low socioeconomic status, social isolation, health and health resource use (31, 32, 33), a critically important question becomes: *are veterans denied VA disability compensation poor and socially isolated?*

Denied Applicants' Sociodemographics

It is widely acknowledged that the adverse health effects of social isolation are often felt more acutely by individuals with low socioeconomic status (31, 34, 35, 36). Widely-cited socioeconomic measures have included male gender (37), minority status (36, 38, 39), unemployment (40), low income and high debt levels (32, 33, 39), limited educational attainment (33), and lack of health insurance (41).

Studies of compensation-seeking veterans suggest that *denied* applicants tend to have low socioeconomic status (e.g., low income, unemployment) (18, 42, 43). One such study, conducted in 2005 found that compared to veterans *awarded* VA disability compensation for post-traumatic stress disorder, those *denied* had a significantly higher probability of reporting low income (26.0% vs. 62.0%, $p < 0.0001$) (42).

A concurrent, separate analysis of VA disability compensation and post-traumatic stress disorder reached a similar conclusion (26). As an extension of prior findings, a more recent examination of VA disability compensation among veterans filing claims for

post-traumatic stress disorder revealed that compared to *awarded* applicants, those *denied* were significantly more likely to be impoverished (15.2% vs. 44.8%, $p < 0.001$), and homeless (12.0% vs. 20.0%, $p = 0.02$). This study further reported comparably low rates of labor force participation (13.2% vs. 19.0%, $p = 0.11$) among both *awarded* as well as *denied* applicants (18).

Denied Applicants' Social Isolation

Social isolation, broadly defined as “disengagement from social ties, institutional connections, or community participation,” is an important determinant of health (44). Studies of the general population have consistently found that individuals with few close personal relationships and limited social support tend to have poorer health outcomes, and higher mortality risk (31, 32, 33); and some studies have reported greater health-related resource use (34, 37, 38). Socially isolated individuals are also more likely to be disabled (38), to suffer anxiety and depression (37, 45, 46), and to have lower socioeconomic status (31, 34, 35, 36).

Prior studies of social structure have cited an array of factors which when considered together, may be useful in characterizing one's social circumstances. In addition to small social networks and infrequent contacts (37, 46), other oft-cited factors have included rural residence and inadequate transportation (32, 33), not owning a home (32, 33), few family members or close friends (33, 35), limitations in mobility (33, 38), limited access to health-related information and feedback (41), and being unmarried (33, 37, 38, 39, 40, 44).

Among the few studies of post-deployment social structure, results suggest that veterans experience social isolation (40, 47); and this isolation, which may begin

immediately upon returning from military service, can be “systematic (47).” These studies also indicate that social isolation can influence health through multiple pathways: For instance, homelessness (48), lower levels of encouragement, support and health-related feedback (49), poverty (18, 50), and poor social functioning (18, 42).

The Present Study

Unfortunately, extant work is sparse and among those few studies relevant to veterans which have examined health care utilization among disability compensation-seeking subjects, many have focused exclusively on post-traumatic stress disorder (6, 7, 18, 26, 27, 50), or compared outcomes across inherently different, and therefore, potentially inappropriate comparison groups (20, 28, 51, 52): As one example, comparative analyses of *awarded* with *not-awarded* may be inappropriate because subjects who apply for disability compensation tend to be much sicker than those who never apply (18). Other studies have only examined VA health care utilization, neglecting “dual-use” (e.g., VA health care and Medicare) (16, 17, 27, 29), while only a limited number have analyzed data from the 2001 National Survey of Veterans, though it “represents an optimal sample for testing models of medical and mental healthcare use (53).” Finally, few, if any studies have analyzed the potential influence of social isolation correlates on VA and non-VA health care utilization among veterans *denied* or *awarded* VA disability compensation.

The present study addresses these limitations. Using cross-sectional VA and non-VA outpatient health care visit count data from the 2001 National Survey of Veterans, we examine relationships between VA and non-VA outpatient health care *service use intensity* - “a more dynamic indicator of disease burden than simply examining whether

services were used (53)” - and VA disability compensation award status (denied vs. awarded) among veterans with physical and mental impairments. We also model correlates of social isolation. Additionally, because being unmarried - a strong correlate of social isolation - is associated with poorer health and reduced health and social services consumption (33, 37, 54), we explore the role of *marital status* as a potential effect modifier of *overall health*, *overall knowledge of VA benefits and services* and *overall VA benefits and services utilization*.

Hypotheses

In terms of VA health care utilization, prior studies suggest that compared to *awarded* applicants, *denied* applicants are sicker, and use fewer VA health-related services. Consistent with these findings, we therefore hypothesized that *denied* applicants in our sample would use fewer VA outpatient health care services compared to *awarded* applicants.

If *denied* applicants are in fact sicker, and yet use less VA health care, do they instead use alternative, non-VA sources (e.g., private physician, local clinic) of health care to satisfy any unmet health care needs? Given that veterans *denied* VA disability compensation tend to be poor and socially isolated, and poverty and social isolation are often associated with reduced health-related service use, we hypothesized that they would likely use fewer, rather than more, non-VA outpatient health care services compared to *awarded* applicants. Consequently, if *denied* applicants use less VA and non-VA health care, then it is conceivable that they may be *under-served* in the provision of critically-needed health care services.

Methods

Data Set

The 2001 National Survey of Veterans (NSV) consists of 20,048 veteran-respondents, and was fifth in a series of comprehensive nationwide surveys intended to assist the VA in program planning. In addition to a wide array of questions regarding sociodemographics, prior military service, health and health care utilization, the NSV also asked veterans about the status of their most-recent VA disability compensation application.

The survey employed a dual frame sample design, consisting of a Random Digit Dialing (RDD) sample and a List (List) sample: the sampling frame for the List sample was constructed from the VHA enrollment frame and the VBA Compensation and Pension frame. Survey data were weighted based on the probability of selection, non-response and household size, making responses generalizable to the larger non-institutionalized U.S. Veteran population. The survey's response rate of 76.4% for the RDD sample, and 62.8% for the List sample "is an excellent response rate for epidemiological telephone-based surveys (28)." The final sample was demographically representative of the known veteran population collected in the 2000 U.S. Census.

Sample Selection

Using the 2001 NSV, we applied the specific inclusion and exclusion criteria described below to create a *final analytic sample* of 4,983 veterans denied or awarded VA disability compensation. A sample selection flow diagram is presented in **Figure 1**.

Among 20,048 veteran-respondents, we began by initially selecting a sample of 5,903 (29.4%) veterans whose *most recent* VA disability compensation application had been “denied” (915) or “approved” (4,988).

Among 915 subjects whose most recent VA disability compensation application had been “denied,” 520 (56.8%) of these subjects were excluded from the final analytic sample for the following reasons: 513 subjects reported having a previously approved service-connected disability rating, “refused to answer” or “did not know,” while 7 subjects were listed as having been assigned to VA health care priority group 3 (*veterans denied VA disability compensation cannot be assigned to VA health care priority group 3*). The remaining 395 (43.1%) subjects did not have a service-connected disability rating. These subjects were included in the final analytic sample and were designated as “denied applicants.”

In this study, we were interested in *denied* applicants who had not received VA disability compensation. There is no statute of limitations on the filing of VA disability compensation claims (55): thus, a veteran can file a new claim for a potentially service-related condition at any time, even if he/she already has a disability rating based on some prior claim. To minimize the influence of previous VA disability and create a more homogeneous sample of *denied* applicants, we selected those *denied* whose most recent claim was rejected and who also did *not* have a disability rating on the basis of some other claim.

Among 4,988 subjects whose most recent VA disability compensation application had been “approved,” 400 (2.0%) of these subjects reported not having a service-connected disability rating, “refused to answer” or “did not know” and were excluded

from the final analytic sample. The remaining 4,588 (91.9%) subjects reported having a service-connected disability rating. These subjects were included in the final analytic sample, and were designated as “awarded applicants.”

Analytical Approach

When modeling several categorical variables, there is no need to differentiate variables as *dependent* or *independent* or to assume causality (56); for this reason, we herein refer to our outcome(s) as the *response*, and all other variables as *factors*.

Factor Variables

Factor variables included in an initial exploratory bivariate analysis (*subsequently described*) conducted prior to multivariate modeling were VA disability compensation award status, overall self-reported health, age, sex, race/ethnicity, educational attainment, receipt of public assistance income, health insurance status, combat/war zone exposure, marital status, employment status, geographic residence, living arrangements, number of dependent children, overall knowledge of VA health-related benefits and services, and overall utilization of VA health-related benefits and services.

