2015

# The Growth in the VA's Disability Compensation Program: The Role of Health

Isabella J. Dougherty
*Wellesley College*, idougher@wellesley.edu

# The Growth in the VA's Disability Compensation Program: The Role of Health

Isabella J. Dougherty
Professor Courtney C. Coile, Economics

Submitted in Partial Fulfillment
Of The Prerequisite For
honors in Economics

April 2015

## Abstract

The VA's Disability Compensation (VADC) program, which provides monthly tax-free cash benefits for qualifying disabled veterans, has been growing rapidly since 2001. The drivers of the program's growth are not well understood and worsening health is one possible driver, but recent liberalizations of medical eligibility criteria may also play a role. This study decomposes the recent growth in the VADC program into the share of the program's growth due to worsening veteran health and the share due to other factors. I use data from the National Health Interview Survey (NHIS) to estimate the relationship between health and receipt of VADC benefits in the late 1990s, and then use those estimates along with the actual health of recent veterans to project the share of today's veterans that would be on the program if eligibility criteria had not changed. My primary empirical finding is that the worsening health of veterans can only explain about one-quarter of the program's growth. This result suggests that the program is not growing primarily due to veterans being in worse health during the post-period. Rather, the program is growing mostly as a result of other factors unrelated to health status. These findings may help policy makers as they consider how to balance the needs of wounded veterans against rapidly rising program expenditures.

## Acknowledgments

First and foremost, I would like to express my sincere gratitude to my advisor, Professor Courtney Coile. From the initial stages of my thesis project, she has been more than supportive and I cannot thank her enough for her patience, enthusiasm, and never-ending supply of chocolate. I could not have had a better advisor and mentor. I am also extremely grateful for the constant support of Professor Robin McKnight, whose office door was always open and who spent countless hours discussing my project with me, and who provided thoughtful feedback at all stages of my research. I would also like to thank my secondary advisor, Sari Kerr, for the valuable feedback she has provided. I would further like to thank my economics professors, Kristin Butcher, Dan Fetter, Joseph Joyce and Olga Shurchkov for teaching me how to think like an economist, and for the valuable advice they have provided me over these last four years. Additionally, I am grateful for the members of this year's Economics Research Seminar for their encouragement and insightful comments. I am especially thankful to Kate Di Lucido for her constant smile and for her comments on previous drafts of my thesis.

I am wholeheartedly grateful for all of my friends who have contributed both directly and indirectly to my research. I would specifically like to thank Marcia Frimpong, Jaki Galyon, Melodie Ha, Prerana Nanda, Alex Poon, Kristina Stark, and the McAfee Community: you have all always been there exactly when I needed you to be and I cannot thank you enough for all the laughs and memories. To my family, thank you for never doubting my abilities, and for your constant love and support.

I could not have done this alone, and it would not be the same without the influences and contributions of the aforementioned individuals.

## Table of Contents

## Introduction

The state of the veteran population within the United States has been a growing concern in recent years. As more veterans return home from recent international military conflicts, their status compared to non-veterans has been a topic of interest for many researchers. The U.S. Department of Veterans' Affairs (VA) and other federal government agencies have developed programs to assist veterans, and as such, questions of how much and how to support veterans have become increasingly prevalent in public policy debates.

Although estimates from the VA show that the U.S. veteran population fell by 18 percent from 2000 to 2012, the number of beneficiaries of the VA's Disability Compensation (VADC) program followed an opposite trend. VADC beneficiaries rose from 2.3 million to 3.7 million beneficiaries over the same time period (Figure 1).[1] This disability program pays monthly tax-free benefits to veterans with disabilities and illnesses resulting from or aggravated by their military service. The striking difference in trends between the number of veterans and program recipients is puzzling and suggests potential long-term implications for the program and the VA budget.

Further, this increase in program beneficiaries is concentrated among those veterans with the highest combined disability ratings (CDR), who are also the veterans who receive the largest benefits (Figure 2). A veteran's CDR reflects the severity of the disability in 10 percent increments from 0 to 100 percent, and is used to determine the base monthly payment the veteran receives. From 2012 to 2013, beneficiaries with a 70 to 100 percent CDR increased by 13 percent, whereas beneficiaries with less than a 20 percent CDR only increased by 1.2 percent.

[1] Further, the percent of veterans receiving VADC benefits rose from 9 percent of veterans to 16 percent, implying that the share of veterans that are beneficiaries is rising even faster than the numbers might suggest.

This rapid increase in beneficiaries with the highest CDRs suggests that veteran health may be worsening over time, given that the CDR is intended to reflect the severity of a veteran's disability. However, this increase in beneficiaries with higher CDRs could also be the result of relaxed rating criteria or more generous ratings for certain disabilities.

Since veterans with higher CDRs receive greater benefit amounts, this concentration of beneficiaries at the highest CDR levels explains why program expenditures more than doubled between 2000 and 2013, while the number of beneficiaries only rose by approximately 60 percent. Expenditures in 2000 were $20 billion, and by 2013 had increased to a 2014 dollar inflation-adjusted $54 billion (CBO, 2014; Veterans Benefits Administration, 2013). This means that the per recipient dollar costs rose by 40 percent over this period, from $8,665 per recipient in 2000 to $14,426 per recipient in 2013. To put this in perspective, these costs exceed expenditures for other more thoroughly studied cash assistance programs. For example, despite the political attention the Temporary Assistance for Needy Families (TANF) program has received, TANF federal expenditures were just under $17 billion in 2013 (Office of Family Assistance (2014)).

While there has been a large amount of research on similar public programs, including the Social Security Disability Insurance (SSDI) program, there has been little research on the VADC program and on the dramatic increase in program expenditures and recipients. The increase in recipients could be due to several factors, including the liberalization of the program's medical eligibility requirements starting in 2001, increased outreach efforts, a weakened economy, and the overall worsening health of veterans.

My paper, motivated by the increase in VADC recipiency and the concurrent decline in the number of veterans, aims to decompose the growth of the VADC program to determine the amount of growth resulting from the worsening health conditions of veterans versus the amount

of growth due to other factors. My question of interest is: how much of the growth in VADC receipt is due to the worsening health of veterans? To answer this question, I first use data from the National Health Interview Survey (NHIS) from 1998 to 2001, a time when the VADC program was relatively stable, to estimate the relationship between health status and VADC receipt. Next, I use these estimates to project program usage during the later period of 2002 to 2010 (the post-period) using the actual characteristics of veterans in the NHIS during this period; this projection effectively calculates how many veterans I would expect to be receiving VADC benefits in the post-period given their actual health status and the relationship between health and program receipt that existed during the pre-period. The difference between the projected rate of VADC receipt in the post-period and the actual rate of VADC receipt during the pre-period is an estimate of the program growth resulting from the worsening health of veterans. The difference between the actual rate of receipt during the later period and the projected rate is the residual growth that contains all other potential drivers of the program's growth.

My primary empirical finding is that the worsening health of veterans can only explain about one-quarter of the program's growth. This result suggests that the program is not growing primarily due to veterans being in worse health during the post-period. Rather, the program is growing mostly as a result of other factors unrelated to health status. Since the residual growth accounts for a large portion of the overall growth, the causes and implications of this residual growth warrant further attention from policy makers.

I also conduct my analysis separately by service cohort, as Vietnam cohort veterans were more affected by the liberalization of medical eligibility criteria, as discussed in more detail below. A 2001 policy change which made type 2 diabetes a presumptive condition for Vietnam service cohort veterans, contingent on their service, ensures VADC benefits for all eligible

Vietnam veterans who claim a disability corresponding to type 2 diabetes without the veteran having to prove a connection between the disease and their military service. While this fact would seem to predispose Vietnam veterans to have a smaller share of program growth explained by health and a larger share attributed to other factors (including the liberalization of eligibility in the post-period), Vietnam veterans also experienced more sharply declining health over time. I find that these two factors roughly offset each other and I find that more of the program's growth in the post-period can be explained by worsening health for Vietnam cohort veterans than for the, healthier, non-Vietnam service cohort veterans.

The rest of the paper is organized as follows. In the next section, I provide background on the VADC program. Next, I provide a summary of prior literature on the effect of military service on health and the effect of VADC receipt on labor force participation of veterans. I then describe the empirical strategy I employ and the dataset used. Next, I present my empirical results and a series of robustness checks. The paper concludes with a discussion of the implications of the findings.

## Background

### VADC Overview

The VADC program provides monthly tax-free benefits to qualifying disabled U.S. veterans from the time they are approved for benefits until death. Benefits may also be paid to spouses, dependent children, and dependent parents, according to the severity of the disability. To qualify for benefits, a veteran must have been honorably discharged, and his or her disabilities must have been incurred or aggravated during military service (including both active service and service-connected duties). Qualifying conditions include both physical and mental

disabilities. This benefit is not means-tested, and beneficiaries can collect other benefits, such as SSDI and veterans' pension, simultaneously and without penalty.

The most frequent disabilities claimed for new recipients in 2013 were disabilities related to tinnitus (ringing in the ears), hearing loss, limitation of flexion (bending movements), lumbosacral or cervical strain, general scars, post-traumatic stress disorder (PTSD), and the limitation of motion of the ankle (Veterans Benefits Administration, 2013).

Application Process

A veteran may begin the application process shortly before or any time after an honorable discharge from active duty.[2] The application process begins with an initial Rating Board, composed of two non-medical and one medical personnel. This Board determines whether or not the claimed disabilities were service-connected. Claimants found to have service-connected disabilities then have their disabilities evaluated and subsequently rated.

All of the claimant's disabilities are rated using the Veterans Benefits Affairs' (VBA's) Schedule for Rating Disabilities. This schedule provides a set of possible disability ratings for each disability ranging from 0 to 100 percent – for example, 0, 30, 70, and 100 percent, with higher percentages reflecting a greater degree of impairment – and specifies the criteria to be used for each disability in determining the appropriate disability rating. The evaluation of mental disorders, for example, rates the disorder based on the level of occupational and social impairment.[3] Program applicants can apply for compensation for multiple injuries and

[2] In 2008, the VA facilitated the application process by implementing the Quick Start program, which allows veterans to apply early for VADC benefits in the two months before discharge (whereas previously, the requirement was at least 60 days in advance).
[3] For mental disorders, disorders are rated either 0, 10, 30, 50, 70, or 100 percent

disabilities, but the individual disability ratings are aggregated using a disability rating table, not directly added, to determine the final CDR.[4] Many veterans claim and receive benefits for multiple disabilities. The average number of disabilities per veteran in 2013 was 4.86 (Veterans Benefits Administration, 2013).

Combined Disability Rating and Benefits

CDR determines the base monthly benefit, an amount intended to reflect the average reduction in earning capacity resulting from the disability. The average monthly benefit increases with the assigned CDR: in 2013, the monthly benefit to a veteran with no dependents assigned a CDR of 10, 30, 50, or 100 percent was $131, $578, $1,041, or $2,858, respectively.[5] This disability rating scale differs from SSDI since the SSDI program deems applicants to be either 100 percent disabled or not disabled, and does not provide benefits for partial disabilities.

The CDR also determines a veteran's eligibility for other benefits. For example, a CDR greater than 30 percent entitles a veteran to allowances for dependents. Further, veterans found to be severely disabled may be eligible for support through the Special Monthly Compensation (SMC) program. This program provides additional cash payments to veterans with disabilities that resulted in the loss of certain organs and extremities, or to veterans who require the aid and attendance of another person. Additionally, at any time either the VA or the veteran can request a re-evaluation of a disability rating. This re-evaluation process is frequently initiated by veterans

[4] The disabilities are listed in descending order of severity and then combined with the use of the VA's Combined Ratings Table. To give an example, if there are three disabilities ratable at 40, 30, and 20 percent, respectively, the combined value for the first two disabilities will be found opposite the 40 and under the 30 in the top row of the table, which gives a value of 58. Then, the combined value for this 58 and 20 percent rating will be found opposite the 58 and below the 20 in the top row, which gives a rating of 66, so the assigned CDR would be rounded to 70 percent.

[5] VBA, Veterans Compensation Benefits Rate Tables, 2013.

who seek to increase their disability rating due to worsening health conditions or the development of new disabilities. This option led the VA to increase the disability ratings of 6 percent of program recipients in 2013 (Veterans Benefits Administration, 2013).

Liberalization of Medical Eligibility Requirements and Presumptive Conditions

Presumptive condition clauses are another feature of the VADC program. These clauses guarantee eligibility of receipt for veterans with certain illnesses and injuries without the necessity of proving the disability was service-connected. These policies are generally contingent on the circumstances of a veteran's active-duty service. Currently, these policies cover former prisoners of war; Vietnam veterans exposed to Agent Orange with symptoms corresponding to diabetes, ischemic heart disease, Parkinson's disease, and B-cell leukemia; and veterans who have served in Southwest Asia since the 1990s with symptoms corresponding to chronic fatigue, fibromyalgia, and other unexplained illnesses linked to environmental exposure. Additionally, beginning in 2010, veterans who claim post-traumatic stress disorder (PTSD) no longer need to document specific events that caused the conditions.[6]

One of these policy changes, the 2001 policy change that made type 2 diabetes a presumptively service-connected disability for Vietnam-war veterans, occurred during my sample period. This policy change resulted from a report by the National Academy of Sciences' Institute of Medicine that found there was "limited/suggestive" evidence of a linkage between exposure to Agent Orange and the onset of type 2 diabetes.[7] Upon release of this report in 2000,

[6] Prior to this policy proof of exposure to events such as bomb blasts, mortar attacks, or firefights needed to be presented to qualify for benefits.
[7] Agent Orange was an herbicide used by the U.S. military to defoliate trees in Vietnam, Cambodia, and Laos during the Vietnam War.

Acting Secretary of Veterans Affairs Hershel W. Gober declared type 2 diabetes a presumptive condition for affected veterans. In 2001, the House of Representatives unanimously passed a bill that, in addition to other changes, included Secretary Gober's addition of type 2 diabetes as a presumptive condition. Thus, beginning in 2001, any veteran who served in the "theater of combat" during the Vietnam War and was exposed to Agent Orange could claim VADC benefits for diabetes without proof of service-connectivity. In other words, these qualifying Vietnam-era veterans do not need to prove exposure to Agent Orange to receive benefits. This policy change broadened the presumptive conditions for Vietnam-era veterans who served Boots-on-the-Ground (BOG).

Liberalizing the medical eligibility requirements by making type 2 diabetes a presumptively service connected disability has been found to be a driver in the program's growth. Duggan et al. (2010) find that program enrollments for Vietnam-era veterans have risen rapidly compared to other cohort groups following this policy change. Autor et al. (2014) find that this change led to a significant increase in the share of Vietnam-era veterans receiving VADC benefits. As I discuss further below, the empirical strategy I employ does not incorporate this liberalization of program eligibility into my projections. Thus, by construction, the increase in enrollment that arises from this policy change (and its associated change in the relationship between health status and VADC receipt) will end up in the residual growth, the difference between the actual rate of VADC receipt and my projections.

## Prior Literature

Two branches of literature are relevant for my research on the growth of the VADC program. The first branch examines the effect of military service on later in life health status,

while the second branch studies the effects of changes to the VADC program.

