NBER WORKING PAPER SERIES

FEDERAL POLICY AND THE RISE IN DISABILITY ENROLLMENT: EVIDENCE FOR THE VA'S DISABILITY COMPENSATION PROGRAM

Mark Duggan
Robert Rosenheck
Perry Singleton

Working Paper 12323
http://www.nber.org/papers/w12323

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 2006

The authors are grateful to David Autor and Melissa Kearney for helpful comments and to Tamara Hayford for outstanding research assistance. We also thank Michael Wells from the Department of Veterans' Affairs for assistance with data sources. Duggan thanks the Alfred P. Sloan Foundation and Singleton thanks the Maryland Population Research Center for support. The views in this paper represent only the views of the authors and not those of any of the other individuals or institutions mentioned above. The authors can be contacted by email at duggan@econ.umd.edu, robert.rosenheck@yale.edu, and singleto@econ.bsos.umd.edu, respectively. We take responsibility for any errors or omissions. The views expressed herein are those of the author(s) and do not necessarily reflect the views of the National Bureau of Economic Research.

Federal Policy and the Rise in Disability Enrollment: Evidence for the VA's Disability Program
Mark Duggan, Robert Rosenheck and Perry Singleton
NBER Working Paper No. 12323
June 2006
JEL No. H55, H56, I10, I38

ABSTRACT

The fraction of non-elderly adults in the U.S. receiving disability benefits from the federal SSDI and/or SSI programs increased from 3.2 to 5.9 percent during the last two decades. Determining how much of this increase was caused by changes in policy versus other factors is difficult given that the programs are essentially uniform nationwide. In this study, we shed light on this issue by investigating the impact of a discrete change in the federal government's third largest disability program, the Department of Veterans Affairs' Disability Compensation (DC) program. In July of 2001, there was an expansion in the medical eligibility criteria for this program that applied only to Vietnam veterans. This change was motivated by an Institute of Medicine study, which linked exposure to Agent Orange and other herbicides used by the U.S. military in Vietnam, to the onset of diabetes. Using veterans who served shortly before and after the Vietnam War as our comparison group, we estimate that this policy change increased DC enrollment by 6.7 percentage points among Vietnam veterans. An additional 2.7 percent experienced an increase in their monthly DC benefit as a result of this policy change. The expanded eligibility criteria for Vietnam veterans can explain 60 percent of the recent acceleration in DC enrollment growth and increased the present value of DC spending by more than $30 billion. Our results further indicate that the policy change was responsible for an increase in the responsiveness of the program to local economic conditions. Our findings strongly suggest that even relatively narrow changes in the eligibility criteria for federal disability programs can have a powerful effect on program enrollment and expenditures.

Mark Duggan
University of Maryland
Department of Economics
3115L Tydings Hall
College Park, MD 20742
and NBER
duggan@econ.umd.edu

Perry Singleton
University of Maryland
3105 Tydings Hall
College Park, Maryland 20742
singleto@econ.bsos.umd.edu

Robert Rosenheck MD
Director, VA Northeast Program Evaluation Center
Professor of Psychiatry, Epidemiology and Public Health, and the Child Study Center, Yale Medical School
VA Connecticut Health Care System
950 Campbell Ave.
West Haven, CT 06516
robert.rosenheck@yale.edu

I. Introduction

The fraction of adults in the United States receiving federal disability benefits has increased substantially during the past two decades. From 1985 to 2005, the percentage of adults between the ages of 25 and 64 receiving Social Security Disability Insurance (SSDI) increased from 2.1 to 4.1 percent (Autor and Duggan, 2006). The corresponding change for the means-tested Supplemental Security Income (SSI) program was an increase from 1.4 to 2.4 percent.[1] A number of explanations have been advanced for the rise in disability enrollment, including the aging of the population, a reduction in labor market opportunities for less-skilled workers, and the increase in female labor force attachment, which has made more women eligible for the SSDI program.

Perhaps the most important contributor to the growth in enrollment, however, was a change to the disability programs themselves. In 1984 the medical eligibility criteria for both the SSDI and SSI programs were liberalized. Because of this change, individuals with conditions that are difficult to verify objectively found it easier to qualify for the programs. In the two decades since this policy change there has been a considerable shift in the conditions with which people qualify for disability benefits, with mental disorders and diseases of the musculoskeletal system (most commonly back pain or arthritis) replacing cancer and diseases of the circulatory system (heart attacks and stroke) as the most common conditions (Duggan and Imberman, 2006).

Precisely how much of the growth in SSDI and SSI enrollment was attributable to the change in the programs' medical eligibility criteria versus other factors is difficult to determine from the available data. Because the programs are federally administered and have uniform standards throughout the country, there is no natural control group with which to compare those affected by the change. Even absent the 1984 reforms, other factors may have induced changes in the conditions

[1] Approximately 25 percent of non-elderly adult SSI recipients are also on DI, so the fraction on either program increased from 3.2 to 5.9 percent. SSI enrollment data for December of1985 were obtained from the 2005 *Annual Statistical Supplement* and for 2005 from SSI Monthly Statistics at http://www.ssa.gov/policy/data_alpha.html. Approximately 91 percent of non-elderly adult SSI recipients in each year were between the ages of 25 and 64.

with which individuals qualified for disability benefits. For example, during this same twenty-year period there was an increase in the treatment and thus potentially in the diagnosis of mental disorders among non-elderly adults (Kessler et al, 2006).[2] Additionally changes in the workplace may have caused more workers to acquire musculoskeletal conditions such as repetitive stress injury. Thus at least part of the change may have been caused by factors other than the 1984 reforms.

To measure the impact of medical eligibility criteria on enrollment in disability programs, one would ideally consider a change that applied only to certain individuals potentially eligible for the program but not others. This strategy would allow the researcher to control for other factors that might influence program participation and may be changing over time. While no such policy changes have occurred in recent years for the SSDI or SSI programs,[3] there was such a change in the U.S. Department of Veterans' Affairs Disability Compensation (DC) program in the summer of 2001. In the year leading up to this policy change, the federal government's third largest disability program provided $17.4 billion in cash benefits[4] to more than 2.3 million veterans whose disabilities were caused or aggravated by their military service.

Until the summer of 2001, the medical eligibility criteria for the DC program were essentially the same regardless of where and when a veteran served. The key requirement was that a disability must have been caused or aggravated by military service. Thus individuals rarely would qualify for DC because of a condition such as diabetes that primarily would affect people long after their period of military service. However in October of 2000 the National Institute of Medicine issued a report that linked exposure to Agent Orange to the onset of diabetes. Agent Orange is an herbicide that was used extensively in Vietnam and many veterans who served there were thus exposed to it. In July of

[2] Some of this change may have been driven by an increase in the incentive to diagnose a mental disorder resulting from the liberalization of disability programs. See Kubik (2001) for evidence that a liberalization of the SSI program increased the likelihood that children were diagnosed with mental disorders.
[3] There was such a change to SSDI but it occurred more than 45 years ago in 1960, when the federal government extended eligibility for the program to individuals under the age of 50.
[4] All expenditure figures cited here and elsewhere in the paper are adjusted to 2005 dollars using the CPI.

2001, the Secretary of Veterans' Affairs responded to this report by adding diabetes to the list of conditions for which a veteran who served in Vietnam during the Vietnam War could qualify for or increase his DC benefits. There was no corresponding change for veterans from other eras.[5]

As Figure 1 demonstrates, this policy change coincided with a sharp break in trend in DC enrollment. From 1997 to 2001, the number of DC beneficiaries grew by just 0.6 percent per year. But during the next four years, the annual growth rate was five times greater at 3.2 percent. Of course, other factors may have been at least partly responsible for this break in trend. Examples include a significant increase in the prevalence of disability among military veterans because of the wars in Afghanistan and Iraq and administrative changes associated with the implementation of the Veterans Claims Assistance Act, which was enacted in 2000 and was designed to make the DC application process easier for veterans from all eras. Additionally, economic conditions in the U.S. were deteriorating during this same period, with the unemployment rate increasing from 4.0 percent to 6.0 percent from 2000 to 2003. Previous work has found that adverse economic conditions lead to increases in enrollment for both the SSDI and SSI programs (Autor-Duggan, 2003; Black, Daniel, and Sanders, 2002) and it is therefore plausible that such a link exists for DC as well.