Main Factor of Interest: VA Disability Compensation Award Status

VA disability compensation award status was a dichotomous variable consisting of those veterans whose most recent VA disability compensation application had been denied and who *had not* been awarded a service-connected disability rating on the basis of a previous claim (“denied applicants”), and a comparison group of veterans whose most recent VA disability compensation application had been approved and who *had* been awarded a service-connected disability rating (“awarded applicants”).

Overall self-reported Health

Global health perceptions are sensitive predictors of morbidity and mortality (57, 58, 59, 60), and have been found to be associated with disability and distress, number of annual physician visits, and socioeconomic status (57, 61), as well as chronic illness (62). In the 2001 NSV, veterans were asked to rate their “general health” on a scale of 1 to 5, with 1 representing excellent health and 5 representing poor health (*this widely applied measure of general health is referred to as the SFI*). Consistent with prior work, overall self-reported health was treated as an ordinal variable (63).

Combat Exposure

Because published studies of veterans report an association between experience in a combat zone and poorer health (40, 47), a dichotomous “yes/no” variable representing combat or war zone exposure was included in an initial bivariate analysis.

Sociodemographics

Because the adverse health effects of social isolation are often felt more acutely by individuals with low socioeconomic status (31, 34, 35, 36), older age (46), male gender (37), minority race (36, 38, 39), receipt of public assistance income, limited educational attainment and lack of health insurance were all operationalized as dichotomous factors and included in our initial bivariate analysis (37, 39, 40).

Social Isolation

Because social isolation is an important determinant of health and health-related resource use (31, 32, 33, 44), being unmarried and unemployed (37, 39, 40), living in a rural area (33, 38, 47), not owning a home (e.g., renting or dwelling) (33, 38, 40, 46), and

having no dependent children (64) were all operationalized as dichotomous factors and included in an initial bivariate analysis.

In addition, because individuals who are socially isolated, in contrast to those who are socially supported are more likely to have limited sources of health-related information (32), a six-level variable asking veterans to characterize their overall knowledge of VA health-related benefits and services was transformed into a dichotomous factor and coded as “Little or no overall knowledge/At least some overall knowledge.” This variable was included in the initial bivariate analysis.

Finally, because lack of participation in VA provided services may be an indicator of social isolation (33, 34), responses to questions regarding use of a wide array of VA health-related benefits and services were transformed into the single count variable described below.

We constructed a count variable to capture past use of an array of VA health-related benefits and services (54). This was done by starting with dichotomous “yes/no” variables reflecting veterans’ *use* in the previous twelve-months or *ever use* of the following seven types of benefits: *VA Life Insurance*, *VA Education or Training*, *VA Hospital*, *VA Pharmacy*, *VA Psychological Counseling*, or *Substance Abuse Treatment*, *VA in-home Healthcare*, and *VA Prosthetics*.

These seven binary variables were summed for each subject with resulting scores ranging from 0 (“no services used”) to 7 (“all services used”). Mean overall VA health-related benefits and services utilization scores were then derived for *denied* applicants and compared with those of *awarded* applicants. The following VA health-related benefits and services, however, were excluded from this count variable: (a) VA

Emergency room use previous 12 months (64.78% missing), and *VA Mortgage ever use* (41.82% missing) were both excluded due to excessive missing values; *VA outpatient health care use previous 12 months* was excluded because it is one of two response variables; (b) *VA Burial Services use* was excluded because it measures potential future use, rather than past use; and (c) *VA Vocational Rehabilitation use* was excluded because only veterans *awarded* VA disability compensation qualify for this benefit.

Response Variables

Two separate response variables were used in our analysis. The first response variable was *VA outpatient health care visit counts during the previous 12 months* and the second response variable was *non-VA outpatient health care visit counts during the previous 12 months*.

In terms of the first response variable, analysis of the number of VA outpatient health care visit counts among our sample revealed that beyond 50 outpatient visits, count frequencies became too sparse to model. To overcome this problem, we truncated this count variable in the following manner: VA outpatient health care visit counts of 50 or more were combined into a single “50 or more VA outpatient visits” category. In terms of the second response variable, count frequencies beyond 50 outpatient visits did not become too sparse to model, and therefore, we did not truncate.

Analysis

This study, based on publicly-available, de-identified data, was approved by the Rutgers University Institutional Review Board. All design-based analyses included the survey’s sampling weights, were two-tailed, conducted with $\alpha = 0.05$ significance level, and performed with Stata version 13.1 (Stata Corp: College Station, Texas).

Modeling Health Care Visit Counts

Health care service utilization count data is often non-normal, “overdispersed” (meaning greater variability in the data than expected), and characterized by “excess zero visit counts” (65, 66). Zero-inflated Negative Binomial Regression (ZINB) is a statistical technique specifically designed for modeling this type of data, and outperforms other methods (53). *ZINB*, a maximum-likelihood regression method, models health care visit counts for two separate groups: a negative binomial regression component predicts visit counts for a “never-zero” group, representing subjects with at least one health care visit (e.g., veterans who use the VHA), while a logistic zero inflation component predicts visit counts for an “always-zero” group, representing subjects with no health care visits (e.g., veterans who never use the VHA).

Similar, albeit more *limited* methods exist for modeling health care visit counts: among them, Zero-inflated Poisson Regression (ZIP) and Negative Binomial Regression (NBR). *ZIP* is similar to *ZINB* in that it models health care visit counts for two separate groups: a Poisson count model component predicts visit counts for a “never-zero” group, while a logit model component predicts excess zero visit counts for an “always zero” group. However, *ZIP* is more limited than *ZINB* in that it does not account for overdispersion. *NBR*, on the other hand, is similar to *ZINB* in that it models overdispersed health care visit counts. However, *NBR* does not model excess zero visit counts, and is therefore, more limited than *ZINB*.

Fitting *ZINB* to complex survey visit count data, however, can be difficult, particularly for smaller samples; and “what constitutes a small sample does not seem to be clearly defined in the literature (67).” Even where non-normal count data is

overdispersed and characterized by excess zeros, insufficient contrasts resulting from sparse visit counts can preclude *jackknife repeated replication* - a method for estimating sampling variability that accounts for the properties of a complex survey design - and therefore, modeling; and such difficulties are exacerbated by lack of either, a formal diagnostic procedure or a commonly-applied solution. For these reasons, while we were able to use *ZINB* to model VA outpatient health care visit counts, we were not able to use it to model non-VA outpatient health care visit counts.

Consequently, we used *ZINB* to model VA outpatient health care visit counts, and *NBR* and *ZIP* separately to model non-VA outpatient health care visit counts. In respect to the latter, however, “there is currently no statistical test to aid in choosing between the standard negative binomial regression model and the zero-inflated alternative (56).” West et al., suggest that in drawing inferences, a researcher should consider the following: *do the one-part and two-part models “lead to nearly identical conclusions?”* and *does the two-part model add additional “scientific insights?” into relationships between factors and the response* (56).

Univariate Analysis

We analyzed summary statistics (**Table 1**) as well as zero and non-zero visit count distributions separately for VA and non-VA health care data. This analysis confirmed that both were characterized by *overdispersion* [$\mu = 4.36$ visits, $\sigma^2 = 75.94$; $\mu = 5.65$ visits, $\sigma^2 = 117.83$], and *excess zeros* [2,007 (46.6%) zeros; 1,048 (24.4%) zeros].

Bivariate Analysis

Bivariate analysis (**Tables 2, 3**) was conducted to explore initial associations between response variables and each individual candidate factor, taking survey sampling

weights and design into account. A p-value criterion of $\alpha = 0.25$ was applied, excluding any variable from initial multivariate modeling that exceeded this criterion.

Bivariate analysis of VA outpatient health care visit counts using *ZINB* resulted in the following: *VA disability compensation award status*, *race/ethnicity*, *education*, *combat/war zone exposure*, and *number of dependent children* were excluded from the “never-zero” model, while *sex*, *receipt of public assistance income*, and *combat/war zone exposure* were excluded from the “always-zero” model.

Separate bivariate analysis of non-VA outpatient health care visit counts using *ZIP* resulted in the following: *VA disability compensation award status*, *age*, *race/ethnicity*, *health insurance status*, *combat/war zone exposure*, *marital status*, *number of dependent children*, and *overall utilization of VA benefits and services* were excluded from the “never-zero” model, while *age*, and *sex* were excluded from the “always-zero” model.

Discharge Status

Because veterans who have been dishonorably discharged are not eligible for VA benefits and services (38 C.F.R §3.12), we examined discharge status (dishonorable vs. honorable) among *denied* applicants. Given that only 3 (0.62%) veterans *denied* VA disability compensation had been dishonorably discharged, we concluded that discharge status likely had minimal effect on VA and non-VA outpatient health care visit counts among *denied* applicants.