The prevalence of health problems affecting veterans raises the question of how military service affects health and health behaviors. There is a large pool of literature that explores this relationship. This branch of literature is important for my research since it may be the case that the effect of military service on health is becoming more negative over time, leading to larger disparities in the health of veterans versus non-veterans over time and contributing to the growth of the VADC program.

In a cross-sectional comparison, Dobkin and Shabani (2009) find that veterans are in significantly worse health than their non-veteran counterparts. Further, they find that these differences increase with age. While this suggests military service may have a negative impact on health, one must interpret these differences cautiously. Veterans and non-veterans tend to differ in terms race, ethnicity, and educational attainment, all of which are correlated with adverse health outcomes; veterans may also differ in ways that are unobservable to the researcher but predispose them to having worse health outcomes.

Other papers find a similar negative relationship between military service and later in life health status. Bedard and Deschenes (2006) suggest a higher rate of premature mortality for WWII and Korean War-era veterans compared to their civilian counter-parts. These higher rates are especially striking for those veteran cohorts with higher combat-related military participation rates. The authors also find these higher rates of mortality are attributable to lung cancer and various heart conditions. However, this paper is similar to the previously mentioned papers in that it does not control for potential underlying differences between veterans and non-veterans.

In addition to physical disabilities, several studies have examined the effect of military service on the prevalence of mental disorders. Hoge et al. (2004) find that individuals who

served in Iraq have significantly higher rates of mental health problems (including PTSD), depression, and substance abuse after returning home from combat than before they were deployed. Prior to being deployed to Iraq, approximately 9.3 percent of men scheduled to be deployed reported cases of PTSD compared to 15.6 to 17.1 percent of men reporting cases after serving in Iraq. Similarly, Card (1987) finds evidence that exposure to combat leads to symptoms significantly related to PTSD. Card finds that 19 percent of Vietnam-era veterans had PTSD at age 36, whereas for other comparable groups, only 12 percent of these individuals reported cases of PTSD.

Angrist et al. (2009) provides an analysis of the effect of military service on health, which allows a more precise causal estimate of the effect. The authors use the Vietnam draft lottery to study the long-term effects of Vietnam-era military service on health and work. Although the authors find no significant effects on work-related disability status for the general Vietnam-era veteran population, they find a strikingly large negative impact on employment and increase in non-work related disability rates for white men with low earnings potentials.

The other relevant branch of literature explores how changes in program eligibility have contributed to the growth of the VADC program. Autor et al. (2014) use the 2001 liberalization of medical eligibility requirements that affected only "boots-on-the-ground" (BOG) Vietnam-era veterans. The authors find that this policy change led to a rapid rise in enrollments for BOG veterans relative to non-BOG veterans. This finding supports the findings by Duggan et al. (2010) of a surge in enrollments for Vietnam-era veterans relative to veterans of later service-cohorts following the 2001 policy change. Duggan et al. (2010) finds that the policy change increased VADC enrollment by 7.6 percentage points among Vietnam-era veterans. These authors further suggest that the policy change increased program expenditures by $2.69 billion

during 2006, and that sensitivity of the program to local economic conditions also dramatically increased. Similarly, Autor et al. (2011) find that the percent of Vietnam veterans receiving benefits increased from 10.7 to 16.5 percent from 1999 to 2006. When they exclude those Vietnam veterans who claim either diabetes or PTSD, the percent remains fairly stable at 8 percent over this same period. This provides suggestive evidence that liberalization of medical eligibility requirements leads to program growth.

These authors also examined the impact of eligibility changes on labor force participation rates. In comparing outcomes of Vietnam war BOG veterans to their non-BOG counterparts, the authors find that labor force participation rates fell for BOG veterans affected by the policy change, suggesting that VADC benefit receipt might provide an alternative to remaining in the labor force for low-skilled workers (Autor et al. 2014, Duggan et al. 2010). Autor et al. (2007) use the 2001 policy change and the fact that the VADC benefits are not work-contingent to assess the income effect of VADC on labor supply. The authors use the unanticipated increase in unearned income for the BOG Vietnam cohort veterans and find, as anticipated, that although the program does not have explicit work disincentives, the policy change led to a substantial reduction in the labor-force participation rates of Vietnam service cohort veterans.

These papers suggest that changing the program's medical eligibility criteria played a role in the growth of the program. Whereas many of these papers try to estimate the effect of military service on health and how changes to medical eligibility requirements have driven program growth, my paper examines how worsening veteran health, another potentially key factor, has contributed to the program's growth.

My empirical analysis follows an approach first implemented by Cutler et al. (2012). In their paper, the authors examine the relationship between health status and work capacity to

explore possible consequences of raising the Social Security early and normal retirement ages. Specifically they ask: given their estimates of the relationship between health and work at ages 59-61 (before Social Security benefits are available) and the actual health of 62-64 year olds (a group that is now eligible for Social Security benefits, but would not be if the early retirement age was raised), what share of 62-64 years olds might be expected to have the capacity to work? My empirical strategy will mimic that of Cutler et al (2012). I undertake a two-step decomposition exercise in which I first estimate the relationship between health characteristics and VADC receipt during an earlier period and then use this and the health characteristics of more recent veterans to determine how much of the program's growth can be explained by worsening health.

## Data

My analysis is conducted using data from the National Health Interview Survey (NHIS). The NHIS is an annual health survey of approximately 100,000 individuals. The NHIS is a valuable dataset because it has detailed information on physical and mental health, functional limitations, demographics (age, race, ethnicity, education), and household characteristics, as well as individual level data on veteran status and a proxy variable for VADC receipt.

This survey is used to track trends in health over time for both health behaviors and disabilities for the non-institutionalized U.S. population. The NHIS surveys adults in the continental U.S. over the age of 19; this sample of the population is designed to be representative of the U.S. population.

Data from this survey is available from 1957 to 2013, but my analysis will only use data from the 1998 to 2010 surveys. These survey years were selected because they span the periods

both before and during the VADC program's rapid growth, and because the variables of interest are available during these years. Specifically, my proxy variable for VADC receipt becomes available in 1998, and my variable for veteran status is only available until 2010. Since I am examining the veteran population, I have restricted the population to male veterans between the ages of 25 to 64 given that most veterans during this time period were males. I focus on veterans age 25 and above because few individuals below this age would have completed their military service and initiated VADC receipt. I end the sample at age 64 because the NHIS is only representative of the non-institutionalized population, and because institutionalization rates rise with age.

The health variables used to generate the projection in this basic model include measures of self-reported health status, activity limitations, and the causes of these activity limitations.[8] The health variables used in my analysis include those conditions that were previously mentioned as the most frequently claimed disabilities for VADC recipients (e.g. hearing problem). My final sample size for this basic model is 44,649 observations, with 17,247 veterans in the pre-period, and 27,402 veterans in the post-period. Thus, even with a relatively short pre-period, I still have a relatively large number of veterans to use in my basic empirical model. The main limitations of this dataset is that it lacks information on specifics of veteran status (period of service, type of service, location of service), and a variable for VADC receipt.[9] Table 2 presents descriptive statistics for the demographic averages of my sample for this basic model.

My proxy for VADC receipt is a variable that asks individuals if they have received disability insurance other than SSDI. To verify that this proxy variable actually captures VADC receipt, I show the percentage of the veteran population and non-veteran population reporting the

[8] A list of the variable included in the basic model are provided in Table 1
[9] Although period of service is not given, in a later model I use birth cohort to approximate service cohort.

receipt of other disability insurance benefits throughout the years of interest in Figure 3. It is assuring that reported receipt of other disability insurance among veterans rises from 5.8 percent to 10 percent over the 1998 to 2010 time period, consistent with the rise in beneficiaries seen in Figure 1. Although these values are somewhat smaller than the values Coile et al. (2015) report for the veteran population based on administrative data, the smaller values in the NHIS are consistent with the well-known underreporting of benefit receipt in major household surveys (Meyer et al. (2008)). Also, by design, the NHIS is representative of the non-institutionalized, civilian population, and as such, I would expect the number of individuals reporting inhibiting disabilities to be less than if institutionalized individuals were included in the dataset. For non-veterans, receipt is flat over time at around 1.2 percent. There are several reasons why receipt for non-veterans is not 0 percent. Some non-veteran respondents may be receiving VADC benefits as the spouse or dependent of a VADC beneficiary; alternatively, this variable may capture receipt of private disability benefits, workers' compensation, and other disability insurance benefits. Given these summary statistics, this proxy variable seems to be primarily capturing VADC receipt.

## Empirical Strategy

Overview

My empirical analysis will adapt an approach originally implemented by Cutler et al. (2012) in order to estimate the work capacity of individuals ages sixty-two and older if the Social Security normal and early retirement ages were to be raised. My project will use this method as part of a decomposition exercise which first estimates the relationship between health characteristics and VADC receipt during a period when the program size was relatively stable

and then use these estimates along with the actual health status of more recent veterans to project how much of the program's growth can be explained by veterans' worsening health and how much may be due to other factors.

The first stage of my analysis will estimate the relationship between health characteristics and VADC receipt for veterans using data from 1998 to 2001, a period when enrollments were relatively stable. I run the model:

$$VADC\_Receipt_i = \beta_0 + \beta_1 Health_i + \beta_2 X_i + e_i$$

where i indicates an individual veteran and *VADC_Receipt* is the proxy variable described above. In this model *Health* includes variables such as self-reported health status, self-reported activity limitations, and the specifics of the causes of the activity limitation. The *X* variable is a vector that includes other identifying covariates such as single year of age dummies, race (black and other), Hispanic ethnicity dummies, education level dummies, marital status dummies, and a citizenship status dummy variable.[10]

Next, I use data from the 2002 to 2010 period. In this step, I take the coefficients ($\hat{\beta}$s) from step one along with the actual health characteristics of veterans from 2002 to 2010 to project program usage. In step two I run the projection:

$$\widehat{VADC\_Receipt_i} = \widehat{\beta_0} + \widehat{\beta_1} Health_i + \widehat{\beta_2} X_i + e_i$$

This projection is made under the assumption that veterans of any given health status would be no more likely to be on the program in the post-period than they were in the pre-period, meaning that the relationship between health and VADC receipt should be the same in the pre- and post-periods. It is possible that this assumption would not hold in reality since factors such

[10] Those individuals reporting non-citizenship status are individuals who still report having served in the U.S. Armed Forces.

as the liberalizations of medical eligibility criteria could make veterans with a given health status more likely to be on the program in the post-period. However, doing the calculation with this assumption allows me to estimate what the program growth would be, based solely on worsening veteran health over time.

The projected share of the post-period (2002-2010) sample receiving VADC benefits is then compared to the actual share reporting VADC benefits. Essentially, this is a decomposition exercise that asks: how much of the program growth is due to worsening health and how much is due to an increased tendency to use the program for a given level of health? If the actual share of veterans receiving benefits exceeds the projection, this suggests that factors other than worsening health are contributing to the program's expansion. This finding is relevant because it implies that factors such as a weak economy, changing program roles, more awareness of the program, or changes in medical eligibility criteria may be driving the growth.

Trends in the Health Status of Veterans

This paper asks how much of the growth of the VADC program can be explained by trends in veterans' health. This question presupposes that the health of veterans has been getting worse over time. In this section, I explore whether this is the case.

Several self-reported health measures suggest a decline in veteran health over time. Figure 4 presents trends in self-reported health status, and shows that the percentage of veterans reporting fair or poor health has been increasing over the period used in my analysis, from 11.7 percent of veterans in 1998 to 16.3 percent by 2010. This represents a nearly 40 percent increase, relative to the initial level. Further, veterans reporting any activity limitation has also been increasing over this same time period, from 15 percent of veterans to 19.5 percent, or by 30

percent relative to the baseline level (Figure 5). One possible factor contributing to the worsening health of veterans over time is the aging of the veteran population. However, adjusting for age does not have a strong effect on this trend, as shown on Figures 4 and 5. Other health variables used in the analysis follow a similar trend of worsening health over time. These self-reported health measures suggest that current veterans are in fact experiencing worse health conditions than in prior years.

Table 1 shows the percent of veterans reporting a given health limitation in the pre- and post-periods as well as the ratio of these two figures, which reflects the change in likelihood of a veteran reporting that limitation in the post-period relative to the pre-period.[11] Unsurprisingly, given the data shown in Figures 4 and 5, these summary statistics show that there is a statistically significant increase between the pre- and post-period for the two key health measures, the share of the sample in fair or poor health and the share reporting an activity limitation. The other activity limitation measures on the table reflect the share of the sample reporting an activity limitation linked to a specific medical condition, and there are statistically significant increases between the pre- and post-periods for many of these measures as well. The largest increases are for those reporting limitations resulting from circulatory problems (2.19 times more likely to be reported in the post-period) and musculoskeletal issues (2.14 times more likely to be reported in the post-period). These summary statistics support the paper's premise that the veteran population is experiencing worsening health over time.

## Results

Baseline Results

[11] These means are based on the population of veterans used in the basic specification model

My paper asks what share of the VADC program growth can be explained by worsening health, and we can now answer that question by comparing the projected program usage to the actual reported receipt in the NHIS.

In Table 3, I show baseline results that reflect the relationship between VADC receipt and health, estimated using my main specification model. Column 1 shows results for the pre-period. This basic regression model includes controls for year of age fixed effects as well as controls for demographic characteristics.[12] The coefficients for fair and poor health mean that, relative to a veteran in excellent health, the omitted category, a veteran in fair health is 6.5 percentage points more likely to report VADC receipt, while veterans in poor health are 9.7 percentage points more likely. To put this in context, the mean rate of VADC receipt in the pre-period is 5.37 percent, so a 9.7 percentage point increase in the probability of VADC receipt would represent a 181 percent increase, relative to the mean. Similarly, the coefficient for reporting any activity limitation reflects that, relative to a veteran who does not report an activity limitation, having an activity limitation makes a veteran 13.7 percentage points more likely to report VADC receipt. Given the 5.37 percent mean rate of VADC receipt in the pre-period, the 13.7 percentage point increase in likelihood of VADC receipt for those veterans with an activity limitation represents a 255 percent increase relative to the mean. The remaining variables relating to activity limitations show the effect of having an activity limitation caused by a specific medical conditions on VADC receipt. For these variables, the coefficient reflects the differential impact on the likelihood of program receipt relative to the main effect of reporting any activity limitation, which is the 13.7 percentage point increase. I do not have any expectations for the direction and magnitude of these coefficients, however the results of the F-

[12] When this model is run without year of age fixed effects, and without demographic controls, there are negligible effects on the coefficients.

statistic is significant, meaning we can reject the hypothesis that the coefficients are jointly equal to zero; including this set of variables does help us to explain VADC receipt.[13]

The coefficients from this regression form a relationship between VADC receipt and health. This relationship is then applied to those veterans in the post-period, along with their actual health and demographic characteristics, to project expected program receipt in this later period. For the purpose of this projection, I assume that a veteran of any given health status would be no more likely to claim program receipt in the post-period than he was in the pre-period, as I am interested in estimating the share of program growth that results only from worsening veterans' health. If the relationship between health status and receipt has changed over time (for example, if veterans with a given health status have become more likely to be receiving VADC benefits), the effect of this would be included in the residual (unexplained) part of the program's growth. The coefficients for the actual post-period relationship between VADC receipt and health are presented in column 2 of Table 3. Although the post-period results are not used in the projection, these coefficients can be used to understand if the relationship between health and VADC receipt has changed from the pre- to the post-period.