The first goal of this paper is to estimate the impact of the Agent Orange decision on enrollment in the DC program. To do this we use veterans from peacetime eras – almost all of whom served shortly before or after the Vietnam era – as our control group. While this group of veterans is clearly not a perfect control group, they had mortality rates and trends in DC enrollment that were quite similar to those for Vietnam era veterans prior to the 2001 policy change and thus form a more appropriate control group than would veterans from any of the other major service eras. Using aggregate data by service era in each year, our estimates suggest that the expansion of the DC program's medical eligibility criteria increased the number of Vietnam veterans on the program in

[5] Prior to this change, diabetes had actually been on the VA's Schedule for Disabilities Ratings, but veterans rarely satisfied the service-connectedness criteria required for benefit receipt. The new policy 'presumptively' linked a Vietnam veteran's diabetes status to Agent Orange exposure and would then be considered service-connected.

September of 2005 by approximately 154,000 over what it would otherwise have been. Given that there were approximately 2.3 million veterans who had served in Vietnam and were alive at this time, this estimate suggests that approximately 6.7 percent of all Vietnam veterans had become eligible for the DC program by the end of the 2005 fiscal year as a result of the policy change.

An additional possible effect of the Agent Orange decision was that Vietnam veterans already on the program could increase their monthly benefits if they were found to have diabetes. In contrast to SSDI and SSI, the DC program pays benefits that are an increasing function of the recipient's combined disability rating (CDR). The CDR depends on the ratings for all of a recipient's rated disabilities, and thus a recipient who could obtain a rating for another condition would typically experience an increase in monthly benefits. Our results suggest that approximately 61,000 Vietnam veterans qualified for an increase in their benefits because of the 2001 policy change. Combined with the effect on enrollment, this suggests that 9.4 percent of the veterans who served in Vietnam and were still alive in 2005 experienced an increase in their DC benefits or became eligible for the program because of the less stringent medical eligibility criteria.

We next investigate the effect of the change in the DC program's medical eligibility criteria on short and long-term expenditures for the program. To do this we estimate the impact of the policy change on the number of Vietnam-era DC recipients with each of the eleven possible CDRs, and then multiply this by average monthly benefits within each CDR. This algorithm captures the effect due to the increase in the number of recipients as well as the increase in benefits for some existing DC recipients. Our estimates suggest that DC expenditures during the 2005 fiscal year were $2.23 billion higher than they would have been in the absence of the Agent Orange decision. Summing the effect across all years and incorporating future exits from the program due to mortality, our estimates suggest that the present value of DC spending increased by $30.5 billion as a result of this decision.

In our final empirical section, we explore whether the change in the DC program's medical eligibility criteria influenced the sensitivity of the program to local economic conditions. A large

literature has explored this issue for other government programs, including AFDC/TANF (Hoynes, 2000; Blank, 2001), Medicaid (Cromwell et al, 1986), food stamps (Ziliak et al, 2003), SSDI (Autor-Duggan, 2003), and SSI (Black, Daniel, and Sanders, 2002; Rupp and Stapleton, 1998). The likelihood of such a link for the DC program is not as clear as for these other programs given that DC benefits are not means-tested and thus the number eligible for the program does not increase as economic conditions deteriorate. Despite this, it is still plausible given that the demand for new sources of income is likely to be greater among those who are out of work or have low earnings.

Our findings demonstrate that DC expenditures did increase much more rapidly in high unemployment areas following the policy change. We detect no corresponding relationship between DC expenditure growth and this measure of economic conditions just prior to the policy change. This result is robust to the inclusion of pre-existing trends in DC expenditures and is driven by spending on Vietnam-era veterans. It therefore appears that the liberalization of the program's medical eligibility criteria made spending for this one category of veterans more sensitive to local economic conditions but there is no corresponding change for their counterparts from other eras.

Taken together, our findings for the VA's Disability Compensation program suggest that the medical eligibility criteria for federal disability programs can have an important impact on program enrollment and expenditures as well as on the responsiveness of the programs to economic conditions. Given the high enrollment in and expenditures on the DC program, it is to some extent surprising that it has been almost entirely ignored in previous economic research.[6] More work on both the causes and the consequences of enrollment in this program, which currently provides benefits and health insurance to almost 12 percent of military veterans, is clearly warranted.

[6] One piece of evidence for this is that of all the papers cited in Bound and Burkhauser's 1999 *Handbook of Labor Economics* chapter on disability programs (1999), 44 focus on SSDI, 17 on SSI, and just 1 on DC. The number of adult disability recipients in these three programs in September of 2005 was 6.47 million, 4.86 million, and 2.64 million, respectively. The one paper that considers DC is a descriptive paper that compares the economic well-being of individuals who receive SSDI, SSI, DC, or Workers' Compensation benefits (Burkhauser and Daly, 1999) in the U.S. with those who receive disability benefits in Germany. Thus this paper does not focus only on DC.

II. The Department of Veterans Affairs and the Disability Compensation Program

The U.S. Department of Veterans Affairs (VA) provides benefits to veterans of military service and their families. At the end of the 2005 fiscal year, the VA estimated that there were 24.4 million veterans residing in the U.S. and that an additional 45 million were potentially eligible for VA benefits as family members or survivors of veterans. According to VA estimates, the number of veterans has declined substantially in recent years, falling by more than 8 percent from September of 2000 to September of 2005.[7]

As Table 1 demonstrates, this change in the veteran population has been associated with a substantial change in its composition, both because of mortality among veterans from earlier eras and because of entry by those serving during the Gulf War era. Most strikingly, the number of veterans from the World War II era declined by 37 percent (from 5.59 to 3.52 million) during this five-year period while the number of veterans from the Gulf War era increased by 42 percent from to 2.84 to 4.03 million. Veterans from the Vietnam era accounted for the largest share in both years, with their ranks declining by 4 percent from 8.01 to 7.70 million but their share of all veterans increasing slightly from 30 to 32 percent.[8] It is worth noting that, while veterans are categorized based on their period of service, the number serving in specific conflicts tend to be much lower than the era-specific population data would suggest. For example, a recent estimate by the VA suggests that just 2.3 million of the 7.7 million Vietnam-era veterans alive in 2005 actually served in Vietnam.

A. VA Programs and Expenditures

Despite the significant decline in the veteran population since 2000, total expenditures for

[7] The data on dependents and population were obtained from the VA's website at http://www.va.gov/about_va/ and http://www.va.gov/vetdata/demographics/Vetpop2004/VP2004B.htm, respectively.

[8] According to the VBA's 2004 *Annual Benefits Report*, the approximate service dates by era were: World War II (September 1940 – July 1947), Korea (June 1950 – January 1955), Vietnam (August 1964 – May 1975), and Gulf War (August 1990 – present). Peacetime includes veterans who served during all other periods. These population estimates assign veterans who served in two or more eras to their earliest era of service. However a veteran who served during a conflict and during peacetime would always be assigned to the conflict.