Multivariate Analysis

We used *ZINB* to jointly model associations between VA outpatient health care visit counts and VA disability compensation award status, adjusting for all other factors. Stata's algorithms, which automatically check for multicollinearity, detected none.

We used *ZIP* to jointly model associations between non-VA outpatient health care visit counts and VA disability compensation award status, adjusting for all other factors. In addition, *NBR* was used to *separately* model associations between non-VA outpatient health care visit counts and VA disability compensation award status, adjusting for all other factors. Stata's algorithms, which automatically check for multicollinearity, detected none here as well.

Missing Data

In modeling VA and non-VA outpatient health care visit counts, missing variable responses were deleted through an automated process of listwise exclusion. Although listwise deletion can result in larger standard errors, these estimated standard errors, are nevertheless, "usually accurate estimates of the true standard errors (68)."

In multivariate modeling of VA disability compensation award status and VA outpatient health care visit counts, missing data resulted in the listwise exclusion of 1,186 (23.8%) observations. In separate multivariate modeling of VA disability compensation award status and non-VA outpatient health care visit counts, missing data resulted in listwise exclusion of between 981 (19.6%) and 1,225 (24.5%) observations.

Given substantial numbers of missing values for VA and non-VA outpatient health care visits, we sought to analyze the potential effect of this *missingness* on mean VA and non-VA outpatient health care visit counts. Because lower socioeconomic status

is associated in some studies with reduced health care utilization, we compared sociodemographics between subjects with *missing* values versus those with *complete* values within (a) *overall sample*, (b) *subset of denied applicants*, and (c) *subset of awarded applicants*. Sociodemographic differences between those with missing data and those with complete data would suggest potential bias (e.g., under-estimates, or over-estimates) in the effect of VA disability compensation award status on VA and non-VA outpatient health care visit counts.

Results

Weighted Descriptive Summary Statistics

Weighted descriptive statistics are provided for the sample of veterans denied or awarded VA disability compensation (**Table 1**). All descriptive summary statistics have been weighted to reflect the population of all U.S. Veterans. Table values are therefore, expressed as weighted mean (and weighted 95% confidence interval for the weighted mean) or weighted proportion (and weighted 95% confidence interval for the weighted proportion).

Descriptive, unadjusted results reveal that compared with *awarded* applicants, those *denied* had higher mean overall self-reported health scores (3.25 vs. 3.76, $p < 0.001$), indicating poorer overall health.

In terms of sociodemographic differences, compared with *awarded*, those *denied* were older (57 years vs. 61.9 years, $p < 0.001$). They were also more likely to be male (93.4% vs. 97.1%, $p = 0.003$), to have a high school degree or less (35.6% vs. 49.8%, $p = 0.001$), and to be recipients of public assistance income (1.73% vs. 10.1%, $p < 0.001$). At

the same time, *denied* were more likely to be unmarried (24.4% vs. 37.2%, $p < 0.001$), unemployed (50.8% vs. 70.0%, $p < 0.001$), non-home owners, rather than home owners (20.0% vs. 28.5%, $p = 0.022$), and to have no dependent children (63.8% vs. 73.7%, $p = 0.005$). They were also more likely to report little or no overall knowledge of VA health-related benefits and services (35.9% vs. 60.3%, $p < 0.001$), and utilized a lower mean number of VA health-related benefits and services (1.44 services vs. 1.21 services, $p = 0.001$).

Multivariate Analysis

VA Outpatient Health Care Visit Counts

ZINB, which uses *logistic zero inflation* to model health care visit counts for a “never-zero” group and *negative binomial regression* which simultaneously models an “always-zero” group, was used to examine multivariate associations between VA outpatient health care visit counts during the previous 12 months and VA disability compensation award status, adjusting for all other factors (**Table 4**).

Results from the *logistic zero inflation* component of the *ZINB* model reveal that VA disability compensation award status ($OR = 120.9$, 95% $CI = 1.586: 922.6$), and having little or no overall knowledge of VA health-related benefits and services ($OR = 4.863$, 95% $CI = 1.245: 18.99$) were associated with increased odds of always zero VA outpatient health care visits, while lack of health insurance ($OR = 0.035$, 95% $CI = 0.002: 0.758$) was associated with decreased odds of always zero VA outpatient health care visits. (**Figure 2** provides a diagrammatic view of these factors).

Results from the *negative binomial regression* component of the *ZINB* model reveal that poor overall self-reported health ($IRR = 1.267$, 95% $CI = 1.156: 1.397$), lack

of health insurance (IRR = 1.448, 95% CI = 1.115: 1.881), increased utilization of VA health-related benefits and services (IRR = 1.731, 95% CI = 1.140: 2.627), and being unemployed (IRR = 1.315, 95% CI = 1.026: 1.685) were all associated with increased VA outpatient health care visit rates, while older age (IRR = 0.998, 95% CI = 0.979: 0.997) was associated with decreased VA outpatient health care visit rates (**Figure 2**).

Moreover, in analyzing potential effect modification, the *negative binomial regression* component of the *ZINB* model also uncovered a significant interaction (IRR = 0.818, 95% CI = 0.683: 0.980) between *marital status* (unmarried/married) and *utilization* of VA health-related benefits and services, indicating that increased utilization of VA benefits and services was associated with lower VA outpatient health care visit rates in *unmarried* veterans compared to *married* veterans.

Non-VA Outpatient Health Care Visit Counts

ZIP, which uses *logistic zero inflation* to model health care visit counts for a “never-zero” group, and *poisson regression* which simultaneously models an “always-zero” group were used to examine multivariate associations between non-VA outpatient health care visit counts and VA disability compensation award status, adjusting for all other factors. As a comparison, *NBR*, which *only* models visit count rates, was used to separately examine multivariate associations between non-VA outpatient health care visit counts and VA disability compensation award status, adjusting for all other factors (**Table 5**).

Results from the *logistic zero inflation* component of the *ZIP* model reveal that minority race (OR = 1.576, 95% CI = 1.121: 2.215), having a high school degree or less (OR = 1.824, 95% CI = 1.399: 2.378), being unmarried (OR = 1.722, 95% CI = 1.290:

2.299), unemployed (OR = 1.447, 95% CI = 1.064: 1.967), being a non-home owner (e.g., renter/occupier), rather than a home-owner (OR = 1.397, 95% CI = 1.031: 1.892), and increased utilization of VA health-related benefits and services (OR = 2.235, 95% CI = 1.981: 2.509) were all associated with increased odds of always zero non-VA outpatient health care visits. (**Figure 3** provides a diagrammatic view of these factors).

Results from the *poisson* component of the *ZIP* model reveal that poor overall self-reported health (OR = 1.419, 95% CI = 1.286: 1.565) was associated with increased rates of non-VA outpatient health care, while having a high school degree or less (OR = 0.738, 95% CI = 0.610: 0.894) was associated with decreased rates of non-VA outpatient health care (**Figure 3**).

As a comparison, results from the *NBR* model reveal that poor overall self-reported health (IRR = 1.348, 95% CI = 1.241: 1.464) and little or no overall knowledge of VA health-related benefits and services (IRR = 1.189, 95% CI = 1.039: 1.360) were associated with increased rates of non-VA outpatient health care, while having a high school degree or less (IRR = 0.700, 95% CI = 0.600: 0.817) or living in a rural area (IRR = 0.831, 95% CI = 0.706: 0.979) were associated with decreased rates of non-VA outpatient health care.

Comparing ZIP and NBR

Comparison of parameter estimates, standard errors and p-values produced by *ZIP* and *NBR* (**Table 5**) reveal few important differences, suggesting that the one-part *NBR* model and the two-part *ZIP* model lead to *similar conclusions* among this sample. However, the *ZIP* model, in modeling *zero* non-VA outpatient health care visit counts, provides *additional insight* into those factors which may explain why some veterans

forgo non-VA sources of outpatient health care; for these reasons, inferences regarding non-VA outpatient health care service-use intensity are based primarily upon results from the *ZIP* model.

Missingness

Separate analyses of *missingness* for VA and non-VA outpatient health care visit counts revealed few significant sociodemographic differences between subjects with *missing* data and those with *complete* data across groups. The similar patterns of missingness among denied and awarded subsets reduces the risk of a bias in survey item completion that would meaningfully impact our conclusions.

Discussion

Summary of findings

In this study, our aim was to examine VA and non-VA outpatient health care visit counts during the previous 12 months among veterans *denied* VA disability compensation. Overall, our data reveal a significant association between VA disability compensation denial and *never use* of VA outpatient health care services but failed to uncover any significant association between VA disability compensation denial and non-VA outpatient health care.