Returning to the details of my projection exercise, the actual growth of the program is found by differencing the sample mean for VADC receipt in post-period from the sample mean for VADC receipt in the pre-period. The sample mean in the post-period is 7.80 percent, and the pre-period sample mean is 5.37, giving an observed program growth of 2.43 percentage points. My model aims to decompose this growth into the growth due to worsening veterans' health and the growth due to other residual factors. My projected post-period receipt is 5.96 percent, an estimate arrived at by combining the estimates from Table 3 and the actual health and

[13] The F-test is statistically significant at the 1 percent level, and is shown in Table 1.

demographic characteristics of veterans in the post-period (summarized in Tables 1 and 2). This projection of 5.96 percent reporting VADC receipt in the post-period represents a 0.59 percentage point growth relative to the pre-period sample mean. Thus, my model is only able to explain 24.28 percent of the program's growth (0.59/2.43), or much less than half, based on observable changes in health and other characteristics. As such, the majority of the program growth is due to residual factors, including the liberalization of medical eligibility criteria, the recession, and other previously discussed explanations. Figure 6 depicts the results of this projection model.

To account for sensitivity in the variability of sampling, I calculate a 95 percent confidence interval around my point-estimate of worsening health status explaining 24.28 percent of the program's growth by running 1000 bootstrap iterations of my projection model. This bootstrapping exercise generates a 95 percent confidence interval around my estimate, and shows that as little as 15.85 percent, and as much as 35.35 percent of the growth can be explained by worsening health. This confidence interval further supports that the worsening health status of veterans explains less than 50 percent of the program's growth.

Further, when I use the model to predict program growth for each individual year in the post-period, the percent of the program's growth attributable to worsening veteran health falls over time. In 2002, my model projects that 5.69 percent of veterans would report VADC receipt, 0.68 percentage points less than the sample mean receipt of 6.37 percent in 2002. This difference between projected and actual growth becomes much larger by 2010. In 2010, my model projects 6.46 percent of veterans would report VADC receipt, which is 3.48 percentage points less than the sample mean of 9.94 percent of veterans. This finding suggests that the effect of other

factors, such as the liberalization of medical eligibility, on VADC receipt is growing over time. The results of this year-by-year projection model are depicted in Figure 7.

One concern about my analysis is the changes over time in the demographic characteristics of my sample as presented in Table 2. One way in which the samples differ is age. This would be problematic if there is a relationship between age, health, and VADC receipt, as a model that simply controls for health and age would not address this relationship. For example, this problem would arise if, at a given level of health, older veterans are more likely to be VADC recipients. As a robustness check, I explore this in a model that adds interaction terms between age as a linear variable and health. The results from this projection are presented in Appendix Figure 1. The interaction has no significant impact on my results and findings from this enhanced model are very similar to those from the basic model without these interaction terms.[14]

Another possible concern with my analysis would arise if I have not adequately controlled for all dimensions of health. For example, it could be the case that health declines by more than is captured in my health measures. This would lead me to underestimate the share of the program's growth due to worsening veterans' health. To explore this, I estimate a new, extended version of my basic model with more health variables. This extended model includes health variables that capture whether individuals have ever been diagnosed with specific medical conditions (e.g. cancer) as well as more indicators of mental health.[15] The addition of these variables expands on my basic model since the health variables in my basic model only showed whether an individual had any functional limitation caused by a given condition, not whether they had ever been diagnosed with it.

[14] This model shows the percentage of growth resulting from worsening health conditions at 23.46 percent, only a 0.82 percentage point difference from the basic model without age interaction terms.
[15] Descriptive statistics on the health variables used in this comprehensive model can be found in Appendix Table 1

Although this model controls for a more comprehensive set of health variables, there is a tradeoff in sample size. This extended model, in controlling for more health variables, restricts me to a smaller sample due to missing data, since these questions are only asked of NHIS respondents who receive the "Sample Adult" questionnaire, which is about 40 percent of all NHIS respondents. The use of a smaller sample is expected to raise the standard errors on the regression coefficients. In my analysis, restricting to this sample population results in 7,830 observations in the pre-period and 12,628 in the post-period.[16] I explore the effects of adding these additional health variables by first running my basic model on the smaller sample population and then comparing the projection results with the results of the extended model, a model which is also run using the smaller sample population.

To better compare my models with the different populations and different health variables, I first run a model of my basic specification, but limit the population to that of the sample population. Columns 1 and 2 of Table 4 show regression results for the pre-period coefficients for the basic model run on the full population and sample population, respectively. The first column shows the basic specification model. This model with the sample population has a sample mean of 5.80 percent of veterans reporting VADC receipt in the pre-period, and a sample mean of 8.98 percent in the post-period. This gives an observed program growth of 3.18 percentage points (somewhat higher than the 2.43 point growth in the full sample). My basic projection model predicts that 6.56 percent of veterans to be receiving benefits in the post-period. As such, this model, on the limited population, shows health explaining 23.90 percent of the program growth. This value is quite similar to the result reported above for the full sample, 24.28 percent. I again used 1000 bootstrap iterations and estimated a 95 percent confidence

[16] Descriptive statistics on the demographic information of the sample population can be found in Appendix Table 2

interval which shows that worsening health explains as little as 12.92 percent and as much as 36.87 percent of the program's growth.

Next, I again use this sample population, but add the more comprehensive set of health variables to the model. In this extended model, the F-statistic is again highly significant, so we can again reject the hypothesis that the effects of the health variables are equal. Column 3 of Table 4 presents the regression coefficients for this extended model with the comprehensive health variables on the sample population. Since the sample population is the same in this model as in the model discussed above, the program growth I attempt to explain is the 3.18 percentage points. This extended model projects 6.59 percent of veterans to be receiving benefits in the post-period, a difference of only 0.03 percentage points from the 6.56 percent projected in the basic model above. This extended model, although it controls for a much more comprehensive set of health variables, still only shows worsening health as explaining 24.84 percent of the program growth. The 1000 bootstrap iterations gives a 95 percent confidence interval which shows worsening health as explaining anywhere from 13.20 percent of the growth to 37.82 percent of the program's growth. The results of this projection model, which compares all three models, is presented in Figure 7.

Overall, the addition of these health variables increased the explanatory power of worsening health as a driver of program growth by less than one percentage point (from 23.90 percent to 24.84 percent). Further, the $R^2$ in the basic model with the sample population is 0.110 and the $R^2$ is 0.117 in the comprehensive model, suggesting that the comprehensive model only explains 0.7 percentage points more variation than the basic model. Since the addition of these variables did not drastically change my primary findings, and given that the sample adult population is a population already more inclined to be program recipients, the projection model

with the more concise set of health variables, ran on the full population, continues to be my basic specification model. This model suggests that only 24.28 percent of the growth is the result of worsening health.

These results are suggestive of the effect we expect and appear to be consistent with prior literature that highlights factors other than worsening health as potential sources of growth.

Results by Vietnam Status / Assessing Effects of Medical Eligibility Expansion

To look more closely at the extent to which the liberalizations of program eligibility criteria may have contributed to the growth of the VADC program, I divide my population into two groups. The first is the Vietnam veteran service cohort, and the second is a group comprised of all other veterans. Using this distinction, I report results separately for the Vietnam veteran service cohort and the non-Vietnam cohorts, to explore whether worsening health is responsible for more or less of the program growth for the Vietnam cohort. I separate these service cohorts into Vietnam and non-Vietnam cohorts because of the addition of type 2 diabetes as a presumptive condition resulting from exposure to Agent Orange, which took effect at the end of 2001 and only pertains to veterans who served in the Vietnam War.[17] Since my model estimates the relationship between VADC receipt and health from 1998 to 2001, the eligibility changes from the addition of diabetes as a presumptive condition would not be captured in my model. As such, any changes in probability of VADC receipt resulting from the policy change will appear in the residual growth. This exercise is less than perfect since I cannot determine whether a veteran served boots on the ground and thus was affected by the policy change; however,

[17] More specifically, this change only affected Vietnam veterans who served boots on the ground (BOG) in Vietnam, Laos, or Cambodia; however, as discussed earlier, the NHIS has insufficient data on military service to distinguish between BOG and non-BOG veterans.

narrowing in on the Vietnam service cohort will provide a better estimate of the impact of the policy change than looking at veterans overall, although the effect is still diluted by the inclusion of ineligible non-BOG Vietnam veterans.

Although the NHIS does not provide information on service cohort, I can use birth cohort as a proxy since it is strongly related to veteran service cohort. I replicate the method used in Coile et al. (2015) to identify a veteran's service cohort from his birth cohort. In this method, a service cohort is treated as covering those birth cohorts where a majority of individuals in that birth cohort had their first period of military service in that military conflict. For individuals born in 1942, the most common first service was during the peacetime period between the Korean and Vietnam Wars; for those born in 1955, the most common first service was during the peacetime period after the end of the Vietnam War in 1975. For cohorts born between 1943 and 1954, the most common first service was in the Vietnam War.

Following this method, I use the birth cohort of 1943 to 1954 to represent the Vietnam service cohort. This method, under the basic specification model, yields 7,234 Vietnam War veterans in the pre-period and 12,649 in the post-period, and 9,247 non-Vietnam veterans in the pre-period and 13,080 in the post-period. Summary statistics on demographic and health variables separated by service cohort and period are presented in Tables 7 and 8.

I first make projections for the Vietnam and non-Vietnam samples maintaining the assumption that the relationship between health and VADC receipt is the same for all veterans. Thus, the coefficients initially used to project program receipt in the post-period are the same coefficients presented in Table 3. I find that the sample mean of veterans reporting VADC receipt in the pre-period is much larger for Vietnam veterans – 6.28 percent vs. 4.74 percent. I also find that Vietnam veterans have faster growth in program receipt over the period, as the

share of the sample reporting VADC benefits rises by 3.03 percentage points for Vietnam veterans vs. 1.92 percentage points for other veterans. Further, Tables 5 and 6 show that the changes over time in health and demographic characteristics are different for these two groups. Vietnam veterans are getting older and sicker in the post-period, but their other demographic characteristics remain relatively unchanged from the pre- to the post-period (as might be expected because the birth cohorts in this sample are fixed, so any changes over time in demographic characteristics are due to sampling variation or differential mortality). The non-Vietnam cohorts are not aging as quickly since there are both older veterans aging out my sample of veterans age 25 to 64 and younger veterans entering my sample; in addition, the other demographic characteristics of the sample change more over time, likely as a results of the change in birth cohorts included in the sample.

Ultimately, these changes end up driving the results. My model projects growth in VADC receipt for Vietnam veterans based on the fact that the Vietnam sample is sicker (and older) in the post-period. I also project growth in VADC receipt for the non-Vietnam veterans, but this growth seems to be due to changes in their other observable characteristics that make them more likely to be on the program. More specifically, I estimate that the projected growth in VADC receipt for Vietnam veterans between the pre- and post-periods would be 0.84 percentage points. This is 2.19 percentage points less than the observed growth of 3.03 percentage points. As such, this model suggests that worsening health can explain 27.72 percent of the growth, similar to the 24.28 percent explained for the entire population. The 1000 bootstrap iterations generates a 95 percent confidence interval which shows worsening health explaining as little as 9.21 percent to 44.96 percent of the program's growth. Program receipt for the non-Vietnam group is projected to grow 0.26 percentage points, while the observed growth was 1.92 percentage points. As such,

the models explain 13.54 percent of this growth. For the non-Vietnam cohort, the 1000 bootstrap iterations shows worsening health explaining as little as -7.56 percent to 31.72 percent of the program's growth. Ultimately, I do not have enough precision to rule out the possibility that my projection explains 0 percent of the program's growth. However, my upper bound of 35.73 percent gives me confidence that changes in the health status of the veteran population cannot explain 100 percent of the VADC program growth among non-Vietnam cohort veterans. Since the non-Vietnam cohort population did not become much sicker from the pre- to the post-period, it is not surprising that health explains very little of the program's growth; indeed, the projected growth in the program is due to shifting demographic characteristics, not worsening health. Since the 95 percent confidence intervals overlap, I cannot reject the hypothesis that the amount of program growth explained by worsening health for the Vietnam cohort veterans and non-Vietnam cohort veterans is the same.

An alternate approach is to relax the assumption that the relationship between health and VADC receipt is the same for both the Vietnam and non-Vietnam cohorts. This model runs the projection separately for both groups.[18] As such, the coefficients used to generate the projection are now different for the two cohorts.[19] The relationship between health and VADC receipt for the two groups, as depicted by the regression coefficients, is somewhat different when this

[18] This model includes age as a linear variable rather than as individual year of age dummies. This change to the model was made to reflect that, since the Vietnam and non-Vietnam service cohorts were generated using birth cohorts, each cohort group would be missing certain ages in both the pre- and post-periods. For example, the pre-period analysis for the Vietnam cohort only includes veterans who are between the ages of 43 and 58, and the post-period includes individuals who are between the ages of 47 to 64. As such, a model with year of dummy variables would not be able to capture the relationship between health and a 64 year old individual since there were no 64 year olds in the pre-period.

[19] The regression coefficients for the pre- and post-periods by Vietnam and Non-Vietnam service cohorts are presented in Appendix Table 3. An interesting point to note is the relationship between diabetes and likelihood of VADC receipt for Vietnam service cohort veterans in the pre- and post-periods. In the pre-period, a Vietnam veteran reporting a limitation from diabetes was 3.32 percentage points more likely to report program receipt. In the post-period, reporting a limitation from diabetes makes a Vietnam veteran 12.3 percentage points more likely. An 8.98 percentage point change from the pre- to post-period.

assumption is relaxed. In this alternate approach, the health coefficients are now larger for Vietnam veterans.

The model for the Vietnam service cohort veterans shows 6.28 percent of these veterans reporting VADC receipt in the pre-period and predicts 8.23 percent of these veterans to be on the program in the post-period. As such, the projected growth is 1.95 percentage points. This is less than the actual growth of 3.03 percentage points. For Vietnam War service cohort veterans, worsening health now explains 64.36 percent of the program's growth.[20] The results of this analysis are presented in Figure 8. This projection is much higher due to the large coefficients on the health variables (Appendix Table 3). However, even though the Vietnam cohort veterans are getting sicker over time, worsening health still explains less than 75 percent of the program's growth. This supports expectations based on the prior literature that changes to the medical eligibility criteria have a sizable impact on the number of program beneficiaries. The Agent Orange decision in 2001 appears to have led more members of the affected service cohort to apply and subsequently receive VADC benefits, a growth in the program not explained by the projection based on the pre-period relationship between VADC receipt and health.