VA programs and for medical care through the Veterans Health Administration have increased by an average of 6 percent per year during the same period. Table 2 lists total VA spending by category for the 1998 through 2005 fiscal years. As this table shows, Compensation and Pension (CP) programs were the largest category of spending throughout this period, with the $32.1 billion in CP benefits representing 46 percent of total spending by the VA during the 2005 fiscal year. The Veterans Health Administration (VHA) provided medical care to 4.96 million patients during this same year at a cost of $30.7 billion (44 percent of total VA spending). The remaining $7.5 billion in VA spending was spread across several categories, including operating expenses, construction, insurance, housing assistance, vocational rehabilitation, training programs, and burial and memorial benefits.

CP benefits are paid through four main programs. By far the largest in terms of enrollment and expenditures is the Disability Compensation program, which according to the data displayed in Tables 3A and 3B, accounted for 75 percent of CP enrollment and 74 percent of expenditures, respectively, during the 2005 fiscal year. The DC program pays benefits to disabled veterans of military service whose conditions were caused or aggravated by their military service. The program is not means-tested and an individual's DC benefits are not directly affected by his earnings. This is in contrast to the SSDI and SSI programs, which substantially reduce recipients' incentives to work.

The Disability Pension (DP) program is targeted at low-income wartime veterans who either are age 65 or older or are permanently and totally disabled (regardless of service-connectedness). This program accounted for just 10 percent of CP enrollment and 9 percent of CP spending during the 2005 fiscal year. Beneficiaries of both the DC and DP programs are eligible for health care through the VHA and their expenditures accounted for much of the $30.7 billion in VHA spending during this same year.[9] The VA also paid $4.5 billion in cash benefits to the survivors of 0.54 million deceased veterans through the Death Compensation and Death Pension programs, with this accounting for the remaining 15 percent of CP enrollment and expenditures.

[9] The VHA provides care to other veterans as well, with 4.96 million served by the VHA during the 2004 fiscal year.

B. The Disability Compensation Program

To apply for Disability Compensation benefits, a veteran must submit an application at one of 63 regional offices of the Veterans Benefit Administration (VBA). At this stage, the 'authorization unit' collects necessary information regarding the claimant's application. These would include military service records and medical records from both VA medical facilities and private providers. The application is then forwarded to a Rating Board, which determines whether each disability for which an application is submitted is service connected and assigns an appropriate degree of disability according to the Schedule for Rating Disabilities. These ratings range from 0 to 100 percent (in 10 percent increments) depending on the type and severity of the disability, with more severe conditions receiving a higher rating.[10] The recipient's combined disability rating (CDR) is a function of the individual ratings. If the award is made for just one condition then the CDR is equal to the rating for that condition. If the award is made for multiple conditions then the CDR will be greater than any of the individual ratings, though the CDR is not simply a sum of the remaining ratings.[11] For example, a DC recipient with three disabilities rated at 30 percent each would receive a CDR of 70 percent while someone with two disabilities rated at 40 percent each would have a CDR of 60 percent.

If a DC award is made, the CDR is used to determine the monthly cash benefit amount, which is an increasing function of this rating.[12] The monthly benefit can increase beyond this base for DC recipients with a CDR of 30 percent or more and who have dependent spouses, children, or parents. The benefit can also increase for those with ratings of 60 percent or more who are so disabled that they are deemed unemployable. The second column of Table 4 lists the baseline benefit

[10] The possible ratings depend on the disability. For example type II diabetes can have ratings of 10, 20, 40, 60, or 100 percent, whereas arthritis can only be assigned a rating of 10 or 20 percent. For a list of conditions and possible ratings see http://www.warms.vba.va.gov/bookc.html. A disability with a zero percent rating would not increase the monthly cash benefit but would have priority for health care treatment through the Veterans Health Administration.
[11] If a claimant has multiple disabilities, only the claimant's residual ability is considered when determining the impact of the next disability considered. For example, if a veteran has two disabilities rated at 50%, then only 50% of his ability is considered when determining the impact of the second disability. Therefore, his CDR would be 80%; the sum of 50% for the first and 25% for the second (.5*(1-.5)) rounded to the nearest increment of 10%.
[12] The VBA considers the average reduction in earnings capacity to determine the benefit amount associated with each value of the CDR.

amounts for the 2005 fiscal year (October 2004 to September 2005) by disability rating. As the table shows, benefit amounts increase with the CDR and the dollar increment from one category to the next also increases with the CDR. For example the monthly payment rates for ratings of 10, 40, 70, and 100 percent are $108, $466, $1056, and $2299, respectively. The next three columns in the table show the adjustments to these baseline amounts if the veteran has one dependent child, one dependent spouse, or both, and also the increment to benefits for each additional child under the age of 18 or each child age 18 and up and enrolled in school.[13]

The first three columns of Table 5 list the total number of recipients, the total dollars paid, and the average monthly benefit in each CDR category in September of 2005. The average payment to the 2.64 million DC recipients in that month was $741 for a total of $1.954 billion in cash benefits (thus approximately $23 billion for the year). Those with ratings between 0 and 20 percent accounted for 45 percent of recipients but just 9 percent of dollars paid. The corresponding shares for those with ratings at or above 70 percent were 20 and 62 percent, respectively.[14]

As the next several columns of this table demonstrate, there was considerable variation across service eras in the distribution of the combined disability rating.[15] For example, among Vietnam era DC recipients, 31 percent had CDRs of 70 percent or more. The corresponding share for DC recipients serving in the Gulf War was just 12 percent. Because of this, average monthly benefits also varied widely by service era, from a low of $542 for Gulf War veterans to a high of $973 for veterans serving in Vietnam. DC recipients from peacetime, World War II, and the Korean War eras

[13] The monthly benefit amounts are adjusted each year, with the percentage increase equal to the percentage increase in the Consumer Price Index (CPI). Benefit amounts by CDR and by dependent status for the 1999 through 2005 fiscal years are available at http://www.vba.va.gov/bln/21/Rates/comp01.htm.

[14] The average monthly benefit amounts for those with ratings between 0 and 20 percent are very close to the baseline amounts because they are not eligible for dependent benefits. The average amounts paid for those rated 60 percent and higher are much greater than the baseline amounts because many of these recipients are eligible for the 100 percent payment amount because they are deemed unemployable.

[15] DC recipients are assigned to eras based on where their most significant disability occurred. Thus a person serving in Korea and in peacetime whose disability was incurred during peacetime would be categorized as peacetime for the DC program but as a Korean War veteran in the population data. This will introduce measurement error in our estimates for era-specific DC enrollment, though the extent of this error seems unlikely to change significantly over short time periods.

had average monthly benefits of $611, $695, and $756, respectively.

C. The DC Program's Medical Eligibility Criteria

In a typical year more than 70 percent of Disability Compensation applicants apply for benefits for more than one condition. One of three outcomes is possible – outright rejection, an award for some but not all conditions, or an award for all conditions. During the 2000 fiscal year, 14 percent of applications considered were awarded for all conditions, 48 percent for some conditions, and 38 percent were outright rejected (VBA, 2001).[16] During the course of the year a total of 83,159 DC awards were made, with the average number of rated conditions among new recipients equal to 3.2. This was somewhat higher than the corresponding number among all DC recipients, which stood at 2.5 in September of 2000.

Until July of 2001, the medical eligibility criteria for DC benefits were essentially the same across service eras. Any veteran who was honorably discharged and whose disability did not result from his willful misconduct could qualify for DC benefits if his disability "was a result of disease or injury incurred or aggravated during active military service." Many conditions would clearly have resulted from military service. For example if a soldier lost one or more limbs during a battle then there would be no uncertainty about whether the injury was service-connected. The same would also be true for scars, the most commonly compensated diagnosis among DC recipients at the end of the 2000 fiscal year. The existence of such a causal link for the typical tinnitus (persistent ringing in the ears) or post-traumatic stress disorder application might be somewhat less clear cut, though still certainly plausible. The fact that these two conditions were among the ten most commonly compensated by the DC program in fiscal year 2000 suggests that the VA's medical examiners frequently concluded they were caused or aggravated by military service.[17]

[16] These decisions are frequently appealed. Existing DC recipients can also apply for an increase in their benefit amount, either because of an increase in the severity of a rated condition or because a new health problem arises.
[17] A listing of the top twenty impairments at the end of each fiscal year can be found in the VBA's annual report. In September of 2000 more than 12 percent of DC recipients had "scars, other" as one of their qualifying conditions.