VA Outpatient Health Care

Consistent with our hypothesis, we found that compared to *awarded* applicants, those *denied* were much more likely to *never use* VA outpatient health care. This finding was not unexpected since a VA disability compensation award is among the strongest predictors of VA health care utilization (1, 26, 69, 70). However, use (or non-use) of

health care is a function, not simply of any individual factor, but rather of a constellation of factors (41). Therefore, avoidance of VA outpatient health care services by at least some *denied* applicants cannot be explained entirely by their lack of service-connection.

What other factors, therefore, might explain why some veterans denied VA disability compensation do not use any VA outpatient health care services?

Health Status

Since imminent health needs are among the strongest drivers of health care utilization (41), it is conceivable that *denied* applicants do not use any VA outpatient health care because they are, in fact, in good health. This is unlikely, however, since unadjusted analysis revealed significantly poorer overall self-reported health among *denied* applicants in our sample, compared to those *awarded*; additionally, prior work has consistently reported poor health among veterans *denied* VA disability compensation (18, 26, 50).

Non-VA Outpatient Health Care

Another potential explanation for why some *denied* applicants may avoid VA outpatient health care services could be that they are, instead, using non-VA health care paid for by other sources (e.g., Medicare). Veterans can be “dual users,” receiving inpatient and outpatient health care services from the VA as well as from sources outside of the VA (71, 72). Prior studies have reported that despite being eligible for VA health care services, some uninsured veterans do not use *any* VA health care services (72). However, as noted by Nelson et al., “[t]he extent of use of other health care coverage among veterans is of interest but has been difficult to quantify (72).”

Absent prior work, we had hoped to provide some insight into *denied* applicants' use (or non-use) of non-VA outpatient health care services. While not attaining statistical significance, the direction of the association (OR = 0.73, $p = 0.213$) between non-VA outpatient health care visit counts and VA disability compensation award status suggests that compared to *awarded*, those *denied* may be more likely to use non-VA outpatient health care. The implication that *denied* applicants, at least under some circumstances, may be more inclined to use non-VA outpatient health care, perhaps in place of VA outpatient health care, is an important and unresolved issue. Future large-scale studies of dual-use among veterans *denied* VA disability compensation could provide additional insight.

Navigating the System

Finally, the ability of an individual to access health-related benefits and services in a large federal health care system is a function of many factors, including but not limited to the nature of the impairment (e.g., physical vs. psychiatric), overall knowledge and attitudes, financial needs, and availability of social support (41, 73). Undeniably, some veterans may confront substantial impediments to health care (62). In this respect, some individuals may be so severely impaired that they are unable to provide the VA with a coherent medical history, or complete necessary paperwork, or even reliably attend evaluations (21, 22, 34). For other veterans, impediments to health care may include difficulty arranging transportation (62), fear of being stigmatized, and/or skepticism about treatment (74). Unfortunately, our results did not provide insight into specific factors which may impede *denied* applicants' use of VA outpatient health care. Future

research into barriers to health care among veterans *denied* VA disability compensation could provide a valuable contribution to this nascent body of scholarly work.

Strengths and Limitations

To our knowledge, this is the first comparative analysis of VA and non-VA outpatient health care visit counts among veterans with physical and mental impairments who were *awarded* or *denied* VA disability compensation. Our study, nevertheless, has a number of limitations.

To begin with, the cross-sectional study design means we cannot establish temporality between responses and factors (e.g. does use or non-use of VA outpatient health care precede VA disability compensation denial, or does VA disability compensation denial precede use or non-use of VA outpatient health care?). Also, in analyzing non-VA outpatient health care visit counts, we conducted design-based, multivariate analysis using both zero-inflated poisson regression (ZIP) as well as negative-binomial regression (NBR). Comparison of multivariate results for *ZIP* and *NBR* revealed few differences, demonstrating that in modeling non-VA outpatient health care visit rates among our sample of *denied* and *awarded* applicants, both approaches lead to similar inferences.

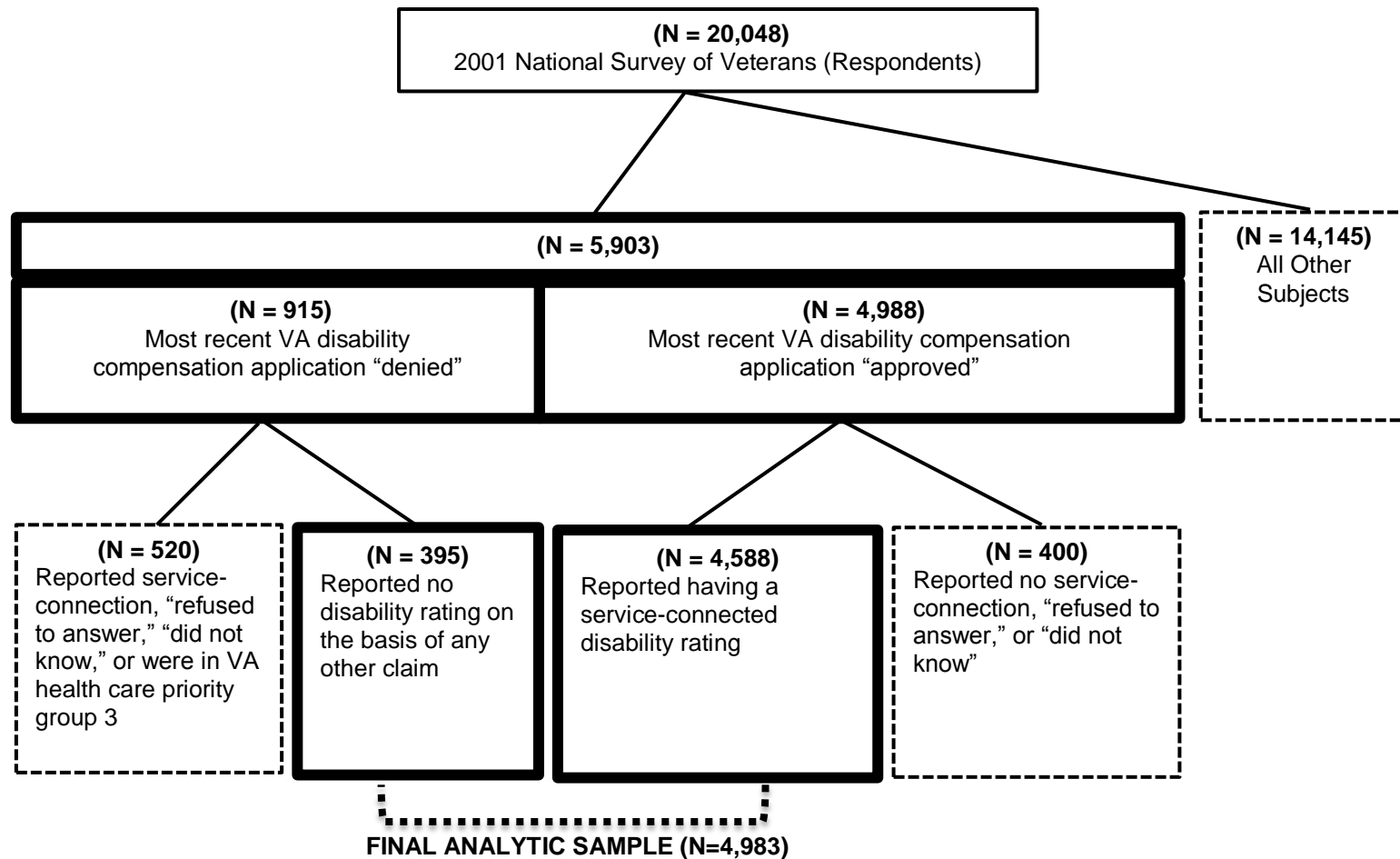
Additionally, missing values for VA and non-VA outpatient health care visits resulted in substantial listwise deletion. However, analysis of *missingness* revealed few significant sociodemographic differences between subjects with *missing* data and those with *complete* data (data not shown). We are, therefore, confident in our inferences regarding associations between VA disability compensation award status and VA and non-VA outpatient health care visit counts.

As a final limitation, findings based on the 2001 NSV are subject to potential selection bias. Given the NSV's sampling frame (e.g., non-institutionalized veterans), it seems likely that the sickest, poorest and most-vulnerable *denied* applicants (e.g., homeless) "are underrepresented in the NSV (28)." Their exclusion may explain why we did not uncover any association between VA disability compensation award status and non-VA outpatient health care.