The model with only non-Vietnam service cohort veterans showed 4.74 percent of these veterans reporting VADC benefits in the pre-period, and my model projects that the program would shrink and have fewer program recipients in the post-period. This corresponds to the fact that the non-Vietnam service cohort veterans are not in worse health over time. My model predicts 4.72 percent of veterans to report VADC receipt in the post-period. This is a projected growth of -0.02 percentage points, 1.94 percentage points less than the actual growth of 1.92

[20] The 1000 bootstrap iterations gives a 95 confidence interval which shows that worsening health status could explain as little as 30.58 and as much as 107.42 percent of the program's growth. As such, this analysis is sensitive to sampling and the model cannot rule out that observed program growth was entirely due to the worsening health status of veterans.

percentage points (to 6.46 percent of these veterans reporting program receipt in the post-period). As such, for non-Vietnam service cohort veterans, my model shows worsening health explaining -1.04 percent of the program's growth.[21]

Overall, this analysis by service cohort does not support the hypothesis that worsening health would explain less of the program's growth for Vietnam veterans due to the liberalization of the medical eligibility criteria. Ultimately, since the Vietnam service cohort veterans become sicker in the post-period relative to the pre-period, and since the non-Vietnam cohort veterans do not become sicker, these changes in health status outweigh any possible effects of the liberalization of the medical eligibility criteria. The summary statistics on the percentage of veterans reporting any activity limitation underscores this offsetting effect caused by the changes in health status.

## Discussion and Conclusion

These results show that the growth in the VADC program is not solely the result of worsening veteran health. More precisely, regardless of the model used, less than 50 percent of the program growth can be explained by worsening health conditions. This main result passes several robustness checks that include interacting the health variables with age, and running the projection with a more comprehensive set of health variables.

The concept that the program is not only growing due to worsening health conditions is not unique to this paper, rather, this is consistent with prior studies that have examined labor force participation and program receipt. An alternate explanation provided in those papers is that the additional liberalization of medical eligibility criteria and an increase in the number of

[21] The 1000 bootstrap iterations generate a 95 percent confidence interval which shows worsening health can explain as little as -13.87 percent and as much as 11.90 percent of the program's growth.

presumptive condition clauses have also contributed to the program's growth. In this paper, I present new evidence suggesting that this explanation as a driver of the program's growth. Upon examining the differential effects for Vietnam versus non-Vietnam cohort veterans, it seems that the policy changes that liberalized eligibility for Vietnam veterans resulted in the program's growth since, when isolating the Vietnam cohort population, worsening health still explains only 64.36 percent of the growth. This provides preliminary evidence that the rapid growth in the program may be the result of the liberalization of medical eligibility criteria.

The findings in this paper raise the question of whether the rapid growth of the VADC program has been inefficient. Evidence presented in the existing literature on the program (Autor et al. (2014)) suggest that it may have been, in that VADC receipt grew very rapidly after the diabetes eligibility change among those made newly eligible for benefits. However, if the initial level of program use was too low, meaning that many people with health problems were not on the program when they should have been, this growth could be efficient. Ultimately, further research is warranted on the growth of this program for which the budget is an ever-increasing share of federal budget and shows no sign of slowing down. Further discussion to address the program's growth, whatever the main cause may be, merits our attention.

## References


Agent Orange Review: Information for veterans who served. (2001, October). 18(1), 1-15.

Angrist, J.D., Chen, S., & Frandsen, S. (2009). Did Vietnam Veterans Get Sicker in the 1990s? The Complicated Effects of Military Service on Self-Reported Health. *National Bureau of Economic Research Working Paper* No. 14781.

Autor, D., & Duggan, M. (2007). Distinguishing Income from Substitution Effects in Disability Insurance. *The American Economic Review, 97(2),* 119-124.

Autor, D., Duggan, M., & Lyle, D. (2011). Battle Scars? The Puzzling Decline in Employment and Rise in Disability Receipt among Vietnam Era Veterans. *The American Economic Review, 101(3),* 339-344.

Autor, D., Duggan, M., Greenberg, K., & Lyle, D. (2014). The Impact of Disability Benefits on Labor Supply: Evidence for the VA's Disability Compensation Program. *Discussion Papers 14-010, Stanford Institute for Economic Policy Research*.

Bedard, K., & Deschenes, O. (2006). The Long-Term Impact of Military Service on Health: Evidence from World War II and Korean War Veterans. *The American Economic Review, 96(1),* 176-194.

Card, J. J. (1987). Epidemiology of PTSD in a National Cohort of Vietnam Veterans. *Journal of Clinical Psychology*, *43*(1), 6–17.

Coile, C., Duggan, M., & Guo, A. (2015). Veteran's Labor Force Participation: What Role Does the VA's Disability Compensation Program Play? *National Bureau of Economic Research Working Paper Series* No. 20932.

Congressional Budget Office (2014). Veterans' Disability Compensation: Trends and Policy Options. Pub. No. 4617, August.

Cutler, D. M., Meara, E., & Richards-Shubik, S. (2013). *Health and Work Capacity of Older Adults: Estimates and Implications for Social Security Policy* (SSRN Scholarly Paper No. ID 2577858). Rochester, NY: Social Science Research Network.

Dobkin, C., & Shabani, R. (2009). The Health Effects of Military Service: Evidence from The Vietnam Draft. *Economic Inquiry, 47(1),* 69.

Duggan, M., Rosenheck, R., & Singleton, P. (2010). Federal Policy and the Rise in Disability Enrollment: Evidence for the VA's Disability Compensation Program. *Journal of Law and Economics* 53:379-398.

Hoge, C. W., Castro, C., Messer, S., McGurk, D., Cotting, D., & Koffman, R. (2004). Combat Duty in Iraq and Afghanistan, Mental Health Problems, and Barriers to Care. *The New England Journal of Medicine, 351(1),* 13-22.

Meyer, B. D., & Sullivan J. X. (2008). Changes in Consumption, Income, and the Well-Being of Single Mother Headed families. *American Economic Review* 98(5):2221-2241.

Minnesota Population Center and State Health Access Data Assistance Center, *Integrated Health Interview Series: Version 5.0*. Minneapolis: University of Minnesota, 2012.

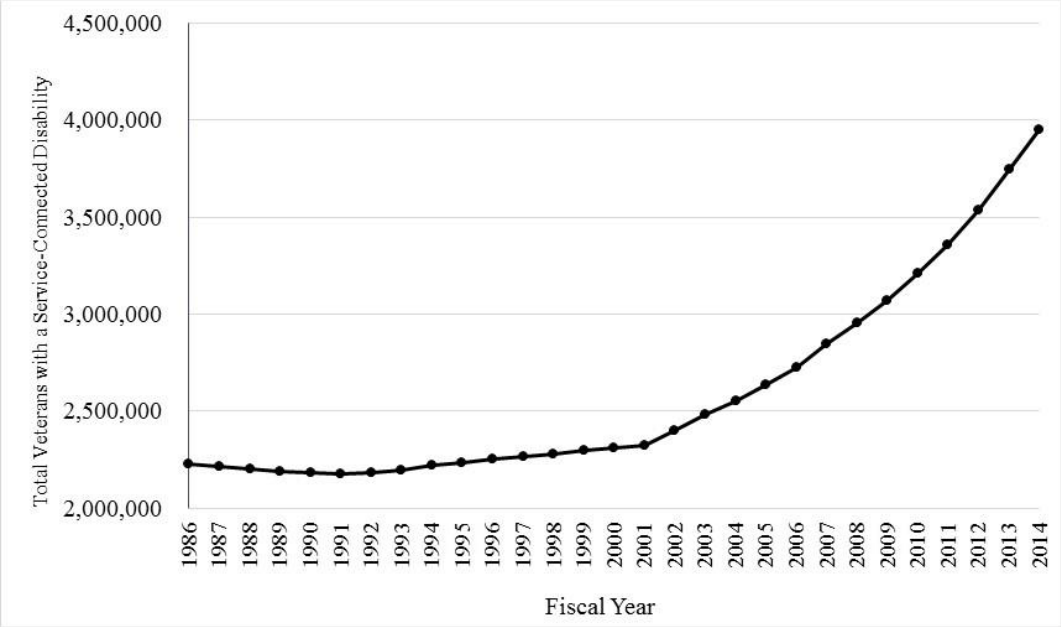
Office of Family Assistance (2014). TANF Financial Data: Fiscal Year 2013.

United States Department of Veteran Affairs (2013). Veterans Compensation Benefits Rate Tables- Effective 12/1/13.

Veterans Benefits Administration (2013). Annual Benefits Report: Fiscal Year 2013.

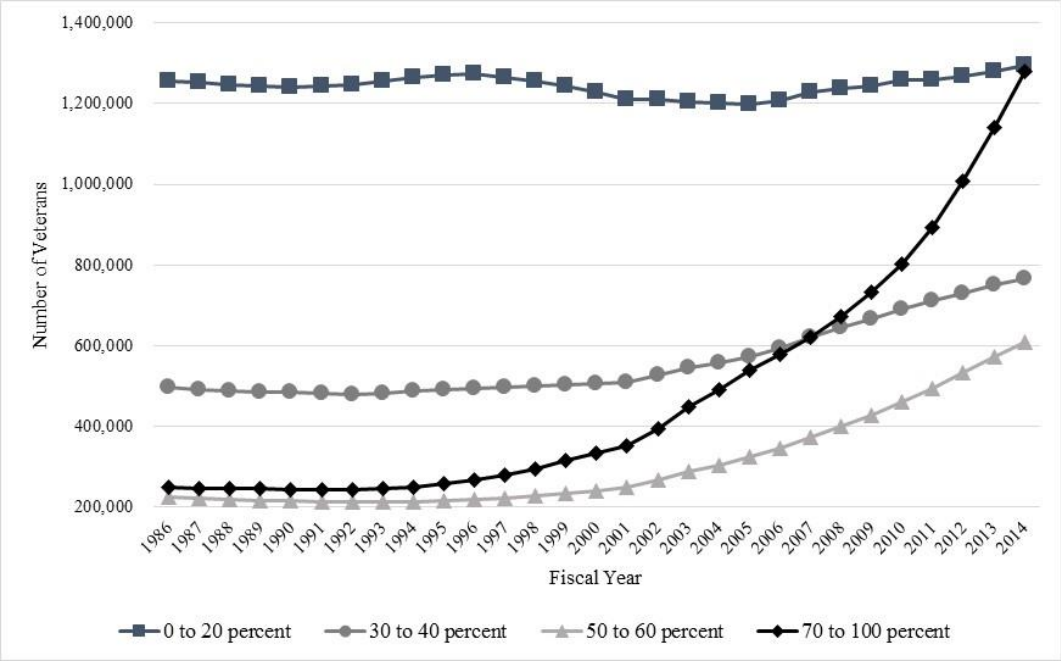
## Figures

**Figure 1: Growth in the VADC Program over Time: Total Veterans receiving VADC benefits from 1986 to 2014**



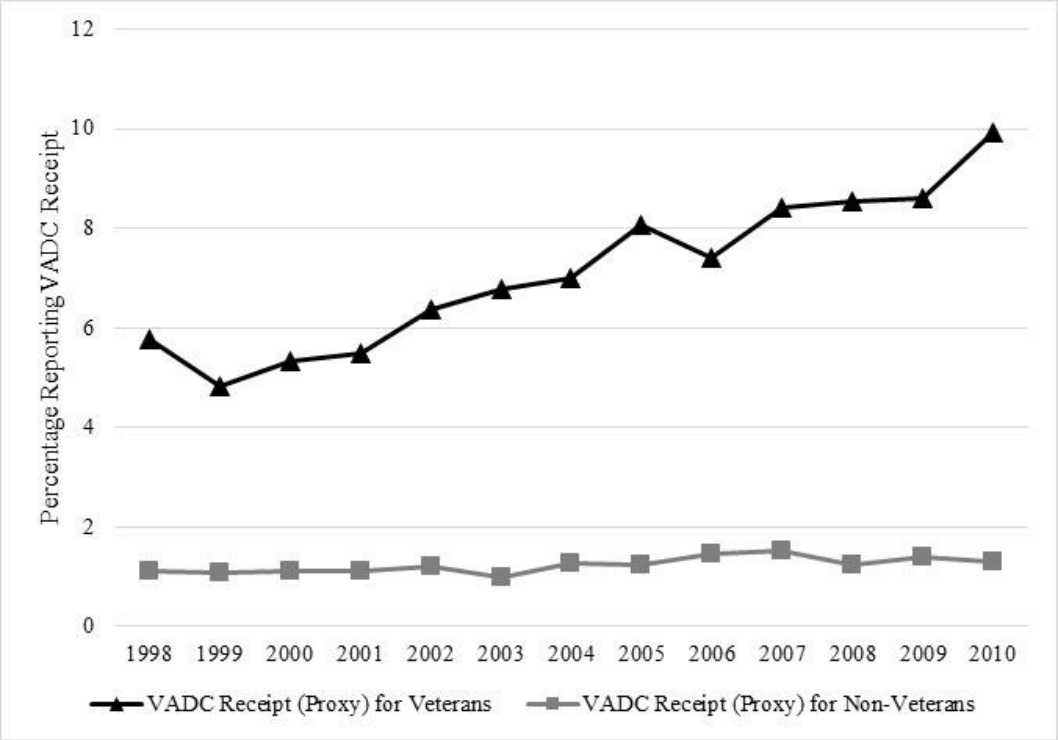

Source: Department of Veterans Affairs, Veterans Benefits Administration; 1985-1998: COIN CP-127 *Reports;* 1999-2014: *Annual Benefits Report*.

**Figure 2: Service-Connected Disabled Veterans by Disability Rating Groups: 1985 to 2014**



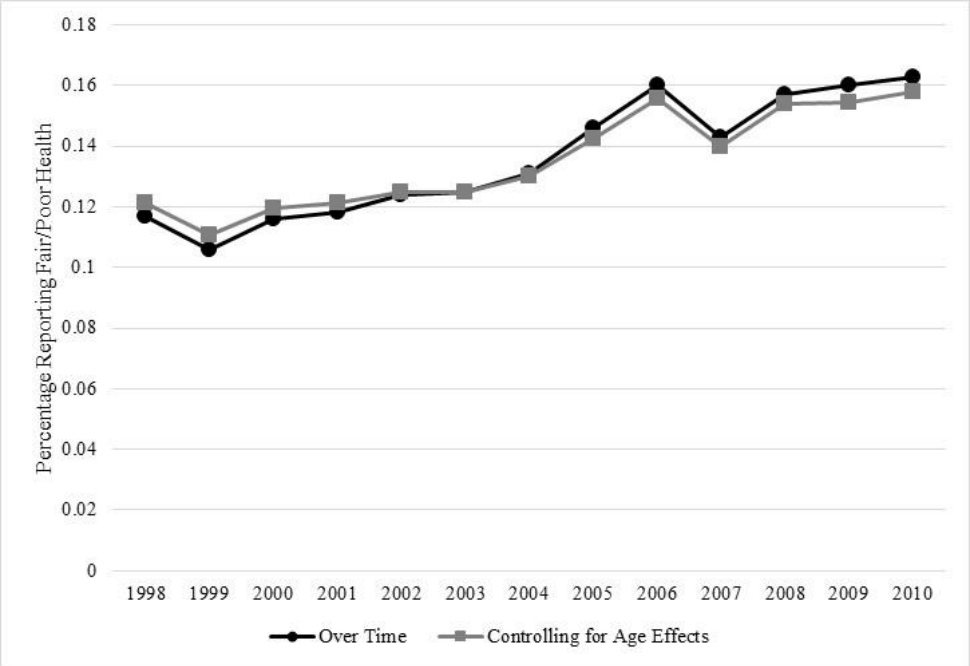

Source: Department of Veterans Affairs, Veterans Benefits Administration; 1985-1998: *COIN CP-127 Reports*; 1999-2013: *Annual Benefits Reports*.
Prepared by the National Center for Veterans Analysis and Statistics.