Proving such a link existed for a condition such as diabetes would undoubtedly be much more difficult. Indeed a 2000 report by the National Academy of Sciences argued that the most important determinants of diabetes were physical inactivity, family history, and obesity (NAS, 2000). Despite this, approximately 1.6 percent of DC recipients had diabetes as one of their covered conditions in September of 2000. While this share is not trivial, diabetes was not one of the twenty most common conditions among DC recipients at that time,[18] nor was it one of the ten most common conditions for DC recipients from any of the five major service eras.

III. The Institute of Medicine Report on Agent Orange Exposure

While the DC program's medical eligibility criteria were essentially the same for all military veterans up until July of 2001, the types of disabilities incurred undoubtedly varied across service eras. For example, one might expect a significantly higher rate of service-connected post traumatic stress disorder (PTSD) among DC recipients who served in the Vietnam War than among their counterparts from other eras given the intensity of the conflict there. And this was indeed the case, with 13.3 percent of DC recipients from the Vietnam era receiving compensation for PTSD in September of 2000 versus just 2.2 percent of all other DC recipients (VBA, 2001).

Another reason that the disabilities incurred might vary across service areas is that different weapons and techniques were used by the U.S. military and their opponents over time. One notable example of this is the use of herbicides in the Vietnam War. Agent Orange was one of fifteen herbicides used by the U.S. military to defoliate trees that might otherwise provide cover to opposing forces. Estimates suggest that from 1962 to 1971, more than 19 million gallons of herbicides were sprayed in all four military zones of Vietnam, with the affected area equal to 8.5% of the country's

---

Next most common were skeletal conditions (10.6 percent), knee impairment (9.8 percent), and arthritis due to trauma (8.0 percent). Tinnitus (6.2 percent) and PTSD (5.8 percent) were the 6th and 9th most common conditions.

[18] The VBA annual report only lists the top 20 conditions overall and the top four conditions within each major diagnostic category. The condition ranked number 20 overall had a 2.7 percent share.

total land area. Although the use of Agent Orange did not begin until 1965, it represented more than 80 percent of all herbicides sprayed in Vietnam (VA, 2003).

Soon after the war ended, many Vietnam veterans voiced concerns about the possible long term effects of exposure to the dioxins in Agent Orange and other herbicides used in Vietnam. In response to these concerns, the VA established the Agent Orange Registry in 1978, which provided voluntary medical examinations to veterans who served in Vietnam between 1962 and 1975. Thirteen years later, the Agent Orange Act of 1991 was enacted, which charged the National Academy of Sciences' Institute of Medicine with conducting an independent review of the existing scientific literature regarding the possibility of a link between Agent Orange exposure and the prevalence of certain medical conditions.

In a series of five reports released between 1994 and 2003, the Institute of Medicine (IOM) grouped forty different medical conditions into one of four categories – (1) sufficient evidence of an association between Agent Orange and the condition (2) limited or suggestive evidence of an association (3) inadequate or insufficient evidence and (4) limited or suggestive evidence of no association. Interestingly, none of the four categories required causal evidence. In the first three reports, diabetes was placed in the third category, with the IOM concluding that there was insufficient evidence to establish an association between dioxin exposure and the onset of diabetes.

But soon after the third IOM report was released in 1999, two new studies were released that provided supporting evidence of an association between dioxin exposure and diabetes (Calvert et. al., 1999; AFHS, 2000). In October of 2000 in response to a special request by the VA, the IOM evaluated the new studies in the context of previous research and concluded that there was suggestive evidence of an association between Agent Orange exposure and the onset of diabetes (IOM, 2000). This catapulted diabetes from category three to category two. In response to this report, the Secretary of the VA announced in November of 2000 that type II diabetes would be compensable under the DC program and, more importantly, that diabetes would be "presumptively" service-

connected among those veterans who served in Vietnam.[19] Diabetes would not become compensable, however, until July of 2001.

Shortly after this policy change, the growth in total DC enrollment increased substantially, as shown in Figure 1. From September of 1997 to September of 2001 the number of DC recipients increased by just 0.6 percent per year but during the next four years the annual growth rate was 3.2 percent. The timing of this increase in enrollment growth strongly suggests that the policy change described above was the main cause.

However this was not the only possible explanation for the increase in the rate of DC enrollment growth. For example, the Veterans Claim Assistance Act, which was enacted in 2000, required the VA to provide more assistance to DC applicants from all eras and to add more resources to the processing of DC applications (GAO, 2002). Similarly the economic downturn and the corresponding increase in the unemployment rate may have caused some veterans to seek out alternative sources of income. And finally, the wars in Afghanistan and Iraq may have led to a significant increase in the prevalence of disabilities among veterans serving in these conflicts. In the next two sections we estimate the impact of the Agent Orange decision on DC enrollment and expenditures while controlling for these and other potentially confounding factors.

IV. The Effect of the Agent Orange Decision on Enrollment in the DC Program

Theoretically, one would expect the Agent Orange decision to have increased the propensity of veterans who served in Vietnam to apply for DC benefits. As Parsons (1980), Bound (1989), and others have noted, a key determinant of an individual's decision to apply for disability benefits is the probability that an award is made. It seems likely that this award probability increased following the July 2001 policy change, especially for Vietnam veterans who knew they had diabetes. But it may

[19] No such presumption was made for veterans who served during the Vietnam era but not in Vietnam, with the exception of veterans who served in Korea in either 1968 or 1969. This group was added because Agent Orange and similar herbicides were used by the U.S. military in Korea during this two-year period (VA, 2005).

also have increased the incentive for other Vietnam veterans. For example, a veteran who thought there was some chance that he had diabetes might go for a medical checkup.[20] This medical checkup could identify other health problems, and thus he could subsequently qualify for the DC program even if he did not have diabetes. Similarly, the change in the program's medical eligibility criteria may have increased the discussion of the DC program among Vietnam veterans. This could have reduced the effective application costs sufficiently to cause some to apply for DC benefits.

The policy change would also have increased the incentive for existing DC recipients who served in Vietnam to apply for an increase in their monthly benefit. As described above, a veteran's DC benefit is a function of the combined disability rating (CDR), which generally increases when an additional condition is rated at 10 percent or more. Thus the Agent Orange decision could have increased both DC enrollment and the amount of benefits paid to existing DC recipients.

A. Differences-in-Differences Estimates of the Impact on DC Enrollment

In its publication titled *Annual Benefits Report*, the Veterans Benefit Administration provides detailed information each year on the characteristics of individuals receiving DC benefits at the end of the previous fiscal year. This information includes the number of DC recipients with certain diagnoses, the number with each of the eleven possible combined disability ratings (0 to 100 percent), the average monthly benefit received, and many other variables of interest. This data is further broken down by service era, with DC recipients classified according to where their most significant disability occurred. Thus if a veteran served in both the Korean and Vietnam Wars but incurred his highest rated disability in the Vietnam War, his service era would be set to Korean War. This era-specific data can be used to estimate the impact of the policy change described above on enrollment in the DC program.