Conclusion

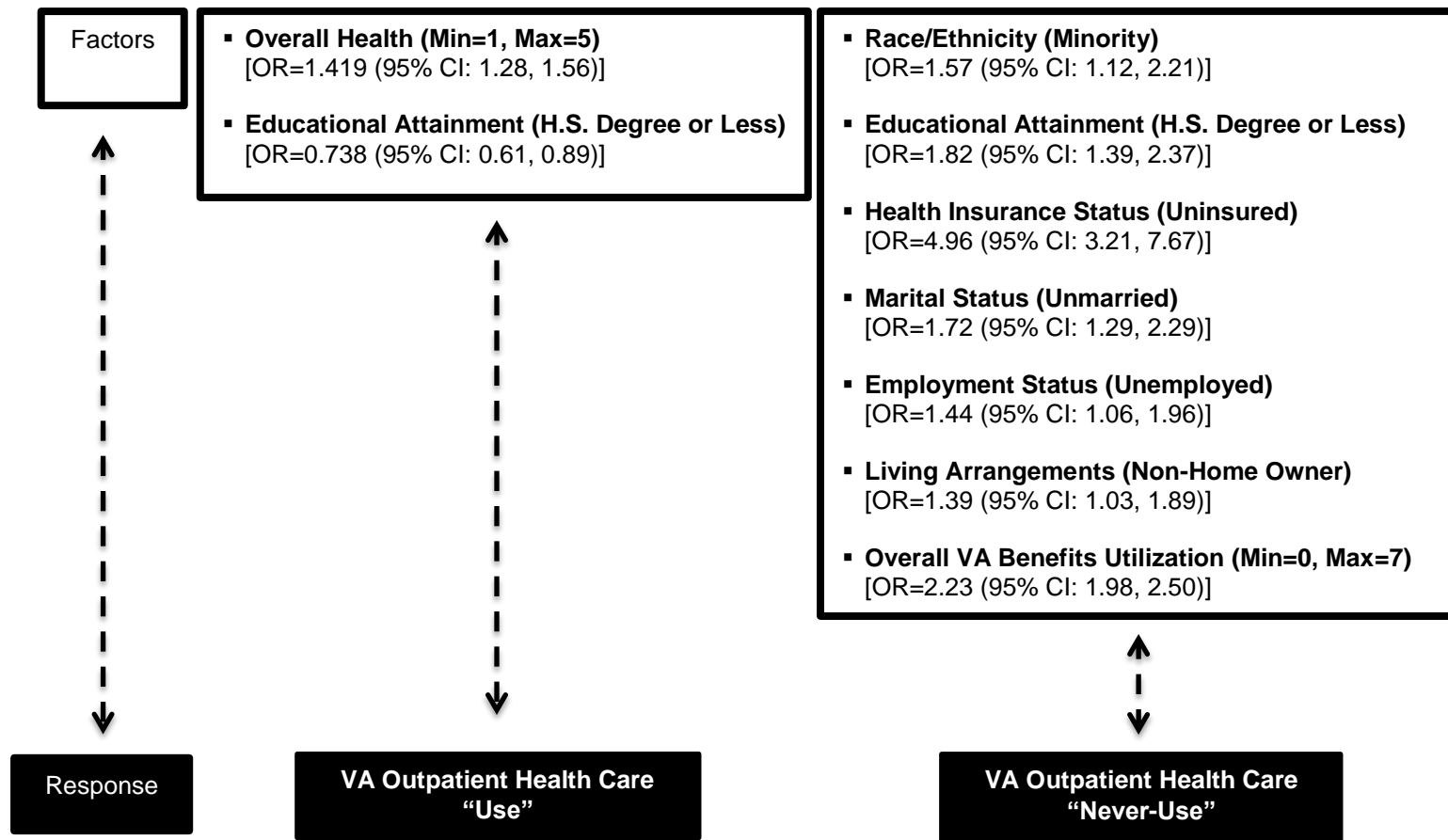
The broad picture of *denied* applicants that emerges from available data shows them, compared to *awarded* applicants to be more likely to forgo VA outpatient health care services despite likely equal need. Social isolation among the *denied* applicants may play a critical role in this lack of VA outpatient health care service utilization. In the context of increased risks of homelessness and premature mortality, our findings support the impression that *denied* applicants are indeed a particularly vulnerable subgroup of veterans who may not seek out VA outpatient health care when denied service-connected disability.

Figure 1: Sample flow diagram of final analytic sample of veterans denied or awarded VA disability compensation



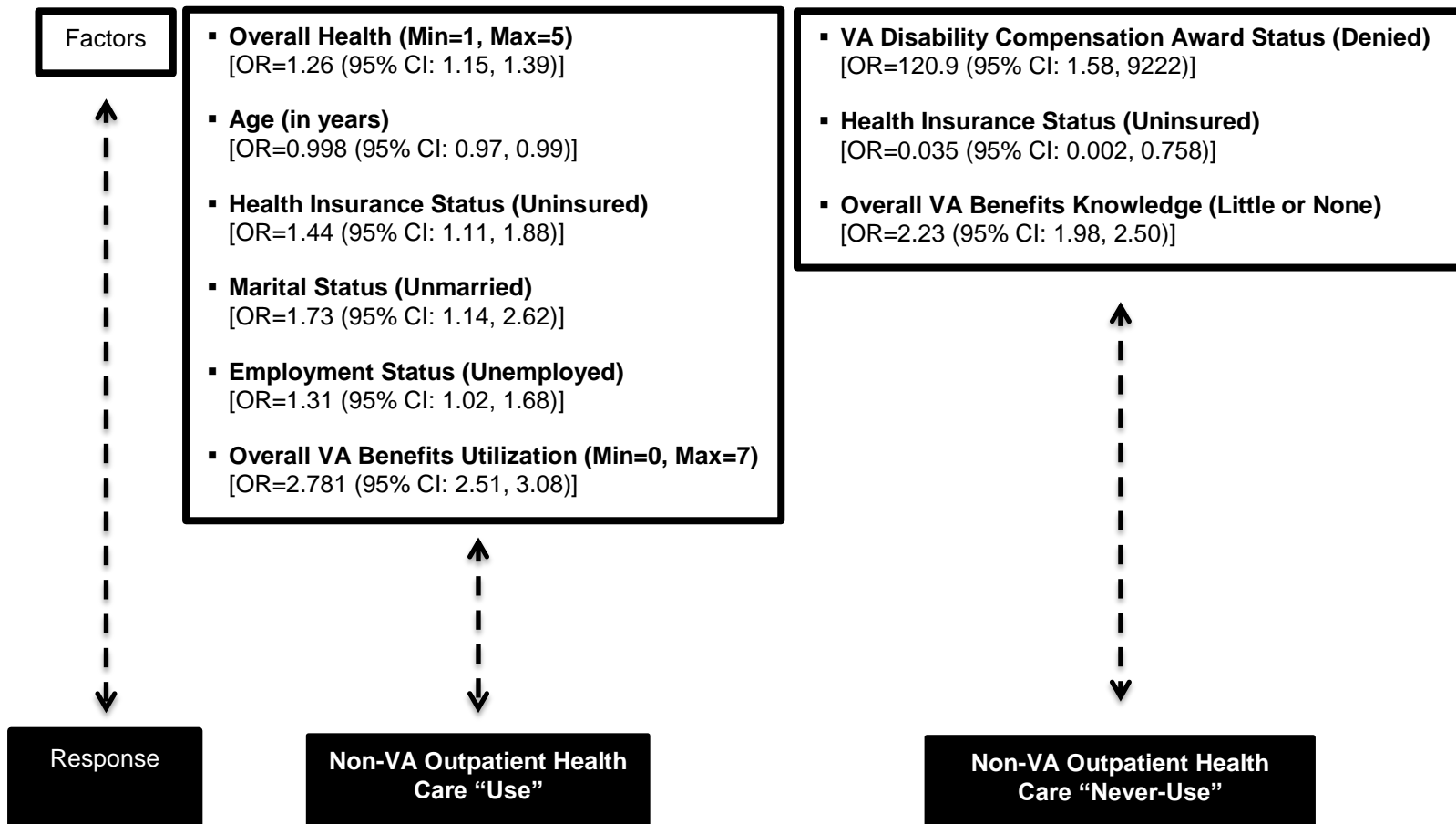
Notes: Boxes with dashed-lines represent "excluded" subjects
Boxes with thick continuous lines represent "included" subjects

Figure 2: Diagrammatic view of factors significantly associated with VA outpatient health care “Use” or “Never-Use” (ZINB Model, Table 4)