**Figure 3: Percentage of Veterans and Non-Veterans Reporting VADC Receipt over Time**



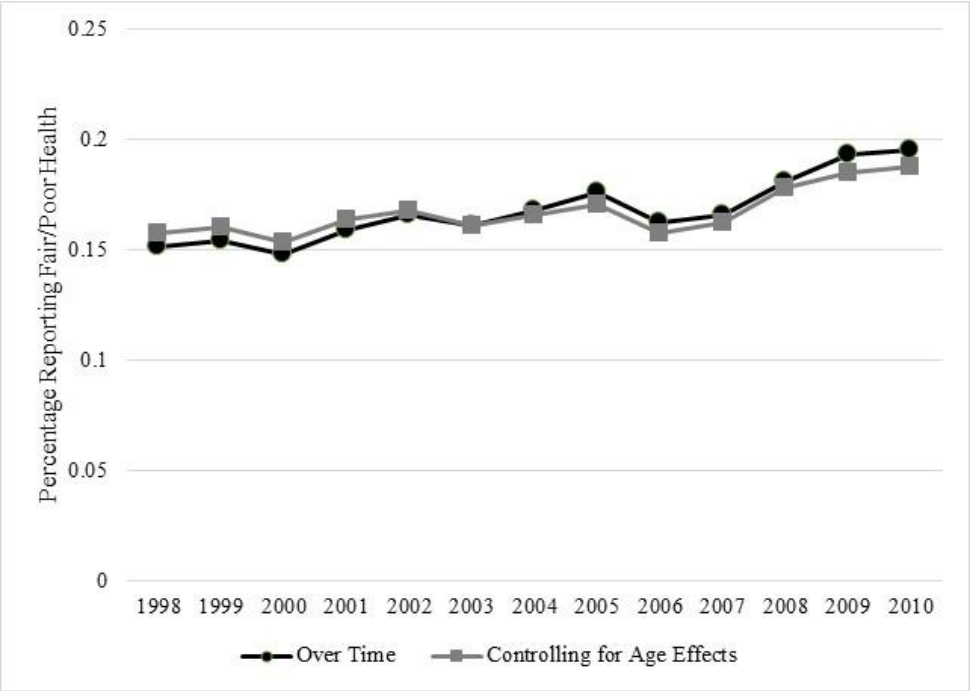

Source: Author's calculation from *NHIS*, 1998-2010.
This chart shows the percentage of Veterans, and non-Veterans reporting receipt of disability insurance that is not Social Security Disability Insurance from 1998-2010.

**Figure 4: Percentage of Veterans Reporting Fair or Poor health**



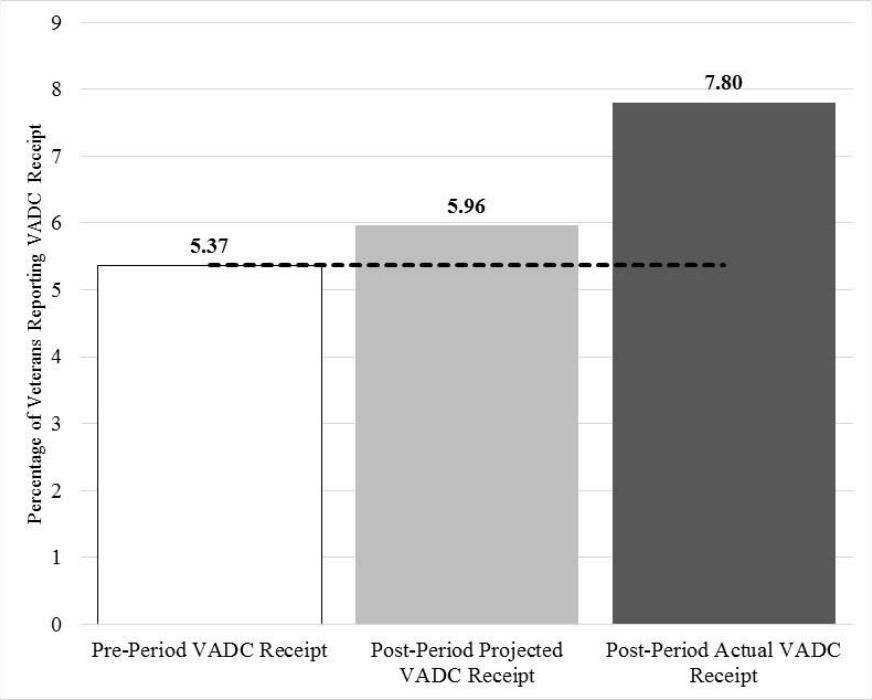

Source: Author's calculation from *NHIS*, 1998-2010.
This chart shows the percentage of Veterans reporting fair or poor health in the years 1998-2010 in the NHIS, and the percentage reporting fair or poor health while controlling for age effects.

**Figure 5: Percentage of Veterans Reporting Any Activity Limitation**



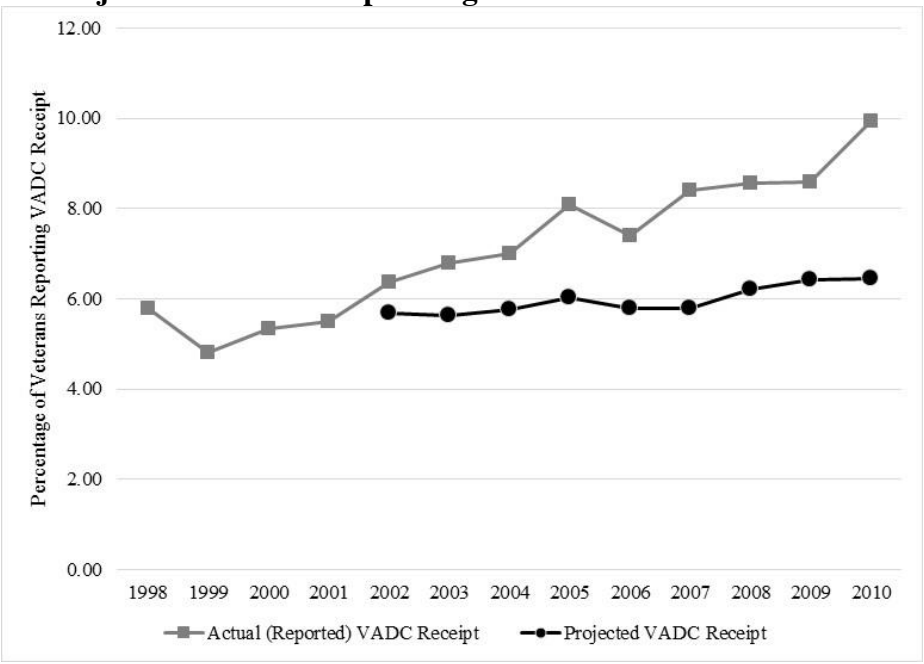

Source: Author's calculation from *NHIS*, 1998-2010.
This chart shows the percentage of Veterans reporting any limitation in the years 1998-2010 in the NHIS, and the percentage reporting any limitation while controlling for age effects.

**Figure 6: Results from Basic Projection Model**



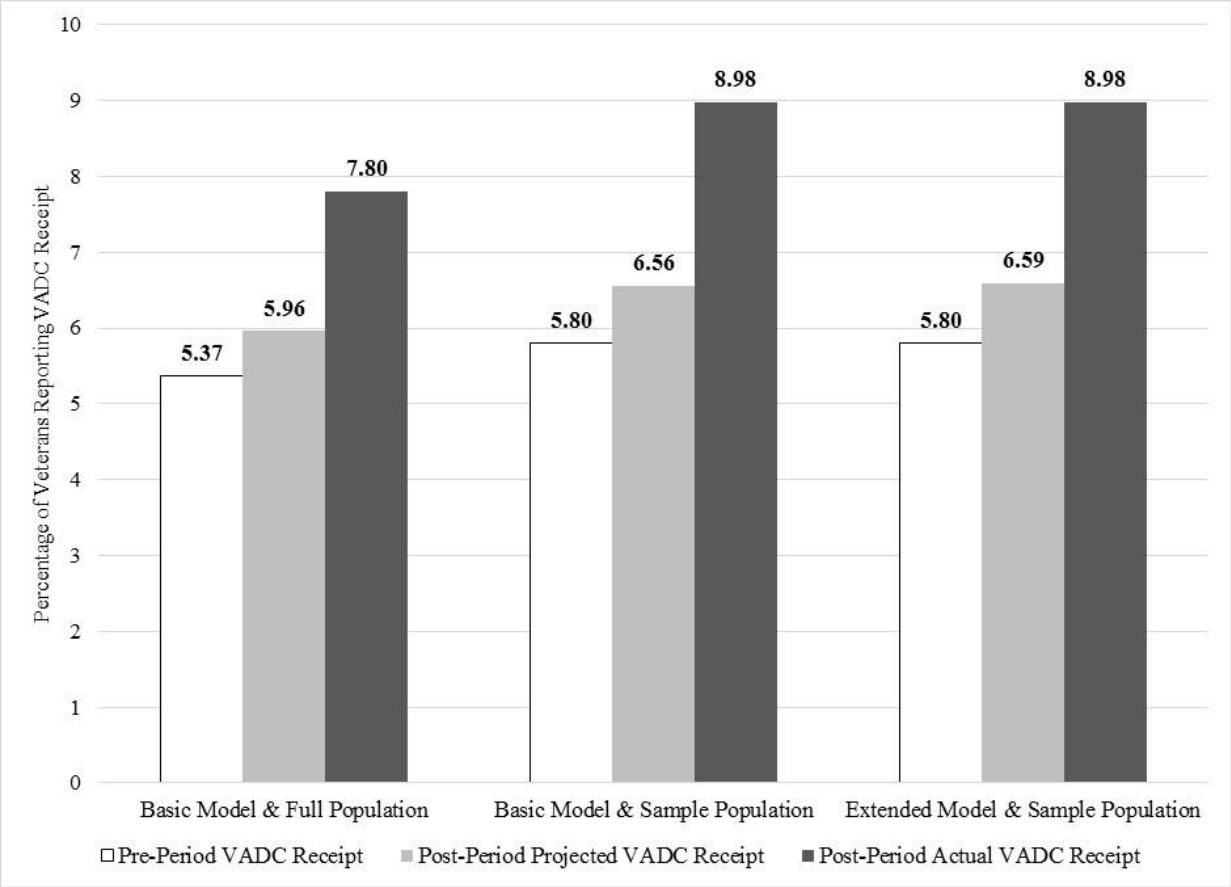

Notes: This figure shows the projected program growth in VADC receipt from the pre-period to the post-period. The first bar shows the pre-period sample mean for veterans reporting VADC receipt, the second bar shows the projected post-period VADC receipt, and the third bar shows the post-period sample mean of veterans reporting VADC receipt.

**Figure 7: Projected VADC Receipt Using Basic Model for All Post-Period Years**



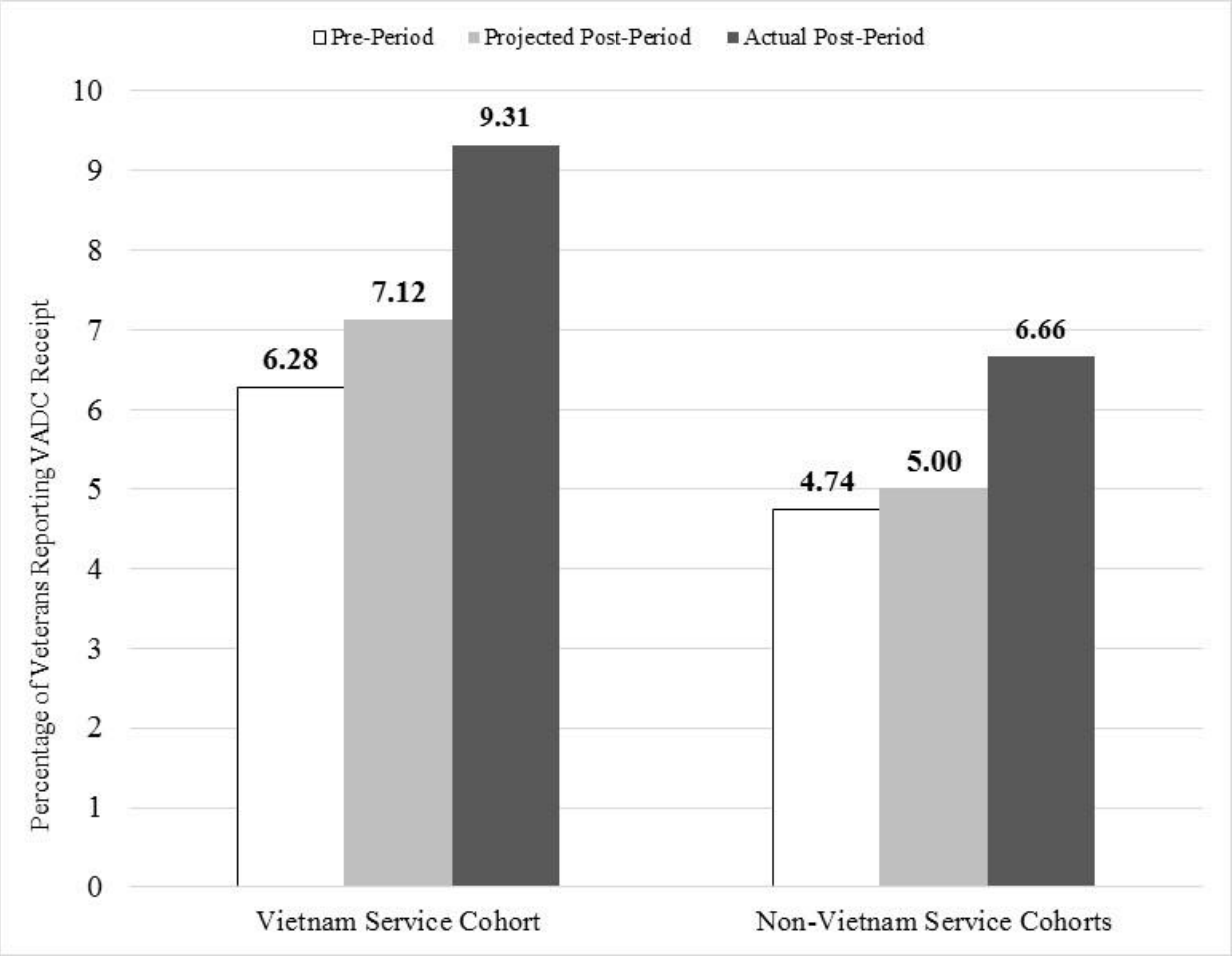

Notes: This figure shows the predicted program receipt and actual receipt for each year in the post-period.