Because the Agent Orange decision differentially affected veterans from in the Vietnam War,

[20] According to a CDC report (2003), approximately one third of diabetics in US are undiagnosed. See Singleton (2006) for an anlysis of self-reported rates of diagnosed diabetes among veterans and non-veterans in response to the Agent Orange decision.

one can essentially use veterans from other eras as a control group. The availability of a control group is useful for identification purposes given that other changes occurring around the same time might also have affected DC enrollment. For example, the Veterans Claim Assistance Act that was passed in the year 2000 influenced the DC application and award process for veterans from all service eras (GAO, 2002). To the extent that this policy, the economic downturn, and other factors did not have a different effect on Vietnam veterans than on veterans from other eras, then their effects could be captured by the time effects Θ_t in the following differences-in-differences model:

$$(1) \quad DC_{jt} = \beta_0 + \beta_1 * X_{jt} + \beta_2 * Vietnam_j + \beta_3 * Vietnam_j * POST_t + \sum_{t=\tau_1}^{\tau_2} \theta_t + \varepsilon_{jt}$$

In this model,[21] the outcome variable DC_{jt}, is equal to one if individual j received DC benefits in year t and zero otherwise. The variable $Vietnam_j$ is equal to one if individual j is a Vietnam era veteran and zero otherwise. $POST_t$ is set equal to one after the policy takes effect, though to the extent that the impact is not immediate it may be more appropriate to allow the policy's impact to vary over time. The parameter of particular interest in this model is β_3, which is the coefficient on the interaction between the $Vietnam_j$ and $POST_t$ variables. If the assumptions of the differences-in-differences model hold, then this parameter represents the impact of the policy change on the probability of DC enrollment among Vietnam era veterans. The key assumption of this model is that, for β_3 to be reliably estimated, there must not be unobserved factors that influence DC enrollment differentially for Vietnam era veterans following the policy change.

Ideally when estimating a differences-in-differences model such as this one, the treatment and control groups would be identical on background characteristics such as age, gender, education, and other possible determinants of DC enrollment. Of course, veterans who served in Vietnam will differ from other veterans in many respects. For example, they are significantly older on average

[21] Note that the inclusion of year indicators in this model makes it unnecessary to add a POST variable separately, as this would then be a linear function of certain year indicators.

than Gulf War veterans and much younger than veterans who served in World War II or Korea. But to the extent that the overall enrollment effect of these differences does not change at the time of the policy change, it should be captured by era-specific fixed effects and era-specific time trends. But when interpreting the estimates below, it is worth bearing in mind that there is no perfect control group for Vietnam veterans.

B. Choosing the Control Group

The Veterans Benefit Administration classifies military veterans into one of five mutually exclusive service eras – World War II, Korea, Vietnam, Gulf War, and peacetime – based on when they were serving at the time of their disability. In terms of age, those classified as peacetime are most similar on average to Vietnam era veterans because they served either right after the Vietnam War (and before the Gulf War) or immediately prior to the Vietnam War (and after the Korean conflict). According to the most recent estimates from the VA and summarized in Table 1, these two groups accounted for 53 and 44 percent, respectively, of the peacetime era veteran population in September of 2000. The 5.6 percent five-year mortality rate for this group was similar to the rate for Vietnam veterans (3.9 percent), though much lower than the rate among Korean War (17 percent) and World War II era (37 percent) veterans. Thus at least on this one dimension it seems that veterans from peacetime eras are the most appropriate control group for Vietnam era veterans.

The data summarized in Table 6 lists the number of veterans receiving DC benefits by service era in September of each year from 1998 to 2005. This table also lists the percentage change in this number from the previous year, the number of veterans in each service era, and the fraction of veterans receiving DC benefits. Before considering the effect of the 2001 policy change, three points are worth noting from this table. First, the number of DC recipients who served in World War II is declining steadily throughout this time period, by an average of approximately 6.6 percent per year. This largely reflects the high mortality rate among this group, which can be seen by the similarly steady decline in the number of World War II veterans. Second, the number of DC recipients who

served in the Gulf War era increased rapidly throughout this time period by an average of 14.9 percent per year. While this has largely been driven by an increase in the number of Gulf War era veterans (those serving since August 1990), the increase in the fraction receiving benefits from 9.6 to 15.2 percent has been nearly as important. And finally, the trends from 1997 to 2000 in DC enrollment are fairly similar for the other three service eras. During this three-year period, DC enrollment increased by an average of 0.8 and 1.7 percent per year, respectively, among Vietnam and peacetime era veterans, while declining by an average of 2.2 percent per year among those serving in the Korea conflict.

Given these trends, it seems clear that veterans from either the World War II or Gulf War eras would not be an appropriate control group. Which of the other two eras is more appropriate is not as obvious. On the one hand, prior to the Agent Orange decision, peacetime and Vietnam era veterans had similar rates of DC enrollment, at 8.6 and 9.3 percent, respectively. Similarly their mortality rates from 2000 to 2005 were much more similar. On the other hand, veterans from the Korean War, like their counterparts who served in Vietnam, incurred their disabilities in a military conflict and thus their service-connected disabilities may be more similar. But this similarity is arguably not as important as the pre policy enrollment and mortality rates, and we therefore use individuals who served in peacetime as our control group.[22]

Figure 2 summarizes the results from such a comparison using data from 1998 through 2005. Here we display the fraction of Vietnam-era and peacetime-era veterans receiving DC benefits in September of each year.[23] As is clear from the figure, the trends for the two groups were fairly similar from 1998 to 2000, with the rate of enrollment increasing from 9.0 to 9.3 percent among

[22] In a companion set of results not summarized here we obtained similar estimates when using veterans from the Korean War era as our control group

[23] As described above, the assignment of DC recipients to eras (the numerator) differs somewhat from the assignment of veterans to eras for population estimates (the denominator). For example, to be counted as peacetime in the population data a veteran must have served only in peacetime. To be assigned to peacetime as a DC recipient the veteran must have incurred his most severe disability during peacetime. This will introduce measurement error in our estimated enrollment rates. But as long as the impact of this has a smooth trend over time, it should not bias this comparison or the results that follow.

Vietnam veterans and from 8.1 to 8.6 percent among peacetime veterans.[24] The trend for the peacetime group was quite similar during the next five years, with 9.5 percent of peacetime veterans receiving DC benefits by the end of the 2005 fiscal year. But the fraction of Vietnam era veterans on the DC program increased dramatically during this same four-year period, rising from 9.3 to 11.9 percent. A differences-in-differences estimate of the effect of the Agent Orange decision on the change in DC enrollment from September of 2000 to September of 2005 would therefore be 1.7 percent (2.6 percent increase minus a 0.9 percent increase).[25] This estimate was obtained from an analog to equation (1) above that uses aggregate rather than individual-level data and replaces the $POST_t$ indicator with year effects so as to differentiate the effect in 2002 from the effect in 2005.

Ideally we would estimate equation (1) above using individual-level data, as this would allow us to control for each individual's background characteristics X_{jt} and estimate the characteristics of the veterans who were affected by the policy. But unfortunately only aggregate data on DC enrollment is publicly available and it is therefore what we use here. It is worth stressing that, as long as there are not significant changes in the background characteristics that both coincide with the timing of the policy and differ by service era, our estimates will be very similar to the ones that would result from using individual level data. This is because our key sources of variation are service era and time and we can reliably estimate average DC enrollment by service era and time.

Our baseline estimate of 1.7 percentage points does not account for the fact that the pre-existing trends in DC enrollment were slightly different for veterans from the Vietnam and peacetime eras. We next account for this by assuming that the average annual increase for each group from 1998 to 2000 continued for the next five years. Given this assumption, the predicted rates of DC

[24] The trends are similar through 2001 as well, though as our diagnosis data below demonstrates, the policy change had already started to have an effect by the end of 2001 and thus we consider it as post policy here.