Notes: Double-sided arrows indicate that for some factors the causal association cannot be specified in this cross-sectional analysis; Reference for categorical factors: educational attainment (at least some college), race/ethnicity (white), health insurance status (insured), marital status (married), employment status (employed), living arrangements (home-owner)

Figure 3: Diagrammatic view of factors significantly associated with non-VA outpatient health care “Use” or “Never-Use” (ZIP Model, Table 5)



Notes: Double-sided arrows indicate that for some factors the causal association cannot be specified in this cross-sectional analysis; Reference for categorical factors: health insurance status (insured), marital status (married), employment status (employed), VA disability compensation award status (awarded), overall VA benefits knowledge (at least some)

Table 1: Weighted descriptive summary statistics for the sample of 4,983 veterans denied or awarded VA disability compensation. Values expressed as weighted mean (and weighted 95% confidence interval for the weighted mean) or weighted proportion (and weighted 95% confidence interval for the weighted proportion)

VARIABLES	Overall (95% CI) % or mean	Denied (95% CI) % or mean	Awarded (95% CI) % or mean	*p
<u>Response Variables</u>				
VA outpatient health care visits (min=0, max=50+)	3.78 (3.44: 4.11)	3.32 (2.07: 4.57)	3.86 (3.50: 4.22)	0.429
Non-VA outpatient health care visits (min=0, max=156)	6.08 (5.43: 6.72)	7.48 (4.74: 10.2)	5.82 (5.29: 6.35)	0.228
<u>Main Factor of Interest</u>				
VA Disability Compensation Award Status	----	15.9 (14.2: 17.7)	84.0 (82.2: 85.7)	----
<u>Health Status</u>				
Overall Subjective Health (min=1, max=5)	3.33 (3.28: 3.37)	3.76 (3.62: 3.91)	3.25 (3.20: 3.29)	< 0.001
<u>Sociodemographics</u>				
Age (in years)	57.7 (57.1: 58.3)	61.9 (60.2: 63.5)	57.0 (56.3: 57.6)	< 0.001
Sex (%)				
Male	94.0 (93.0: 94.0)	97.1 (95.2: 99.0)	93.4 (92.4: 94.5)	0.003
Female	5.94 (5.04: 6.84)	2.84 (.091: 4.76)	6.53 (5.47: 7.59)	0.003
Race/Ethnicity (%)				
Non-white races	18.4 (17.0: 19.7)	22.2 (17.5: 26.9)	17.6 (16.1: 19.2)	0.088
White race	81.5 (80.2: 82.9)	77.7 (73.0: 82.4)	82.3 (80.7: 83.8)	0.088
Educational Attainment (%)				
High school or less	37.9 (36.1: 39.7)	49.8 (42.6: 56.9)	35.6 (33.7: 37.6)	0.001
At least some college	2.0 (60.2: 63.8)	50.1 (43.0: 57.3)	64.3 (62.3: 66.2)	0.001
Health Insurance Status (%)				
No Insurance	11.6 (10.3: 13.0)	10.9 (7.03: 14.9)	11.8 (10.4: 13.1)	0.688
Insurance	88.3 (86.9: 89.6)	89.0 (85.0: 92.9)	88.1 (86.8: 89.5)	0.688
Public Assistance Income (%)				
Recipient	3.08 (2.31: 3.85)	10.1 (6.22: 14.0)	1.73 (1.10: 2.36)	< 0.001
Non-recipient	96.9 (96.1: 97.6)	89.8 (85.9: 93.7)	98.2 (97.6: 98.8)	< 0.001

Table 1 (continued)

VARIABLES	Overall (95% CI) Mean or %	Denied (95% CI) Mean or %	Awarded (95% CI) Mean or %	*p
<u>Active-Duty Stressor</u>				
Combat/War Zone Exposure (%)				
Yes	56.3 (54.5: 58.2)	52.4 (45.8: 59.0)	57.1 (54.9: 59.3)	0.207
No	43.6 (41.7: 45.4)	47.5 (40.9: 54.1)	42.8 (40.6: 45.0)	0.207
<u>Social Isolation</u>				
Marital Status (%)				
Not Married	26.5 (24.6: 28.4)	37.2 (31.2: 43.1)	24.4 (22.6: 26.3)	< 0.001
Married	73.4 (71.5: 75.3)	62.7 (56.8: 68.7)	75.5 (73.6: 77.3)	< 0.001
Employment Status (%)				
Unemployed	53.9 (52.0: 55.8)	70.0 (63.1: 76.4)	50.8 (49.0: 52.7)	< 0.001
Employed	46.0 (44.1: 47.9)	29.9 (23.1: 36.8)	49.1 (47.2: 50.9)	< 0.001
Geographic Residence (%)				
Rural	22.2 (20.8: 23.7)	25.1 (19.9: 30.3)	21.7 (20.1: 23.2)	0.232
Urban	77.7 (76.2: 79.1)	74.8 (69.6: 80.0)	78.2 (76.7: 79.8)	0.232
Living Arrangements (%)				
Non-home owner	21.3 (19.9: 22.7)	28.5 (21.8: 35.2)	20.0 (18.5: 21.5)	0.022
Home owner	78.6 (77.2: 80.0)	71.4 (64.7: 78.1)	79.9 (78.4: 81.4)	0.022
Number of Dependent Children (%)				
No dependent children	65.4 (63.6: 67.1)	73.7 (67.2: 80.3)	63.8 (62.0: 65.6)	0.005
At least 1 dependent child	34.5 (32.8: 36.3)	26.2 (19.6: 32.7)	36.1 (34.3: 37.9)	0.005
Overall Knowledge of VA Benefits (%)				
Little or no overall knowledge	39.8 (38.0: 41.6)	60.3 (54.4: 66.2)	35.9 (34.2: 37.6)	< 0.001
At least some overall knowledge	60.1 (58.3: 61.9)	39.6 (33.7: 45.5)	64.0 (62.3: 65.7)	< 0.001
Overall Utilization of VA Benefits (min=0, max=7)	1.40 (1.35: 1.44)	1.21 (1.08: 1.34)	1.44 (1.39: 1.48)	0.001

Notes: *p = statistical significance of difference between denied applicants and awarded applicants
 Weighting based on National Survey of Veterans 2001

Table 2: Design-based bivariate analysis of initial candidate factors and response, VA outpatient health care service use intensity. Values expressed as weighted odds ratio or incidence rate ratio (and weighted 95% confidence interval for the weighted odds ratio or incidence rate ratio), and weighted p-value

	ZINB (Predicts Use)		ZINB (Predicts Non-Use)	
VARIABLES	IRR (95% CI)	p	OR (95% CI)	p
<u>VA Disability Compensation Status</u>				
VA Disability Compensation Award Status (Denied)	0.99 (0.60: 1.62)	0.969	1.57 (0.89: 2.77)	0.106
<u>Health Status</u>				
Overall self-reported Health (min=1, max=5)	1.40 (1.28: 1.53)	< 0.001	0.58 (0.50: 0.66)	< 0.001
<u>Sociodemographics</u>				
Age (in years)	0.99 (0.98: 1.00)	0.075	0.98 (0.95: 0.98)	0.239
Sex (Male)	0.75 (0.56: 1.00)	0.055	1.66 (0.63: 4.30)	0.286
Race/Ethnicity (Minority)	1.01 (0.81: 1.26)	0.898	0.44 (0.18: 1.03)	0.055
Educational Attainment (High school or less)	1.14 (0.89: 1.46)	0.267	0.46 (0.28: 0.75)	0.002
Health Insurance Status (Uninsured)	1.51 (1.25: 1.83)	< 0.001	0.00 (0.00: 0.00)	< 0.001
Public Assistance Income (Recipient)	1.67 (0.91: 3.06)	0.091	0.52 (0.09: 2.75)	0.434
<u>Active-Duty Stressor</u>				
Combat/War Zone (Exposed)	1.03 (0.83: 1.28)	0.753	0.79 (0.51: 1.22)	0.284
<u>Social Isolation</u>				
Marital Status (Unmarried)	1.55 (1.26: 1.86)	< 0.001	0.44 (0.25: 0.76)	0.003
Employment Status (Unemployed)	1.87 (1.50: 2.34)	< 0.001	0.34 (0.22: 0.53)	< 0.001
Geographic Residence (Rural)	0.85 (0.65: 1.10)	0.219	0.61 (0.35: 1.06)	0.074
Living Arrangements (Non-home owner)	1.16 (0.91: 1.49)	0.210	0.33 (0.16: 0.66)	0.001
Number of Dependent Children (No dependent children)	0.93 (0.71: 1.21)	0.604	0.58 (0.40: 0.85)	0.004
Overall Knowledge of VA Benefits (Little or none)	1.32 (1.05: 1.67)	0.018	2.49 (1.71: 3.61)	< 0.001
Overall Utilization of VA Benefits (min=0, max=7)	1.63 (1.52: 1.75)	< 0.001	0.11 (0.09: 0.14)	< 0.001