**Figure 8: Comparison of Projected VADC Receipt under All Three Models**



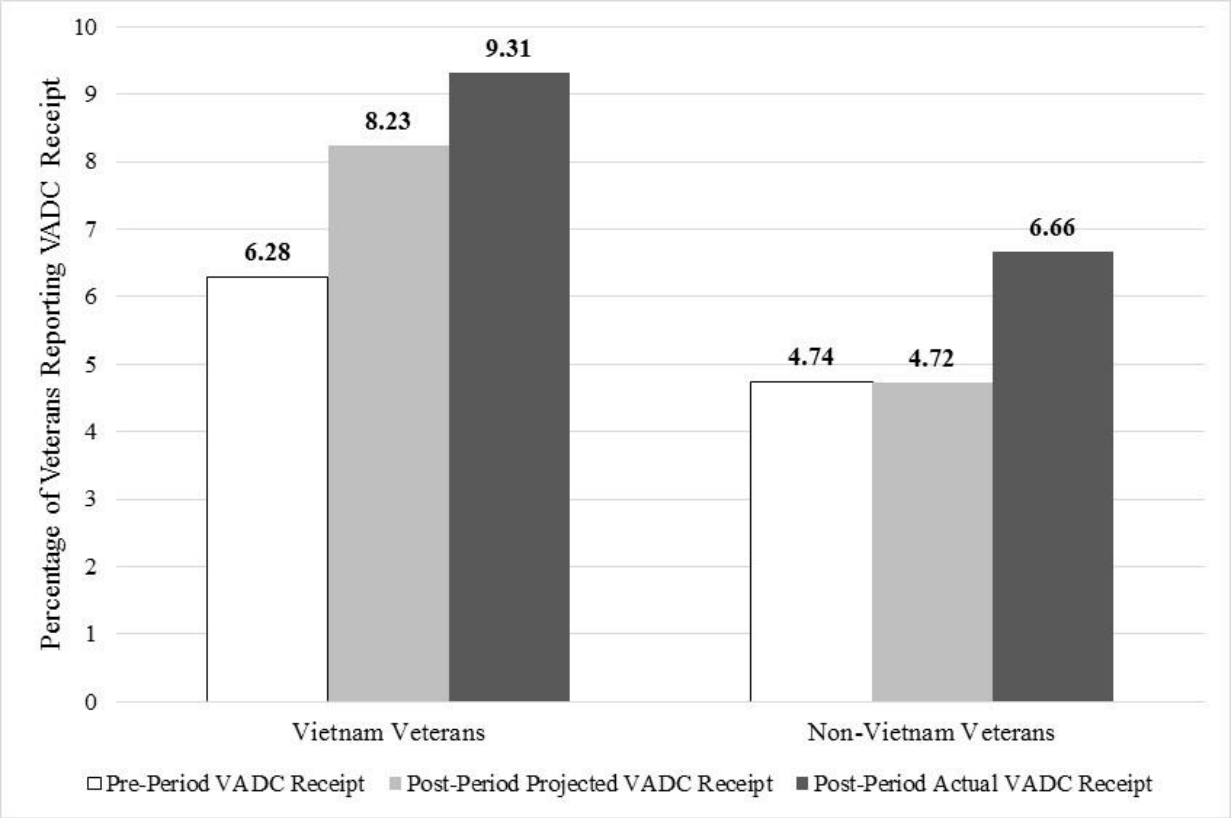

Notes: This figure shows the predicted program growth in VADC receipt as broken down by three separate models. The basic model includes the full population and the concise set of health variables. The basic model and sample population models include the concise set of health variables regressed over the sample adult population. The extended model includes the most comprehensive set of health variables regressed over the sample adult population. The first bar in each model shows the pre-period sample mean for veterans reporting VADC receipt, the second bar shows the projected post-period VADC receipt, and the third bar shows the post-period sample mean of veterans reporting VADC receipt.

**Figure 9: Comparison of Projected VADC Receipt: Vietnam vs. Non-Vietnam Service Cohorts (Assuming a Constant Relationship between VADC Receipt and Health)**




Notes: This figure shows the predicted program growth in VADC receipt as broken down between the Vietnam War service cohort and the non-Vietnam war service cohorts when the relationship between VADC receipt and health is held constant for both groups. The first bar in each model shows the pre-period sample mean for veterans reporting VADC receipt, the second bar shows the projected post-period VADC receipt, and the third bar shows the post-period sample mean of veterans reporting VADC receipt.

**Figure 9: Figure 8: Comparison of Projected VADC Receipt: Vietnam vs. Non-Vietnam Service Cohorts (Allowing the Relationship between VADC Receipt and Health to Vary)**




Notes: This figure shows the predicted program growth in VADC receipt as broken down between the Vietnam War service cohort and the non-Vietnam war service cohorts when the relationship between health and VADC receipt is allowed to vary across the two groups. The first bar in each model shows the pre-period sample mean for veterans reporting VADC receipt, the second bar shows the projected post-period VADC receipt, and the third bar shows the post-period sample mean of veterans reporting VADC receipt.

## Tables

**Table 1: Descriptive Statistics for Health Variables in the Pre- and Post-Periods**

| | Pre-Period | Post-Period | Ratio |
|---|---|---|---|
| | 1998-2001 | 2002-2010 | |
| Reporting Excellent Health | 30.47 | 25.88 | 0.85*** |
| Reporting Very Good Health | 32.90 | 32.18 | 0.98 |
| Reporting Good Health | 25.22 | 27.58 | 1.09*** |
| Reporting Fair Health | 8.48 | 10.61 | 1.25*** |
| Reporting Poor Health | 2.93 | 3.75 | 1.28*** |
| "Has any activity limitation" | 15.30 | 17.36 | 1.13*** |
| "Activity limitation from: Back/Neck problem" | 4.98 | 5.31 | 1.07 |
| "Activity limitation from: Arthritis/rheumatism" | 2.35 | 2.78 | 1.18*** |
| "Activity limitation from: Depression/Emotional problem" | 1.96 | 2.65 | 1.35*** |
| "Activity limitation from: Diabetes" | 1.40 | 2.05 | 1.46*** |
| "Activity limitation from: Hearing Problem" | 0.63 | 0.76 | 1.21 |
| "Activity limitation from: Musculoskeletal problem" | 0.71 | 1.52 | 2.14*** |
| "Activity limitation from: Cancer" | 0.71 | 0.88 | 1.24** |
| "Activity limitation from: Circulatory Problem" | 0.27 | 0.59 | 2.19*** |
| "Activity limitation from: Digestive Problem" | 0.34 | 0.58 | 1.71*** |
| "Activity limitation from: Other Mental Problem" | 0.15 | 0.25 | 1.67** |
| "Activity limitatoin from: Fracture/bone/joint injury" | 2.16 | 2.33 | 1.08 |
| "Activity limitation from: Heart Problem" | 2.69 | 2.94 | 1.09 |
| "Activity limitation from: Hypertension" | 1.39 | 1.91 | 1.37*** |
| "Activity limitation from: Missing limb/finger" | 0.17 | 0.32 | 1.88*** |
| "Activity limitation from: Lung/breathing problem" | 1.41 | 1.63 | 1.16* |
| "Activity limitation from: Nervous Conditions" | 0.92 | 1.51 | 1.64*** |
| "Activity limitation from: Stroke" | 0.68 | 0.80 | 1.18 |
| "Activity limitation from: Vision Problem" | 0.90 | 0.96 | 1.07 |
| *F-test* | 69.72*** | 131.98*** | |
| *Number of Observations* | 17,247 | 27,402 | |

Notes: *,**,*** indicates statistical significance at the 10, 5, and 1 percent level

**Table 2: Descriptive Statistics for Demographic Variables in the Pre- and Post-Periods**

| | Pre-Period | Post-Period | P-Values |
|---|---|---|---|
| | 1998-2001 | 2002-2010 | |
| *Age (Average)* | 48.79 | 50.46 | 0.00 |
| *Race/Ethnicity (%)* | | | |
| White | 83.83 | 82.42 | 0.00 |
| Black | 12.63 | 14.29 | 0.00 |
| Other Race | 3.54 | 3.29 | 0.16 |
| Hispanic | 7.60 | 8.18 | 0.03 |
| *U.S. Citizen (%)* | 99.54 | 99.54 | 0.95 |
| *Education (%)* | | | |
| Less than High School | 7.50 | 5.55 | 0.00 |
| High School or Equivalent | 33.58 | 31.89 | 0.00 |
| Some College | 23.90 | 24.61 | 0.09 |
| More than College | 35.03 | 37.94 | 0.00 |
| *Marital Status (%)* | | | |
| Married | 72.74 | 70.46 | 0.00 |
| Divorced/Separated | 16.75 | 18.60 | 0.00 |
| Widowed | 1.41 | 1.59 | 0.15 |
| Never Married | 9.09 | 9.35 | 0.36 |
| *VADC Receipt (%)* | 5.37 | 7.80 | 0.00 |
| *Number of Observations* | 17,247 | 27,402 | |

Notes: p-values: p<.1; p<.05; p<.01 indicates statistical significance at the 10, 5, and 1 percent levels.

**Table 3: Regression Results from Basic Regression Model**

| | Pre-Period (1) | Post-Period (2) |
|---|---|---|
| Reporting Very Good Health | 0.00979** | 0.00940** |
| | (0.00416) | (0.00407) |
| Reporting Good Health | 0.0200*** | 0.0301*** |
| | (0.00460) | (0.00435) |
| Reporting Fair Health | 0.0654*** | 0.0650*** |
| | (0.00712) | (0.00625) |
| Reporting Poor Health | 0.0972*** | 0.0713*** |
| | (0.0118) | (0.0101) |
| "Has any activity limitation" | 0.137*** | 0.145*** |
| | (0.00764) | (0.00660) |
| "Limitation from: Back/Neck problem" | -0.0103 | 0.0368*** |
| | (0.00923) | (0.00817) |
| "Limitation from: Arthritis/rheumatism" | 0.0356*** | 0.0138 |
| | (0.0120) | (0.0104) |
| "Limitation from: Depression/Emotional problem" | 0.0637*** | 0.0905*** |
| | (0.0129) | (0.0106) |
| "Limitation from: Diabetes" | -0.0218 | 0.0820*** |
| | (0.0154) | (0.0123) |
| "Limitation from: Hearing Problem" | 0.0213 | 0.0143 |
| | (0.0226) | (0.0191) |
| "Limitation from: Musculoskeletal problem" | 0.00987 | -0.0192 |
| | (0.0200) | (0.0132) |
| "Limitation from: Cancer" | -0.0156 | 0.0263 |
| | (0.0203) | (0.0169) |
| "Limitation from: Circulatory Problem" | 0.0427 | 0.00266 |
| | (0.0321) | (0.0210) |
| "Limitation from: Digestive Problem" | -0.0239 | 0.0394* |
| | (0.0288) | (0.0207) |
| "Limitation from: Other Mental Problem" | -0.0866** | 0.0271 |
| | (0.0428) | (0.0312) |
| "Limitation from: Fracture/bone/joint injury" | 0.0243** | 0.0366*** |
| | (0.0122) | (0.0109) |
| "Limitation from: Heart Problem" | -0.0367*** | -0.0262** |
| | (0.0117) | (0.0104) |

**Table 3: Regression Results from Basic Regression Model (Continued)**

| | | |
|---|---|---|
| "Limitation from: Hypertension" | -0.00243 | -0.0279** |
| | (0.0158) | (0.0133) |
| "Limitation from: Missing limb/finger" | 0.0775* | 0.0703** |
| | (0.0405) | (0.0276) |
| "Limitation from: Lung/breathing problem" | -0.0178 | -0.0265** |
| | (0.0150) | (0.0130) |
| "Limitation from: Nervous Conditions" | 0.00366 | 0.0823*** |
| | (0.0179) | (0.0132) |
| "Limitation from: Stroke" | 0.0560*** | 0.0241 |
| | (0.0210) | (0.0179) |
| "Limitation from: Vision Problem" | 0.0146 | -0.0333** |
| | (0.0191) | (0.0169) |
| High school diploma | 0.0134** | 0.00266 |
| | (0.00673) | (0.00710) |
| Some College | 0.0314*** | 0.0242*** |
| | (0.00701) | (0.00729) |
| More than College | 0.0270*** | 0.0296*** |
| | (0.00680) | (0.00710) |
| Black | 0.00326 | 0.0133*** |
| | (0.00509) | (0.00450) |
| Other Race | -0.00393 | 0.0140 |
| | (0.00940) | (0.00865) |
| Hispanic Ethnicity | 0.00311 | -0.00568 |
| | (0.00662) | (0.00572) |
| Married | -0.0117 | 0.00526 |
| | (0.0140) | (0.0124) |
| Divorced or Separated | -0.0155 | 0.0188 |
| | (0.0145) | (0.0127) |
| Never Married | -0.0164 | -0.00447 |
| | (0.0150) | (0.0133) |
| Non-Citizen | -0.0132 | -0.00655 |
| | (0.0244) | (0.0228) |
| Observations | 17,247 | 27,402 |
| R-squared | 0.091 | 0.110 |

Notes: Column (1) shows the results from the most basic model in the pre-period and column (2) shows the results from the post-period. Both models include single year of age dummies, race (black and other) and Hispanic ethnicity dummies, education level dummies, marital status dummies, and citizenship dummies. *,**,*** indicates statistical significance at the 10, 5, and 1 percent level. Standard errors are in parentheses.