[25] One possible source of bias is that DC recipients who served both in peacetime and in Vietnam could, after qualifying from diabetes, switch from being classified as peacetime to being classified as Vietnam for the purposes of DC enrollment. This would not represent a new recipient but we would count it as such. Similarly we would double count because they would be subtracted from the control group and added to the treatment group. While there is no way to rule out this possibility with the available data, the fact that the trend in DC enrollment for peacetime era veterans did not change significantly after 2001 suggests that it is not an important source of bias.

enrollment in September of 2005 for peacetime and Vietnam era veterans were 9.6 and 9.9 percent, respectively. The actual rate of 9.5 percent for our control group was almost identical to their predicted rate. But the same was not true for veterans from the Vietnam era, whose actual DC enrollment of 11.9 percent was 2.0 percentage points higher in 2005 than predicted.

Given that there were approximately 7.7 million Vietnam-era veterans alive in September of 2005, our findings suggest that the Agent Orange decision increased DC enrollment by 154,000 above what it otherwise would have been by September of 2005. But this decision applied only to the 2.3 million veterans who served in Vietnam. Thus the expanded eligibility criteria induced a 6.7 percentage point increase in DC enrollment among those veterans who actually served in Vietnam. Furthermore, the change in the medical eligibility criteria for Vietnam veterans can explain more than 60 percent of the acceleration in DC enrollment since the end of the 2001 fiscal year that is apparent in Figure 1.[26]

V. The Effect on Existing DC Recipients and on Program Expenditures

The results in the previous section estimated the effect of the Agent Orange decision on the number of veterans receiving DC benefits but did not shed light on the effect for individuals already on the program. As mentioned above, a Vietnam-era DC recipient could have applied for an increase in benefits if he thought that he might have diabetes. In this section, we first explore whether this effect was important by using aggregate data from the VBA's *Annual Benefits Report* on the diagnoses of DC recipients and of those newly awarded DC benefits. We then investigate the effect of the policy change on total DC expenditures, which incorporates both the benefits paid to new recipients and the increase in benefits for existing recipients.

[26] The number of DC recipients increased at a 0.64 percent annual rate from 1998 to 2001. Had this growth continued during the next four years, the number of DC recipients would have been 255,809 lower. Thus the induced increase of 154,000 accounts for more than 60 percent of this. Essentially all of the remaining above trend after 2001 is attributable to the growing importance of entry by Gulf War veterans and the declining importance of exits by World War II DC recipients.

A. The Number of Vietnam Veterans Experiencing an Increase in DC Benefits

The top two rows of Table 7 list the number and percentage, respectively, of all DC recipients receiving compensation for diabetes in each year. At the end of the 2000 fiscal year, just 1.6 percent of DC recipients were paid for this condition, with this fraction unchanged from the previous year. But in the years following the 2001 policy change, this percentage increased consistently, reaching a peak of 7.5 percent by the end of 2004 (the most recent year of the VBA's *Annual Benefits Report*). This increase was driven almost entirely by Vietnam era DC recipients, with 18.5 percent of them receiving compensation for diabetes in September of 2004 versus just 1.7 percent for all other DC recipients.[27] According to the 2004 *Annual Benefits Report*, diabetes was the most frequently compensated condition among Vietnam era DC recipients in the autumn of 2004 after not being in the top ten just three years earlier.

The number of Vietnam-era DC recipients compensated for diabetes increased from 18,993 in September of 2000 to 163,485 by September of 2004. Had the number of diabetes awards to Vietnam veterans remained at 600 (the average of the number in 1999 and 2000, as shown in Appendix Table 2) in each of the next four years, the total number of awards for this condition would have been lower by approximately 99,332 during this period.[28] If one makes the conservative assumption that none of these awardees would have exited the program by the end of 2004, then an additional 45,841 individuals receiving DC benefits at the time of the 2001 Agent Orange decision enjoyed an increase in their benefits by September of 2004 because their diabetes was covered.[29] However this estimate excludes the number enjoying an increase in benefits during the 2005 fiscal

[27] Values in this table with an asterisk were imputed. See the notes to Appendix Tables 1 and 2 for a description of our imputation procedure.

[28] This is lower than the increase in the number of DC recipients. One plausible explanation is that some of the applications that resulted from the policy change had diabetes rejected but one or more other conditions accepted. As mentioned above, the most common outcome of a DC application is for one or more conditions to be rejected and one or more to be accepted.

[29] To calculate this, we subtract the increase in the number of Vietnam era veterans with diabetes from 2000 to 2004 (144,492) from the increase in the number of new DC recipients with diabetes as a covered condition (the sum of the number of diabetes awards to Vietnam veterans from 2001 to 2004 minus 2400).

year, and we therefore inflate this estimate by one-third to arrive at an estimate of 61,121 for the number of existing DC recipients who enjoyed an increase in their monthly benefits because of the Agent Orange decision.[30]

When combined with the results from the previous section, our estimates suggest that approximately 215,000 Vietnam veterans enrolled in DC or enjoyed an increase in their DC benefits as a result of the Agent Orange decision. This represents approximately 2.8 percent of the estimated 7.7 million veterans who served during the Vietnam era and were still alive in September of 2005. However, less than one-third of these 7.7 million actually spent time in Vietnam or in the surrounding waters. Thus approximately 9.4 percent of the 2.3 million veterans who actually served in Vietnam and were living in September of 2005 became eligible for Disability Compensation or enjoyed an increase in their benefits between July of 2001 and September of 2005 as a result of the program's less stringent medical eligibility criteria.

B. The Impact on Short and Long-Term Disability Compensation Expenditures

The effect of the Agent Orange decision on Disability Compensation expenditures depends both on the characteristics of those awarded benefits because of the expanded medical eligibility criteria and their counterparts already on the program who enjoyed an increase in their benefits. The main determinant of the short-term increase in spending is the CDR of new recipients and the increase in the CDR for existing recipients. If the 154,000 Vietnam veterans awarded benefits all had a CDR of just 10 percent, for example, then the effect on spending would be relatively modest. The same would be true if the 61,000 enjoying an increase in their benefits rose from a CDR of 10 to just 20 percent.

To estimate the effect of the Agent Orange decision on benefits paid, one would ideally use

[30] Some of those applying for an increase in benefits may have applied for multiple conditions or for an increase in ratings for existing conditions. Even if their diabetes applications were turned down, some existing recipients may have enjoyed an increase in benefits because of the application that was induced by the policy change. This is one reason that our estimate may be too low.

individual-level longitudinal data on DC enrollment and benefit amounts for all veterans. This would allow us to estimate which new recipients enrolled in the program because of the policy change and which existing recipients enjoyed an increase in their benefits. Aggregating up the monthly benefits for these individuals, we could then calculate the effect on DC spending. Unfortunately we do not have this type of data. An (admittedly imperfect) alternative is to utilize aggregate data on the distribution of CDRs by service era in the years leading up to and following the policy change. As in the previous section, here we control for pre-existing trends among Vietnam-era veterans to estimate the change that would have occurred in the absence of the Agent Orange decision if the pre-2000 trends had continued through 2005. Specifically we estimate the annual change from 1998 to 2000 in the number of Vietnam era veterans with each CDR and use this to predict the number with this CDR in 2005 as follows:

$$(2) \quad \hat{V}_{DC,j,05} = V_{DC,j,00} + \left[5 * \left(\frac{V_{DC,j,00} - V_{DC,j,98}}{2} \right) \right]$$

with $V_{DC,j,t}$ equal to the number of Vietnam era DC recipients in CDR j in year t. We attribute any difference between the actual and predicted number of recipients within each CDR to the Agent Orange decision. To estimate the effect on spending we simply multiply these CDR-specific effects by the average monthly benefit amount for that CDR. One important advantage of this approach is that – if our assumptions are correct – it captures the spending effect that is attributable both to new recipients and to existing recipients.