Notes: Reference for categorical factors: VA disability compensation award status (awarded), sex (female), race/ethnicity (white), educational attainment (at least some college), health insurance status (insured), public assistance income (non-recipient), combat/war zone (not exposed), marital status (married), employment status (employed), geographic residence (urban), living arrangements (home-owner), overall knowledge of VA benefits (at least some)

Table 3: Design-based bivariate analysis of initial candidate factors and response, non-VA outpatient health care service use intensity. Values expressed as weighted odds ratio and incidence rate ratio (and weighted 95% confidence interval for the weighted odds ratio and incidence rate ratio), and weighted p-value

	ZIP (Predicts Use)		ZIP (Predicts Non-Use)	
VARIABLES	IRR (95% CI)	p	OR (95% CI)	p
<u>VA Disability Compensation Status</u>				
VA Disability Compensation Award Status (Denied)	1.23 (0.84: 1.79)	0.269	0.81 (0.58: 1.14)	0.231
<u>Health Status</u>				
Overall Self-Reported Health (min=1, max=5)	1.41 (1.26: 1.57)	< 0.001	1.43 (1.29: 1.60)	< 0.000
<u>Sociodemographics</u>				
Age (in years)	1.00 (0.99: 1.00)	0.532	0.99 (0.98: 1.00)	0.560
Sex (Male)	0.84 (0.67: 1.06)	0.155	0.96 (0.57: 1.61)	0.885
Race/Ethnicity (Minority)	1.05 (0.85: 1.30)	0.632	1.57 (1.19: 2.08)	0.001
Educational Attainment (High school or less)	0.86 (0.73: 1.02)	0.101	1.66 (1.42: 1.94)	< 0.001
Health Insurance Status (Uninsured)	0.82 (0.58: 1.17)	0.290	6.25 (4.68: 8.47)	< 0.001
Public Assistance Income (Recipient)	1.41 (0.94: 2.11)	0.090	2.10 (1.22: 3.62)	0.006
<u>Active-Duty Stressor</u>				
Combat/War Zone (Exposed)	0.93 (0.78: 1.11)	0.431	1.18 (0.95: 1.46)	0.112
<u>Social Isolation</u>				
Marital Status (Unmarried)	1.05 (0.88: 1.26)	0.536	2.42 (1.94: 3.03)	< 0.001
Employment Status (Unemployed)	1.25 (1.05: 1.48)	0.010	2.40 (1.90: 3.05)	< 0.001
Geographic Residence (Rural)	0.87 (0.73: 1.02)	0.102	1.20 (0.92: 1.57)	0.154
Living Arrangements (Non-home owner)	1.18 (0.93: 1.48)	0.152	2.20 (1.78: 2.71)	< 0.001
Number of Dependent Children (No dependent children)	1.08 (0.88: 1.32)	0.413	1.24 (0.99: 1.56)	0.047
Overall Knowledge of VA Benefits (Little or none)	1.10 (0.94: 1.29)	0.205	0.84 (0.68: 1.03)	0.090
Overall Utilization of VA Benefits (min=0, max=7)	1.05 (0.94: 1.16)	0.331	2.34 (2.12: 2.59)	< 0.001

Notes: Reference for categorical factors: VA disability compensation award status (awarded), sex (female), race/ethnicity (white), educational attainment (at least some college), health insurance status (insured), public assistance income (non-recipient), combat/war zone (not exposed), marital status (married), employment status (employed), geographic residence (urban), living arrangements (home-owner), overall knowledge of VA benefits (at least some)

Table 4: Estimated weighted incidence rate ratios and odds ratios (and 95% confidence intervals for the weighted incidence rate ratios and odds ratios) from the zero-inflated negative binomial regression model for VA outpatient health care service use intensity previous 12 months

Factors	Zero-Inflated Negative Binomial Regression			
	Negative Binomial Regression (Predicting Use)		Logistic Zero Inflation (Predicting Never Use)	
	IRR (95% CI)	p	OR (95% CI)	p
VA Disability Compensation Award Status (Denied)			4.79 (1.58: 9.22)	0.031
<u>Health Status</u>				
Overall self-reported Health (min=0, max=5)	1.26 (1.15: 1.39)	< 0.001	0.39 (0.11: 1.42)	0.154
<u>Sociodemographics</u>				
Age (per year)	0.98 (0.97: 0.99)	0.012	0.92 (0.81: 1.05)	0.219
Sex (Male)	0.87 (0.60: 1.25)	0.449		
Race/Ethnicity (Minority)			0.01 (0.00: 7.23)	0.168
Educational Attainment (High school or less)			0.04 (0.00: 2.40)	0.118
Health Insurance Status (Uninsured)	1.44 (1.11: 1.88)	0.006	0.03 (0.00: 0.75)	0.029
Public Assistance Income (Recipient)	1.31 (0.73: 2.36)	0.353		
Geographic Residence (Rural)	1.06 (0.77: 1.45)	0.697	0.25 (0.02: 2.77)	0.250
<u>Social Isolation</u>				
Marital Status (Unmarried)	1.73 (1.14: 2.62)	< 0.001	0.58 (0.03: 11.2)	0.715
Employment Status (Unemployed)	1.31 (1.02: 1.68)	0.011	0.11 (0.00: 1.65)	0.104
Living Arrangements (Non-home owner)	0.97 (0.75: 1.24)	0.816	0.71 (0.11: 4.48)	0.718
Number of Dependent Children (No dependent children)			1.97 (0.39: 9.92)	0.396
Overall Knowledge of VA Benefits (Little or none)	1.14 (0.89: 1.45)	0.270	4.86 (1.24: 18.9)	0.020
Overall Utilization of VA Benefits (min=0, max=7)	2.78 (2.51: 3.08)	< 0.001		
Marital Status x Overall Utilization of VA Benefits	0.81 (0.68: 0.98)	0.031		

Notes: Reference for categorical factors are: VA disability compensation award status (awarded), sex (female), race/ethnicity (caucasian), educational attainment (at least some college), health insurance status (insured), public assistance income (non-recipient), marital status (married), employment status (employed), living arrangements (home-owner), number of dependent children (at least 1), overall knowledge of VA benefits (at least some knowledge)

Table 5: Estimated weighted incidence rate ratios and odds ratios (and weighted 95% confidence intervals for the weighted incidence rate ratios or odds ratios) from the zero-inflated poisson regression model for non-VA outpatient health care service-use intensity previous 12 months

Factors	Zero-Inflated Poisson Regression			
	Poisson Regression (Predicting Use)		Logistic Zero Inflation (Predicting Never Use)	
	IRR (95% CI)	p	OR (95% CI)	p
VA Disability Compensation Award Status (Denied)			0.73 (0.44: 1.20)	0.213
<u>Health Status</u>				
Overall self-reported Health (min=1, max=5)	1.41 (1.28: 1.56)	< 0.001	0.94 (0.83: 1.05)	0.279
<u>Sociodemographics</u>				
Age (per year)				
Sex (Male)	0.81 (0.63: 1.04)	0.100		
Race/Ethnicity (Minority)			1.57 (1.12: 2.21)	0.010
Educational Attainment (High school or less)	0.73 (0.61: 0.89)	0.003	1.82 (1.39: 2.37)	< 0.001
Health Insurance Status (Uninsured)			4.96 (3.21: 7.67)	< 0.001
Public Assistance Income (Recipient)	1.05 (0.67: 1.63)	0.813	1.12 (0.33: 3.77)	0.849
<u>Active-Duty Stressor</u>				
Combat/War Zone (Exposed)			1.15 (0.89: 1.50)	0.267
<u>Social Isolation</u>				
Geographic Residence (Rural)	0.89 (0.74: 1.05)	0.185	1.30 (0.96: 1.78)	0.087
Marital Status (Unmarried)			1.72 (1.29: 2.29)	< 0.001
Employment Status (Unemployed)	0.98 (0.82: 1.17)	0.859	1.44 (1.06: 1.96)	0.019
Living Arrangements (Non-home owner)	1.07 (0.83: 1.36)	0.574	1.39 (1.03: 1.89)	0.031
Number of Dependent Children (No dependent children)			1.00 (0.71: 1.42)	0.962
Overall Knowledge of VA Benefits (Little or none)	1.10 (0.95: 1.28)	0.179	0.91 (0.66: 1.26)	0.596
Overall Utilization of VA Benefits (min=0, max=7)			2.23 (1.98: 2.50)	< 0.001