## Table 4: Comparison of Regression Results from Three Models

| | Pre-period | | | Post-period | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Reporting Very Good Health | 0.00979** | 0.00293 | -0.000858 | 0.00940** | 0.00635 | 0.00166 |
| | (0.00416) | (0.00637) | (0.00642) | (0.00407) | (0.00646) | (0.00648) |
| Reporting Good Health | 0.0200*** | 0.0207*** | 0.0129* | 0.0301*** | 0.0377*** | 0.0261*** |
| | (0.00460) | (0.00712) | (0.00733) | (0.00435) | (0.00694) | (0.00713) |
| Reporting Fair Health | 0.0654*** | 0.0689*** | 0.0533*** | 0.0650*** | 0.0827*** | 0.0613*** |
| | (0.00712) | (0.0107) | (0.0112) | (0.00625) | (0.00975) | (0.0102) |
| Reporting Poor Health | 0.0972*** | 0.112*** | 0.0936*** | 0.0713*** | 0.0741*** | 0.0466*** |
| | (0.0118) | (0.0181) | (0.0188) | (0.0101) | (0.0153) | (0.0159) |
| "Has any activity limitation" | 0.137*** | 0.152*** | 0.152*** | 0.145*** | 0.146*** | 0.142*** |
| | (0.00764) | (0.0112) | (0.0112) | (0.00660) | (0.00972) | (0.00976) |
| "Limitation from: Back/Neck problem" | -0.0103 | -0.0239* | -0.0374*** | 0.0368*** | -0.00295 | -0.00913 |
| | (0.00923) | (0.0133) | (0.0135) | (0.00817) | (0.0120) | (0.0123) |
| "Limitation from: Arthritis/rheumatism" | 0.0356*** | -0.0180 | -0.0267 | 0.0138 | 0.0231 | 0.0223 |
| | (0.0120) | (0.0178) | (0.0178) | (0.0104) | (0.0150) | (0.0150) |
| "Limitation from: Depression/Emotional problem" | 0.0637*** | 0.0784*** | 0.0704*** | 0.0905*** | 0.0747*** | 0.0742*** |
| | (0.0129) | (0.0180) | (0.0186) | (0.0106) | (0.0147) | (0.0152) |
| "Limitation from: Diabetes" | -0.0218 | -0.0339 | -0.0380 | 0.0820*** | 0.118*** | 0.0961*** |
| | (0.0154) | (0.0224) | (0.0242) | (0.0123) | (0.0180) | (0.0192) |
| "Limitation from: Hearing Problem" | 0.0213 | 0.0683** | 0.0693** | 0.0143 | 0.0246 | 0.0250 |
| | (0.0226) | (0.0328) | (0.0328) | (0.0191) | (0.0276) | (0.0276) |
| "Limitation from: Musculoskeletal problem" | 0.00987 | -0.0409 | -0.0410 | -0.0192 | -0.0140 | -0.0171 |
| | (0.0200) | (0.0273) | (0.0273) | (0.0132) | (0.0194) | (0.0194) |
| "Limitation from: Cancer" | -0.0156 | 0.00232 | -0.00179 | 0.0263 | 0.0614** | 0.0417 |
| | (0.0203) | (0.0306) | (0.0322) | (0.0169) | (0.0256) | (0.0269) |
| "Limitation from: Circulatory Problem" | 0.0427 | 0.00761 | 0.0185 | 0.00266 | 0.0175 | 0.0244 |
| | (0.0321) | (0.0433) | (0.0433) | (0.0210) | (0.0298) | (0.0298) |
| "Limitation from: Digestive Problem" | -0.0239 | 0.00176 | -0.00497 | 0.0394* | 0.0906*** | 0.0821*** |
| | (0.0288) | (0.0421) | (0.0421) | (0.0207) | (0.0294) | (0.0296) |
| "Limitation from: Other Mental Problem" | -0.0866** | -0.202*** | -0.201*** | 0.0271 | 0.113** | 0.105** |
| | (0.0428) | (0.0649) | (0.0648) | (0.0312) | (0.0440) | (0.0440) |
| "Limitation from: Fracture/bone/joint injury" | 0.0243** | 0.0346* | 0.0329* | 0.0366*** | 0.0174 | 0.0153 |
| | (0.0122) | (0.0182) | (0.0182) | (0.0109) | (0.0158) | (0.0158) |
| "Limitation from: Heart Problem" | -0.0367*** | -0.00238 | -0.0245 | -0.0262** | -0.0230 | -0.0397** |
| | (0.0117) | (0.0177) | (0.0201) | (0.0104) | (0.0159) | (0.0178) |
| "Limitation from: Hypertension" | -0.00243 | 0.0538** | 0.0561** | -0.0279** | -0.0181 | -0.0206 |
| | (0.0158) | (0.0238) | (0.0239) | (0.0133) | (0.0191) | (0.0192) |
| "Limitation from: Missing limb/finger" | 0.0775* | -0.0636 | -0.0647 | 0.0703** | 0.0104 | 0.00887 |
| | (0.0405) | (0.0622) | (0.0621) | (0.0276) | (0.0392) | (0.0393) |
| "Limitation from: Lung/breathing problem" | -0.0178 | -0.0472** | -0.0464** | -0.0265** | -0.0509*** | -0.0717*** |
| | (0.0150) | (0.0212) | (0.0224) | (0.0130) | (0.0192) | (0.0211) |
| "Limitation from: Nervous Conditions" | 0.00366 | -0.00241 | -0.00195 | 0.0823*** | 0.0570*** | 0.0582*** |
| | (0.0179) | (0.0259) | (0.0259) | (0.0132) | (0.0187) | (0.0187) |
| "Limitation from: Stroke" | 0.0560*** | -0.00907 | 0.0288 | 0.0241 | 0.0523* | 0.0631** |
| | (0.0210) | (0.0300) | (0.0362) | (0.0179) | (0.0268) | (0.0315) |
| "Limitation from: Vision Problem" | 0.0146 | 0.0211 | 0.0155 | -0.0333** | 0.00417 | 0.0101 |
| | (0.0191) | (0.0267) | (0.0268) | (0.0169) | (0.0247) | (0.0251) |
| Depressed (K6 Depression Indicator) | | | -0.00718 | | | -0.00354 |
| | | | (0.0166) | | | (0.0144) |
| Ever told had asthma | | | -0.00102 | | | -0.00179 |
| | | | (0.0102) | | | (0.00876) |

**Table 4: Comparison of Regression Results from Three Models (Continued)**

| | | | | | | |
|---|---|---|---|---|---|---|
| Ever told had cancer | | | 0.00563 | | | 0.0179* |
| | | | (0.0115) | | | (0.00995) |
| Ever told had coronary heart disease | | | -0.00958 | | | 0.0242* |
| | | | (0.0148) | | | (0.0130) |
| Ever told had emphysema | | | -0.00454 | | | 0.0473*** |
| | | | (0.0202) | | | (0.0165) |
| Ever told had heart attack | | | 0.0534*** | | | -0.0143 |
| | | | (0.0154) | | | (0.0137) |
| Ever told had heart condition / disease | | | -0.00358 | | | 0.0136 |
| | | | (0.0107) | | | (0.00945) |
| Ever told had hypertension | | | 0.00637 | | | 0.0180*** |
| | | | (0.00609) | | | (0.00559) |
| Had low back pain, past 3 months | | | 0.00874 | | | 0.0124** |
| | | | (0.00610) | | | (0.00593) |
| Told had liver condition, past 12 months | | | 0.0662*** | | | 0.0473*** |
| | | | (0.0182) | | | (0.0155) |
| Had neck pain, past 3 months | | | 0.0329*** | | | 0.0112 |
| | | | (0.00783) | | | (0.00733) |
| Ever told had a stroke | | | -0.0491** | | | -0.00874 |
| | | | (0.0222) | | | (0.0183) |
| Ever told had an ulcer | | | 0.000696 | | | 0.00924 |
| | | | (0.00877) | | | (0.00881) |
| Has trouble seeing | | | 0.00554 | | | -0.00617 |
| | | | (0.00947) | | | (0.00901) |
| Ever told had diabetes | | | 0.00748 | | | 0.0253*** |
| | | | (0.0106) | | | (0.00842) |
| High school diploma | 0.0134** | 0.0160 | 0.0142 | 0.00266 | 0.00531 | 0.00434 |
| | (0.00673) | (0.0103) | (0.0103) | (0.00710) | (0.0109) | (0.0109) |
| Some College | 0.0314*** | 0.0394*** | 0.0359*** | 0.0242*** | 0.0302*** | 0.0278** |
| | (0.00701) | (0.0107) | (0.0107) | (0.00729) | (0.0111) | (0.0112) |
| More than College | 0.0270*** | 0.0348*** | 0.0320*** | 0.0296*** | 0.0354*** | 0.0338*** |
| | (0.00680) | (0.0104) | (0.0104) | (0.00710) | (0.0109) | (0.0109) |
| Black | 0.00326 | 0.00420 | 0.00760 | 0.0133*** | 0.0126* | 0.0141** |
| | (0.00509) | (0.00765) | (0.00768) | (0.00450) | (0.00688) | (0.00692) |
| Other Race | -0.00393 | 0.0109 | 0.00918 | 0.0140 | 0.0249* | 0.0243* |
| | (0.00940) | (0.0150) | (0.0150) | (0.00865) | (0.0139) | (0.0139) |
| Hispanic Ethnicity | 0.00311 | -0.00495 | -0.00323 | -0.00568 | 0.000804 | 0.00148 |
| | (0.00662) | (0.0105) | (0.0105) | (0.00572) | (0.00928) | (0.00928) |
| Married | -0.0117 | -0.00805 | -0.00915 | 0.00526 | 0.0119 | 0.0112 |
| | (0.0140) | (0.0177) | (0.0176) | (0.0124) | (0.0155) | (0.0155) |
| Divorced or Separated | -0.0155 | -0.0127 | -0.0140 | 0.0188 | 0.0303* | 0.0299* |
| | (0.0145) | (0.0181) | (0.0180) | (0.0127) | (0.0158) | (0.0158) |
| Never Married | -0.0164 | -0.0177 | -0.0171 | -0.00447 | 0.00259 | 0.00447 |
| | (0.0150) | (0.0189) | (0.0189) | (0.0133) | (0.0168) | (0.0168) |
| Non-Citizen | -0.0132 | -0.00388 | -0.00476 | -0.00655 | -0.00371 | -0.00433 |
| | (0.0244) | (0.0391) | (0.0390) | (0.0228) | (0.0386) | (0.0385) |
| Observations | 17,247 | 7,830 | 7,830 | 27,402 | 12,628 | 12,628 |
| R-squared | 0.091 | 0.110 | 0.117 | 0.110 | 0.117 | 0.122 |

Notes: Regressions include single year of age, race (black and other), Hispanic ethnicity, education level, marital status, and citizenship dummies. *,**,*** indicate statistical significance at the 10, 5, and 1 percent level. Standard errors are in parentheses. Columns (1) and (4) are results from the basic model in the pre- and post-periods, respectively, columns (2) and (5) are results from the basic model regressed over the sample population in the pre- and post-periods, respectively, and columns (3) and (6) are results from the comprehensive model regressed over the sample population in the pre- and post-periods, respectively.

**Table 5: Descriptive Statistics for Demographic Variables in the Pre- and Post-Periods for Vietnam and Non-Vietnam Service Cohort Veterans**

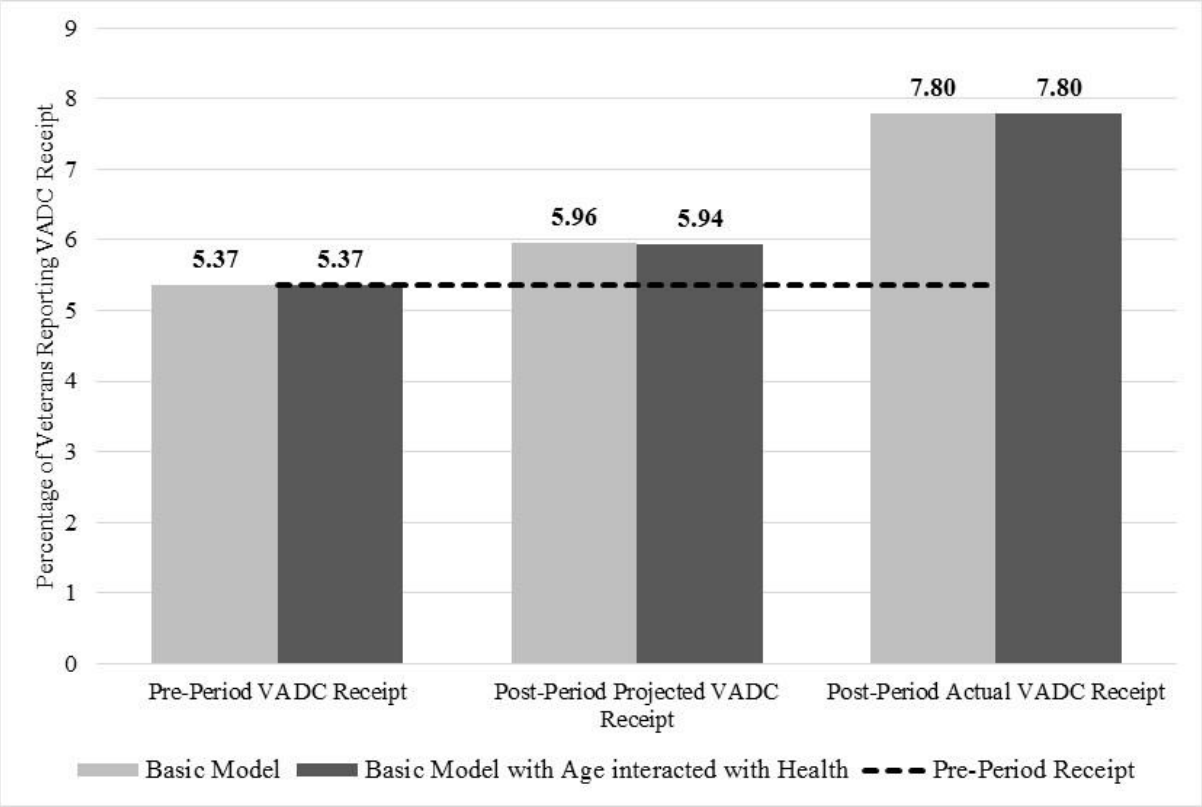
| | Vietnam Service Cohort | | Non-Vietnam Service Cohorts | |
|---|---|---|---|---|
| | Pre-Period | Post-Period | Pre-Period | Post-Period |
| | 1998-2001 | 2002-2010 | 1998-2001 | 2002-2010 |
| *Age (Average)* | 51.16 | 57.15 | 46.96 | 44.13 |
| *Race/Ethnicity (%)* | | | | |
| White | 85.08 | 85.33 | 83.00 | 80.17 |
| Black | 11.72 | 11.80 | 13.23 | 16.48 |
| Other Race | 3.19 | 2.86 | 3.77 | 3.36 |
| Hispanic | 7.04 | 5.87 | 7.96 | 9.92 |
| *U.S. Citizen (%)* | 99.79 | 99.71 | 99.31 | 99.40 |
| *Education (%)* | | | | |
| Less than High School | 6.73 | 6.21 | 8.20 | 5.04 |
| High School or Equivalent | 31.19 | 31.05 | 35.36 | 32.76 |
| Some College | 23.90 | 22.64 | 24.04 | 26.78 |
| More than College | 38.18 | 40.11 | 32.40 | 35.42 |
| *Marital Status (%)* | | | | |
| Married | 74.61 | 73.88 | 71.46 | 66.83 |
| Divorced/Separated | 18.51 | 18.44 | 15.43 | 19.22 |
| Widowed | 1.08 | 2.23 | 1.63 | 1.02 |
| Never Married | 5.81 | 5.45 | 11.47 | 12.93 |
| *VADC Receipt (%)* | 6.28 | 9.31 | 4.74 | 6.66 |
| *Number of Observations* | 7,234 | 12,649 | 9,247 | 13,080 |