Of course, the trend in the number of Vietnam era DC recipients for each CDR may have changed after 2000 even in the absence of the change in the program's medical eligibility criteria. For example, the Veterans Claim Assistance Act, the economic downturn, and related factors could have induced a break in trend. We therefore follow our approach from above and use veterans from the peacetime era as a control group. If our algorithm does a reasonable job of predicting the actual change in the number in each CDR bin for this group, it suggests that our estimates for the effect of

the Agent Orange decision are not driven by potentially confounding factors.

The results from this analysis are summarized in Table 8. The first and second panels include data for Vietnam and peacetime era veterans, respectively. The first three columns of the top panel list the number of Vietnam era veterans on the DC program with each of the eleven possible CDRs in 1998, 2000, and 2005, respectively. An examination of this data suggests that, despite the fact that the number of DC recipients was not changing much from 1998 to 2000, the distribution of the CDRs was. For example the number of DC recipients with ratings between 10 and 40 percent ratings declined (by 3 percent from 513,182 to 497,676), while the corresponding number with ratings between 50 and 100 percent increased (by 12 percent). A similar pattern existed for peacetime era DC recipients from 1998 to 2000, with an increase of just 1 percent for ratings between 10 and 40 percent versus an increase of 13 percent for ratings between 50 and 100 percent. These pre-existing trends suggest that, even in the absence of the policy change, the distribution of CDRs among Vietnam and peacetime era DC recipients would have changed after the Agent Orange decision. This could simply reflect the fact that, as veterans from both of these eras aged, their health deteriorated and thus they were given higher ratings for existing conditions or start to receive compensation for additional conditions.

The fourth column lists the change in the number with each CDR that would have occurred from 2000 to 2005 if these pre-existing trends had continued. To calculate these predicted changes, we use equation (2) above. According to our estimates, the number of Vietnam era veterans with a rating of 10 percent would have fallen from 227,800 to 205,077 while the number with a rating of 100 percent would have increased from 85,994 to 106,149 during this five year period. The first of these two estimates is relatively accurate, as the number with a ten percent rating in September of 2005 was 207,282. But the latter estimate is much too low, with the actual number rated at 100 percent standing at 131,434 at the end of our period.

The discrepancy between our estimates and the actual change for all eleven possible CDRs is

listed in column seven. In every case our estimates are too low, which is not so surprising given the substantial increase in DC enrollment among Vietnam era veterans from 2000 to 2005. But in general the discrepancies are greatest for the highest CDRs. For example, we predicted an increase of 33,698 in the number with ratings of 80 percent or more, but the actual increase was substantially higher at 89,233.[31] Multiplying these CDR-specific discrepancies by the average monthly benefit in September of 2005 for each CDR, we estimate that DC expenditures were $2.34 billion higher during the 2005 fiscal year than they would have been if the pre-2000 trend had continued.

The bottom panel repeats this exercise for veterans from the peacetime era. In this case the discrepancies between our predictions and the actual number in each CDR are much smaller. As was true for Vietnam era veterans, we tend to underestimate more for the higher CDRs, though the estimated dollar value of our discrepancies is just $0.04 billion for the 2005 fiscal year, which is 98 percent lower than the corresponding estimate of $2.34 billion for Vietnam era DC spending. This suggests that our estimate for the impact of the policy change on DC expenditures for Vietnam veterans may be too high, as perhaps the number of Vietnam veterans with high CDRs would have accelerated after 2000 in the absence of the Agent Orange decision. But the acceleration for peacetime era veterans was relatively modest, with the $0.04 billion discrepancy representing just 1.02 percent of 2000 DC expenditures for veterans from this era. If we adjust downward our estimate of $2.34 billion by 1.02 percent of Vietnam era DC expenditures for the 2000 fiscal year, we find that the effect of the Agent Orange decision on annual DC spending was $2.23 billion.

What is the present value of this expenditure increase? Calculating this is clearly difficult given that we do not know the mortality rate of those affected by the expansion in medical eligibility criteria. During the 2001 fiscal year, 1.70 percent of Vietnam era veterans exited the program, with

[31] This would be surprising if those entering the program as a result of the policy change tended to have low benefits. But on average in December of 2004 the monthly cash benefit was 19 percent greater among Vietnam-era DC recipients with diabetes than among their counterparts without diabetes. It therefore appears that those entering the program are not compensated only for diabetes.

almost all of these exits (95.2 percent) resulting from death.[32] If we assume that this same exit rate existed for those affected by the policy change and adjust this for the increases resulting from the aging of Vietnam-era veterans, we can estimate a year-specific mortality rate, which we list in the third column of Appendix Table 3. We further assume that there was no expenditure impact in 2001, that the expenditure impact from 2002 to 2005 increased linearly to $2.23 billion, and that this effect did not change in future years (except for exits). This makes the conservative assumption that all Vietnam veterans affected by the policy had enrolled in the program or experienced an increase in their benefits by September of 2005, which seems unlikely given that some Vietnam veterans who do not currently have diabetes may suffer from this illness in the future. Discounting future, inflation-adjusted expenditures[33] at a 2 percent annual rate, we estimate the effect on the present value of DC spending as follows:

$$(3) \quad PV(Expenditures) = \sum_{t=2002}^{2041} \min(1, 0.98^{t-2005}) * S_t * E_t$$

with S_t equal to the estimated fraction still alive in year t and E_t equal to the inflation-adjusted expenditure effect, which is $2.23 billion in every year except for 2002, 2003, and 2004. Here we consider the effect through and including the year 2041, by which date we estimate that essentially 100 percent of Vietnam veterans will have died.

Using the equation described in (3), we estimate that the present value increase in DC spending resulting from the Agent Orange decision was $30.5 billion, which is approximately equal to total DC spending for all veterans during the 2005 fiscal year. This excludes any effect on health care expenditures by the Veterans Health Administration, which we cannot reliably estimate with the available data. Given this and because we do not consider any possible effect on those Vietnam veterans not already affected by September of 2005, this estimate is likely to be much lower than the

[32] This is the most recent year for which the VBA reports the mortality rate of Vietnam era DC recipients in its *Annual Benefits Report* publication.
[33] A DC recipient's cash benefits are adjusted upward each year by the percentage increase in the CPI.

actual increase in the present value of VA expenditures.

VI. The Sensitivity of DC Expenditures to Local Economic Conditions

In contrast to the SSDI and SSI programs, an individual can receive DC benefits even if he has substantial labor market earnings. Thus whereas previous work has found that local economic conditions influence SSI and DI enrollment and expenditures (Black, Daniel, and Sanders, 2002; Autor and Duggan, 2003), it is not obvious that such a link would exist for the DC program. But this previous research has also shown that, when the medical eligibility criteria for the SSDI program were liberalized, the sensitivity of the program to economic conditions increased (Autor and Duggan, 2003). Thus while one might expect a smaller impact on DC expenditures than on spending for other disability programs, this effect may have increased following the 2001 policy change.

There are a number of possible channels through which economic conditions might influence DC expenditures. Perhaps the most obvious one is that veterans without a job or with a job that has low wages are likely to have a greater demand for alternative sources of income than their observably similar counterparts with higher earnings. Additionally it seems plausible that a veteran would need to invest a considerable amount of time and effort to learn about and applying for the program. Because the opportunity cost of time will be lower for those who are out of work or have low paying jobs, this time cost may be less likely to dissuade them. Similarly, advocacy groups and other organizations may have responded to the change in the DC program by launching outreach efforts in those parts of the country where Vietnam veterans were known to have relatively few good labor market opportunities.