Notes: Reference for categorical factors are: VA disability compensation award status (awarded), sex (female), race/ethnicity (caucasian), educational attainment (at least some college), health insurance status (insured), public assistance income (non-recipient), combat/war zone (no combat exposure), geographic residence (urban), marital status (married), employment status (employed), living arrangements (home-owner), number of dependent children (at least 1 dependent child), overall knowledge of VA benefits (at least some)

Table 6: Estimated weighted incidence rate ratios (and weighted 95% confidence intervals for the weighted incidence rate ratios) from the negative binomial regression model for non-VA outpatient health care service-use intensity previous 12 months

Factors	Negative Binomial Regression (Predicting Use)	
	IRR (95% CI)	p
VA Disability Compensation Award Status (Denied)		
<u>Health Status</u>		
Overall Self-Reported Health (min=1, max=5)	1.34 (1.24: 1.46)	< 0.001
<u>Sociodemographics</u>		
Age (per year)		
Sex (Male)	0.85 (0.67: 1.07)	0.174
Race/Ethnicity (Minority)		
Educational Attainment (High school or less)	0.70 (0.60: 0.81)	< 0.001
Health Insurance Status (Uninsured)		
Public Assistance Income (Recipient)	1.04 (0.68: 1.59)	0.837
<u>Active-Duty Stressor</u>		
Combat/War Zone (Exposed)		
<u>Social Isolation</u>		
Geographic Residence (Rural)	0.83 (0.70: 0.97)	0.028
Marital Status (Unmarried)		
Employment Status (Unemployed)	0.88 (0.77: 1.00)	0.062
Living Arrangements (Non-home owner)	0.91 (0.71: 1.18)	0.496
Number of Dependent Children (No dependent children)		
Overall Knowledge of VA Benefits (Little or none)	1.18 (1.03: 1.36)	0.013
Overall Utilization of VA Benefits (min=0, max=7)		

Notes: Reference for categorical factors are: VA disability compensation award status (awarded), sex (female), race/ethnicity (caucasian), educational attainment (at least some college), health insurance status (insured), public assistance income (non-recipient), combat/war zone (no combat exposure), marital status (married), employment status (unemployed), geographic residence (urban), living arrangements (home-owner), number of dependent children (at least 1 dependent child), overall knowledge of VA benefits (at least some)

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CONCLUSION

In this dissertation, we compared health status, as well as patterns of health care utilization of U.S. Veterans *denied* VA disability compensation to those *awarded* VA disability compensation. In the process, given widely-cited relationships between correlates of social isolation, health status (1, 2, 3, 4, 5), and health care utilization (2, 6, 7), we further sought to explore *denied* applicants social circumstances.

Consistent with prior work, we found that veterans *denied* VA disability compensation have comparative poor health, and are more likely to never use VA outpatient health care. We also found evidence of poverty and comparative isolation. Importantly, our findings are based on comparisons with *awarded* applicants who are considered by researchers to be the least-biased comparison group (8, 9).

Hypotheses

A three-paper format, each with its own set of research questions, was used to examine health-related differences between veterans *denied* VA disability compensation and those *awarded* VA disability compensation. In the first paper, a comprehensive review of the research literature “relevant” to veterans seeking VA disability compensation, we hypothesized that there are significant differences in health, health care utilization, and psychosocial characteristics between *denied* applicants and those *awarded*.

In the second paper, a cross-sectional analysis of subjective health status, we hypothesized that there are significant differences in general health, physical and mental

functioning, and limitations in activities of daily living between *denied* applicants and those *awarded*.

In the third and final paper, a cross-sectional analysis of VA and non-VA outpatient health care utilization visit counts - service-use intensity - for the previous 12 months, we hypothesized that there are significant differences in patterns of VA and non-VA health care utilization between *denied* applicants and those *awarded*.

Data Source

The 2001 National Survey of Veterans (2001 NSV), fifth in a series of comprehensive nationwide surveys, is public, cross-sectional data generalizable to the non-institutionalized veteran population. The survey, which was based on a complex sample design, included “composite weights” and a series of 51 “replicate weights.” All dissertation analyses were design-based, and weighted.

Among 20,048 veteran-respondents, we selected a final analytic sample of 4,983 veterans *denied* or *awarded* VA disability compensation. The survey, in collecting extensive health-related data, was a particularly valuable source of research. In particular, the NSV included questions from the Veterans SF-12 questionnaire (VSF-12) - a publically-available scoring algorithm permits derivation of summary measures of physical and mental functioning (10, 11); of additional value, and in contrast to many other surveys/studies, the NSV also collected health care visit count data; visit counts are preferable to the dichotomous (“yes/no”) health utilization measures commonly used in other surveys/studies (12).

Main Findings

Paper 1: Review of the Literature

Our review of the research literature relevant to veterans *denied* or *awarded* VA disability compensation revealed three major findings: first, in contrast to prior work on federal disability compensation, we found that veterans *denied* VA disability compensation may be as impaired or more impaired than those *awarded*; second, veterans *denied* VA disability compensation may use less VA health care than those *awarded*; and third, veterans *denied* VA disability compensation may be comparatively isolated.

Findings in the literature review became the basis for two separate analyses: in paper 2, we comparatively analyzed subjective health status among veterans *denied* or *awarded* VA disability compensation; in paper 3, we comparatively analyzed VA and non-VA outpatient health care service-use intensity among veterans *denied* or *awarded* VA disability compensation.

Paper 2: Comparative Analysis of Health Status

Our comparative analysis of four separate measures of subjective health status - general health, physical and mental functioning, limitations in activities of daily living - revealed important findings: consistent with our hypothesis, poorer overall self-reported health and limitations in activities of daily living were associated with higher odds of VA disability compensation denial, whereas better physical functioning was associated with lower odds of VA disability compensation denial.

Additionally, although the data did not uncover significant differences in mental functioning, nevertheless, given that mental functioning scores are “standardized to the U.S. population (13),” both *denied* as well as *awarded* applicants were below U.S. population norms.

Concerning correlates of social isolation, receipt of public assistance income, being unmarried, and reporting little or no knowledge of VA benefits/services was associated with increased odds of VA disability compensation denial, whereas greater use of VA health-related benefits/services was associated with decreased odds of VA disability compensation denial.

Paper 3: Comparative Analysis of VA and Non-VA Health Care Use

Our comparative analysis of two separate response variables, VA outpatient health care utilization and non-VA outpatient health care utilization, revealed that veterans *denied* VA disability compensation are more likely to forgo VA outpatient health care services. Moreover, while not attaining statistical significance, the direction of association among our relatively small sample suggests that veterans *denied* VA disability compensation may be more likely to use non-VA outpatient health care services, compared to those *awarded* VA disability compensation.

Strengths and Limitations

To our knowledge, this dissertation is the first comparative analysis of multiple domains of subjective health among veterans *denied* or *awarded* VA disability compensation. This work also has the distinction of being the first to comparatively analyze VA and non-VA outpatient service-use intensity among veterans *denied* or

awarded VA disability compensation. This dissertation, nevertheless, has a number of limitations.

To begin with, in terms of our review of the literature relevant to compensation-seeking veterans, quantitative analysis was not possible. However, while it is conceivable that a meta-analysis might have produced different results, our findings were consistent with extant work and, therefore, we are confident that our conclusions would not differ significantly from such an analysis.

As an additional limitation, the cross-sectional study design means that we cannot establish temporality between responses and factors (e.g., does use/non-use of VA outpatient health care precede VA disability compensation denial, or does VA disability compensation denial precede use/non-use of VA outpatient health care?).

As a further limitation, self-reported health measures may be subject to misclassification, a form of information bias. Nevertheless, subjective health measures such as overall self-reported health (also known as the SF1) are widely acknowledged to be valid and reliable indicators of actual health and number of physician visits (14, 15, 16, 17, 18); for this reason, we are satisfied that such misclassification, if any, had minimal effect on our inferences.

Conclusion

The broad picture of veterans *denied* VA disability compensation that emerges from available data shows them, compared to *awarded* applicants to have comparative poor health, and to be more likely to avoid VA outpatient health care services, despite likely equal need. Poverty and social isolation among *denied* applicants may explain, at

least to some extent, poorer health and avoidance of VA health care services. In the context of increased risks of homelessness and premature mortality, our findings support the impression that *denied* applicants are indeed a particularly vulnerable subgroup of veterans who may not seek out VA outpatient health care when denied service-connected disability.

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