**Table 6: Descriptive Statistics for Health Variables in the Pre- and Post-Periods for Vietnam and Non-Vietnam Service Cohort Veterans**

| | Vietnam Service Cohort | | | Non-Vietnam Service Cohorts | | |
|---|---|---|---|---|---|---|
| | Pre-Period 1998-2001 | Post-Period 2002-2010 | Ratio | Pre-Period 1998-2001 | Post-Period 2002-2010 | Ratio |
| Excellent Health | 27.80 | 21.83 | 0.79 | 32.45 | 29.47 | 0.91 |
| Very Good Health | 33.58 | 30.83 | 0.92 | 32.41 | 33.49 | 1.03 |
| Good Health | 25.91 | 29.50 | 1.14 | 24.62 | 25.80 | 1.05 |
| Fair Health | 9.11 | 12.67 | 1.39 | 8.09 | 8.81 | 1.09 |
| Poor Health | 3.61 | 5.17 | 1.43 | 2.42 | 2.42 | 1.00 |
| "Has Any Activity Limitation" | 16.60 | 22.09 | 1.33 | 14.48 | 13.47 | 0.93 |
| "Limitation from: Back/Neck problem" | 5.82 | 6.59 | 1.13 | 4.38 | 4.34 | 0.99 |
| "Limitation from: Arthritis/rheumatism" | 2.51 | 4.02 | 1.60 | 2.35 | 1.79 | 0.76 |
| "Limitation from: Depression/Emotional problem" | 2.68 | 3.22 | 1.20 | 1.46 | 2.16 | 1.48 |
| "Limitation from: Diabetes" | 1.60 | 2.99 | 1.87 | 1.28 | 1.22 | 0.95 |
| "Limitation from: Hearing Problem" | 0.75 | 1.05 | 1.40 | 0.58 | 0.50 | 0.86 |
| "Limitation from: Musculoskeletal problem" | 0.77 | 2.02 | 2.62 | 0.69 | 1.10 | 1.59 |
| "Limitation from: Cancer" | 6.80 | 1.28 | 0.19 | 0.75 | 0.53 | 0.71 |
| "Limitation from: Circulatory Problem" | 0.24 | 0.78 | 3.25 | 0.32 | 0.42 | 1.31 |
| "Limitation from: Digestive Problem" | 0.39 | 0.81 | 2.08 | 0.30 | 0.38 | 1.27 |
| "Limitation from: Other Mental Problem" | 0.15 | 0.23 | 1.53 | 0.14 | 0.28 | 2.00 |
| "Limitation from: Fracture/bone/joint injury" | 2.61 | 2.73 | 1.05 | 1.86 | 2.06 | 1.11 |
| "Limitation from: Heart Problem" | 2.46 | 4.30 | 1.75 | 2.94 | 1.79 | 0.61 |
| "Limitation from: Hypertension" | 1.53 | 2.76 | 1.80 | 1.35 | 1.21 | 0.90 |
| "Limitation from: Missing limb/finger" | 0.21 | 0.46 | 2.19 | 0.13 | 0.20 | 1.54 |
| "Limitation from: Lung/breathing problem" | 1.29 | 2.17 | 1.68 | 1.56 | 1.18 | 0.76 |
| "Limitation from: Nervous Conditions" | 1.01 | 1.93 | 1.91 | 0.92 | 1.21 | 1.32 |
| "Limitation from: Stroke" | 0.82 | 1.26 | 1.54 | 0.59 | 0.40 | 0.68 |
| "Limitation from: Vision Problem" | 1.00 | 1.34 | 1.34 | 0.82 | 0.65 | 0.79 |
| Number of Observations | 7,234 | 12,649 | | 9,247 | 13,080 | |

## Appendix

**Appendix Figure 1: Projection Results Comparing Basic Projection Model with the Basic Projection Model which includes Age and Health Interaction Terms**




Notes: This figure shows the predicted program growth for both the basic model and the basic model with interaction terms between age as a linear variable and health. The first set of bars shows the pre-period sample mean for veterans reporting VADC receipt, the second set of bars shows the projected post-period VADC receipt, and the third set of bar shows the post-period sample mean of veterans reporting VADC receipt.

**Appendix Table 1: Descriptive Statistics for Health Variables in the Pre- and Post-Periods for the Sample Adult Population**

| | Pre-Period | Post-Period | Difference |
|---|---|---|---|
| | 1998-2001 | 2002-2010 | Ratio |
| Excellent Health | 30.10 | 24.88 | 0.83*** |
| Very Good Health | 33.17 | 32.42 | 0.98 |
| Good Health | 24.73 | 27.42 | 1.11*** |
| Fair Health | 9.09 | 11.18 | 1.23*** |
| Poor Health | 2.91 | 4.01 | 1.38*** |
| "Has Any Activity Limitation" | 16.70 | 19.81 | 1.19*** |
| "Limitation from: Back/Neck problem" | 5.67 | 6.18 | 1.09 |
| "Limitation from: Arthritis/rheumatism" | 2.54 | 3.38 | 1.33*** |
| "Limitation from: Depression/Emotional problem" | 2.38 | 3.44 | 1.45*** |
| "Limitation from: Diabetes" | 1.56 | 2.31 | 1.48*** |
| "Limitation from: Hearing Problem" | 0.72 | 0.89 | 1.25 |
| "Limitation from: Musculoskeletal problem" | 0.91 | 1.77 | 1.95*** |
| "Limitation from: Cancer" | 0.72 | 0.95 | 1.32* |
| "Limitation from: Circulatory Problem" | 0.36 | 0.73 | 2.03*** |
| "Limitation from: Digestive Problem" | 0.37 | 0.70 | 1.89*** |
| "Limitation from: Other Mental Problem" | 0.15 | 0.31 | 2.07** |
| "Limitation from: Fracture/bone/joint injury" | 2.26 | 2.79 | 1.23** |
| "Limitation from: Heart Problem" | 2.82 | 3.03 | 1.07 |
| "Limitation from: Hypertension" | 1.52 | 2.23 | 1.47*** |
| "Limitation from: Missing limb/finger" | 0.17 | 0.39 | 2.29*** |
| "Limitation from: Lung/breathing problem" | 1.70 | 1.87 | 1.10 |
| "Limitation from: Nervous Conditions" | 1.05 | 1.88 | 1.79*** |
| "Limitation from: Stroke" | 0.78 | 0.87 | 1.12 |
| "Limitation from: Vision Problem" | 1.11 | 1.12 | 1.01 |
| K6 Depression Indicator | 2.82 | 3.62 | 1.28*** |
| Ever told had asthma | 6.88 | 8.74 | 1.27*** |
| Ever told had cancer | 5.86 | 7.36 | 1.26*** |
| Ever told had coronary heart disease | 5.40 | 6.48 | 1.20*** |
| Ever told had emphysema | 1.89 | 2.90 | 1.53*** |
| Ever told had heart attack | 5.01 | 5.62 | 1.12* |
| Ever told had heart condition / disease | 6.68 | 8.16 | 1.22*** |
| Ever told had hypertension | 28.89 | 36.82 | 1.27*** |
| Had low back pain, past 3 months | 31.14 | 31.01 | 1.00 |
| Told had liver condition, past 12 months | 2.06 | 2.64 | 1.28*** |
| Had neck pain, past 3 months | 14.93 | 16.03 | 1.07** |
| Ever told had a stroke | 2.12 | 2.65 | 1.25** |
| Ever told had an ulcer | 9.77 | 8.70 | 0.89*** |
| Has trouble seeing | 8.51 | 8.88 | 1.04 |
| Ever told had diabetes | 8.01 | 12.38 | 1.54*** |
| *F-Test* | 24.31*** | 40.49*** | |
| *Number of Observations* | 7,830 | 12,628 | |

Notes: p-values: *p<.1; **p<.05; ***p<.01

**Appendix Table 2: Descriptive Statistics for Demographic Variables for the Sample Adult Population**

| | Pre-Period | Post-Period | P-Values |
|---|---|---|---|
| | 1998-2001 | 2002-2010 | |
| *Age (Average)* | 48.74 | 50.64 | 0.00 |
| *Race/Ethnicity (%)* | | | |
| White | 83.63 | 81.71 | 0.00 |
| Black | 13.18 | 15.16 | 0.00 |
| Other Race | 3.19 | 3.14 | 0.82 |
| Hispanic | 6.92 | 7.53 | 0.10 |
| *U.S. Citizen (%)* | 99.58 | 99.60 | 0.78 |
| *Education (%)* | | | |
| Less than High School | 7.66 | 5.86 | 0.00 |
| High School Diploma | 32.85 | 31.10 | 0.01 |
| Some College | 24.37 | 25.13 | 0.22 |
| More than College | 35.12 | 37.91 | 0.00 |
| *Marital Status (%)* | | | |
| Married | 59.30 | 56.15 | 0.00 |
| Divorced/Separated | 25.56 | 28.38 | 0.00 |
| Widowed | 2.12 | 2.54 | 0.05 |
| Never Married | 13.03 | 12.93 | 0.84 |
| *VADC Receipt (%)* | 5.80 | 8.98 | 0.00 |
| *Number of Observations* | 7,830 | 12,628 | |

Notes: p-values: p<.1; p<.05; p<.01 indicates statistical significance at the 10, 5, and 1 percent.

**Appendix Table 3: Regression Results for Vietnam Service Cohort Veterans and Non-Vietnam Service Cohort Veterans**

| | Pre-Period | | Post-Period | |
|---|---|---|---|---|
| | Vietnam | Non-Vietnam | Vietnam | Non-Vietnam |
| | (1) | (2) | (3) | (4) |
| Reporting Very Good Health | 0.0104 | 0.00829 | 0.0101 | 0.0110** |
| | (0.00692) | (0.00532) | (0.00679) | (0.00530) |
| Reporting Good Health | 0.0264*** | 0.0157*** | 0.0255*** | 0.0373*** |
| | (0.00757) | (0.00596) | (0.00706) | (0.00582) |
| Reporting Fair Health | 0.0755*** | 0.0545*** | 0.0824*** | 0.0442*** |
| | (0.0115) | (0.00936) | (0.00955) | (0.00893) |
| Reporting Poor Health | 0.122*** | 0.0459*** | 0.0856*** | 0.0540*** |
| | (0.0183) | (0.0162) | (0.0142) | (0.0160) |
| "Has any activity limitation" | 0.149*** | 0.133*** | 0.149*** | 0.143*** |
| | (0.0120) | (0.0104) | (0.00931) | (0.0103) |
| "Limitation from: Back/Neck problem" | -0.0287** | 0.00964 | 0.0239** | 0.0461*** |
| | (0.0143) | (0.0126) | (0.0115) | (0.0125) |
| "Limitation from: Arthritis/rheumatism" | 0.0363* | 0.0373** | 0.0223 | -0.00620 |
| | (0.0191) | (0.0158) | (0.0138) | (0.0174) |
| "Limitation from: Depression/Emotional problem" | 0.124*** | -0.0424** | 0.114*** | 0.0712*** |
| | (0.0187) | (0.0191) | (0.0151) | (0.0160) |
| "Limitation from: Diabetes" | 0.0332 | -0.0958*** | 0.123*** | -0.00677 |
| | (0.0239) | (0.0209) | (0.0163) | (0.0211) |
| "Limitation from: Hearing Problem" | 0.00262 | 0.00854 | -0.00545 | 0.0379 |
| | (0.0350) | (0.0298) | (0.0259) | (0.0312) |
| "Limitation from: Musculoskeletal problem" | 0.0314 | -0.0213 | -0.0513*** | 0.0493** |
| | (0.0316) | (0.0265) | (0.0182) | (0.0211) |
| "Limitation from: Cancer" | -0.00706 | -0.0234 | 0.0152 | 0.0423 |
| | (0.0339) | (0.0258) | (0.0222) | (0.0299) |
| "Limitation from: Circulatory Problem" | 0.210*** | -0.0580 | -0.0322 | 0.0825** |
| | (0.0574) | (0.0383) | (0.0289) | (0.0334) |
| "Limitation from: Digestive Problem" | -0.121*** | 0.0774** | -0.00939 | 0.133*** |
| | (0.0443) | (0.0393) | (0.0277) | (0.0346) |
| "Limitation from: Other Mental Problem" | -0.118* | 0.00448 | 0.0594 | -0.0358 |
| | (0.0696) | (0.0582) | (0.0510) | (0.0407) |
| "Limitation from: Fracture/bone/joint injury" | 1.00e-04 | 0.0346** | 0.0413*** | 0.0218 |
| | (0.0185) | (0.0170) | (0.0159) | (0.0162) |
| "Limitation from: Heart Problem" | -0.0782*** | 0.00253 | -0.0267* | -0.0501*** |
| | (0.0198) | (0.0149) | (0.0138) | (0.0176) |
| "Limitation from: Hypertension" | -0.0185 | 0.0266 | -0.0509*** | 0.0168 |
| | (0.0249) | (0.0210) | (0.0180) | (0.0218) |
| "Limitation from: Missing limb/finger" | 0.0342 | 0.106* | 0.0310 | 0.140*** |
| | (0.0598) | (0.0600) | (0.0362) | (0.0475) |

**Appendix Table 3: Regression Results for Vietnam Service Cohort Veterans and Non-Vietnam Service Cohort Veterans (Continued)**

| | | | | |
|---|---|---|---|---|
| "Limitation from: Lung/breathing problem" | -0.0533** | 0.0110 | 0.00165 | -0.0904*** |
| | (0.0257) | (0.0186) | (0.0180) | (0.0208) |
| "Limitation from: Nervous Conditions" | -0.00327 | -0.00625 | 0.0880*** | 0.0872*** |
| | (0.0283) | (0.0235) | (0.0184) | (0.0202) |
| "Limitation from: Stroke" | 0.0168 | 0.0587** | 0.0426* | -0.0389 |
| | (0.0318) | (0.0289) | (0.0227) | (0.0342) |
| "Limitation from: Vision Problem" | 0.0956*** | -0.0375 | -0.0105 | -0.0684** |
| | (0.0306) | (0.0257) | (0.0225) | (0.0277) |
| High school diploma | 0.0184 | 0.0115 | 0.00277 | 0.00831 |
| | (0.0116) | (0.00841) | (0.0107) | (0.0101) |
| Some College | 0.0430*** | 0.0246*** | 0.0257** | 0.0287*** |
| | (0.0119) | (0.00884) | (0.0111) | (0.0103) |
| More than College | 0.0344*** | 0.0223*** | 0.0293*** | 0.0383*** |
| | (0.0115) | (0.00858) | (0.0107) | (0.0101) |
| Black | 0.00469 | 0.00264 | 0.0157** | 0.0140** |
| | (0.00859) | (0.00646) | (0.00767) | (0.00577) |
| Other Race | -0.00559 | -0.00581 | 0.0269* | 0.00536 |
| | (0.0161) | (0.0119) | (0.0146) | (0.0117) |
| Hispanic Ethnicity | 0.00398 | 0.00428 | -0.0136 | 0.000399 |
| | (0.0111) | (0.00851) | (0.0104) | (0.00714) |
| Married | -0.0188 | -0.0187 | 0.00825 | 0.00387 |
| | (0.0261) | (0.0170) | (0.0165) | (0.0210) |
| Divorced or Separated | -0.0280 | -0.0189 | 0.0324* | 0.00600 |
| | (0.0267) | (0.0176) | (0.0172) | (0.0214) |
| Never Married | -0.0178 | -0.0252 | 0.0149 | -0.00967 |
| | (0.0283) | (0.0181) | (0.0193) | (0.0218) |
| Non-Citizen | 0.0677 | -0.0333 | -0.0476 | 0.000868 |
| | (0.0592) | (0.0260) | (0.0449) | (0.0272) |
| Age | 0.000834 | 5.24e-06 | -0.000801 | -0.000194 |
| | (0.000807) | (0.000184) | (0.000632) | (0.000215) |
| Observations | 7,234 | 9,247 | 12,649 | 13,080 |
| R-squared | 0.118 | 0.076 | 0.132 | 0.086 |

Notes: Regressions include age as a linear variable, race (black and other) and Hispanic ethnicity dummies, education level dummies, marital status dummies, and citizenship dummies. *, **, *** indicates statistical significance at the 10, 5, and 1 percent level. Standard errors are in parentheses. Columns (1) and (3) show results from the basic model in the pre- and post-periods, respectively, where the population is restricted to those veterans in the Vietnam service cohort. Columns (2) and (4) show results from the basic model in the pre- and post-periods, respectively, where the population is restricted to those veterans who are not in the Vietnam service cohort.