To investigate whether the relationship between the DC program and labor market conditions changed after the Agent Orange decision, we utilize annual, county-level data on expenditures by the

VA on the four Compensation and Pension programs described in Section 2.[34] The available data does not separate out DC spending from spending on the other three programs. But as Table 3B demonstrates, almost 75 percent of Compensation and Pension spending is for the DC program. Additionally changes in Compensation and Pension spending after 2001 were primarily driven by the DC program, with total expenditures for the other three programs growing by an average of less than one percent per year from 2001 to 2004 versus a seven percent annual rate for the DC program.

We merge this Compensation and Pension (CP) expenditure data with annual, county-level unemployment rate data. If local economic conditions had an important impact on the response of veterans to the change in economic conditions, one would expect to find a larger increase in CP expenditures in places with high rates of unemployment at the time of the policy change. To investigate this issue, we estimate models of the following type:

$$(4) \quad \Delta Log(CPSpending_{jt}) = \alpha + \beta_1 UnempRate_{j,t-1} + \beta_2 \Delta Log(CPSpending_{j,t-1}) + \beta_3 \Delta Log(Pop_{j,t}) + \varepsilon_{jt}$$

in which we use the log change in CP spending as our dependent variable. In all specifications we include the estimated change in the number of veterans living in the county.[35] In most of our specifications, we also control for the pre-existing trend in CP expenditures, as places with worse economic conditions may have been experiencing different changes in CP spending at the time of the policy change. The parameter of particular interest in this equation is β_1, which represents the relationship between the county unemployment rate and the log change in DC expenditures. We consider two time periods, the three years prior to the policy change (1998-2001) and the three years following the policy change (2001-2004).

Our estimates for these models are summarized in Table 9. The first two columns present the results from specifications for the 1998 to 2001 period, with the second one controlling for the pre-

[34] Data on enrollment in these programs at the county level are unfortunately not available. One advantage of considering expenditures rather than enrollment is that expenditures would capture the increase in benefits for existing recipients whereas enrollment would not.

[35] To estimate this we obtained the total number of veterans by county in 1990 and 2000 from the decennial census. We then calculated the growth rate and used this to impute the population estimate in 1998, 2001, and 2004.

existing trend in CP spending. The statistically insignificant estimate for β_1 in both specifications suggests that areas with high rates of unemployment in 1998 did not experience larger increases in CP spending during the next three years. But the next two columns reveal that such a relationship did exist for the 2001 to 2004 period. The point estimate of 0.883 in the fourth specification implies that an increase of one-percentage point in the county's 2001 unemployment rate was associated with a 0.9 percent greater increase in CP spending from 2001 to 2004.[36]

In the next four columns we present the results from specifications in which we pool data from these two periods. Here we interact the unemployment rate measure with a POST indicator, which allows us to determine if the change in β_1 from the pre-policy to the post-policy period is statistically significant. We find that it is, as the estimate for the POST * UnempRate coefficient is positive and statistically significant. This significant estimate remains when we introduce state fixed effects in the next two specifications. We do this to account for the possibility that VBA offices differ in their outreach efforts or in their probability of making a DC award.

In the final two specifications we present the results from analogous models in which the explanatory variable of interest is the change in the unemployment rate rather than its level. The results here, while not statistically significant, are qualitatively similar to the ones from the previous columns, suggesting that the relationship of CP expenditures with changes in economic conditions increased following the policy change.

While the timing of the change in the relationship between economic conditions and CP expenditures suggests that the Agent Orange decision was the cause, we test this by investigating whether the increase in DC expenditures is significantly positively related with the fraction of DC benefits paid to Vietnam veterans diagnosed with diabetes. To do this we use aggregate, county-level DC spending in December of 2004 (the one month for which we have this data) and

[36] Our results were qualitatively similar when we used the change in the level (rather than the log) of CP spending per veteran. For example, the analogous estimate for the specification summarized in column 2 was an insignificant -133 whereas the estimate from specification 4 was significant at the 1 percent level and equal to 2471.

differentiate between spending on Vietnam era veterans with diabetes and all other DC spending. The results of our analysis are summarized in Table 10.

The first two columns of this table explore whether the log change in CP spending from 2001 to 2004 was significantly higher in counties where Vietnam veterans accounted for a relatively large share of spending. The significantly positive estimates of .171 (without pre-existing trends) and .198 (with trends) on the fraction of DC spending to Vietnam era veterans suggests that this was indeed the case. This is in contrast to the 1998 to 2001 period, when there was no evidence of a significantly positive relationship, as is shown in the last two columns of the table.

The two explanatory variables included in specifications 3 and 4 differentiate between DC spending for Vietnam veterans with diabetes and all other DC spending for Vietnam veterans. As the coefficient estimates show, there is a significantly positive relationship between the change in CP spending and the fraction of DC spending paid to Vietnam veterans with diabetes. No corresponding relationship exists for DC spending on other Vietnam veterans. This strongly suggests that the coverage of diabetes for Vietnam veterans is responsible for the changing relationship between spending by the VA on Compensation and Pension programs and economic conditions.

It is worth noting that while the results presented here suggest that the sensitivity of the DC program to economic conditions increased as a result of the Agent Orange decision, other factors may be at least partly responsible for our findings. For example, it could be the case that the prevalence of diabetes among Vietnam veterans is greater in counties with high unemployment rates. Thus this final set of results should be taken as suggestive though not definitive evidence of a change in the program's relationship with labor market conditions. But our finding is consistent with the results of Autor and Duggan (2003) for the SSDI program, which found that the sensitivity of that program to economic conditions increased following the liberalization of the program's medical eligibility criteria in the mid-1980s. Such a connection for the DC program seems plausible given that the demand for alternative sources of income is likely to be greater among veterans affected by

the policy who have low earnings or are out of work.

VII. Discussion

The findings in this paper suggest that a change in the medical eligibility criteria for the VA's Disability Compensation program that applied only to Vietnam veterans induced a 6.7 percentage point increase in disability enrollment among this group and increased the monthly benefit amount for an additional 2.7 percent. The effects of this change on VA expenditures were substantial, with our estimates suggesting that DC spending during the 2005 fiscal year was $2.23 billion higher than it otherwise would have been and that the present value increase in VA expenditures was approximately $30.5 billion. These estimates for enrollment and expenditures are likely to be conservative, as we have not considered any effect on veterans not already affected by September of 2005 nor have we incorporated the resulting increase in health care spending through the Veterans Health Administration. Our results further demonstrate that the 2001 policy change has coincided with a change in the responsiveness of the DC program to local economic conditions.

What do these findings imply for other disability programs such as SSDI and SSI? Because only the 2.3 million veterans who served in Vietnam were directly affected by this policy change, it is clear that one cannot assume that a similar change for those programs would have the same response. Additionally, because the DC program is quite different from SSDI and SSI, which pay benefits on an all-or-nothing basis and do not allow recipients to have significant labor market earnings, the effect of such a change for these other programs might be quite different. However the findings do demonstrate that a relatively narrow change in the medical eligibility criteria for the DC program led to an increase in disability benefits for 9.4 percent of the individuals potentially affected by the policy. This makes it more plausible that the 1984 reforms to SSDI and SSI, which expanded the medical eligibility criteria for these programs, could have been largely responsible for the significant increase in enrollment for these two programs from 1985 to 2005.

An obvious next step for future research would be to estimate the effect of the induced increase in DC enrollment on the health, labor supply, and material well-being of veterans who served in Vietnam.[37] In response to the policy change, more Vietnam veterans may have had medical checkups and increased their connection with the Veterans Health Administration. This, along with the increase in dollar benefits, could plausibly have increased the health of veterans who served in Vietnam. Similarly while the DC program does not introduce a high marginal tax rate on earnings, it is plausible that a DC award or an increase in DC benefits could reduce labor supply through an income effect. Whether the net effect would be an increase or reduction in household income is theoretically ambiguous.

More generally, the DC program is a large and rapidly growing program that has essentially been ignored in prior economic research. At present there are 2.7 million veterans receiving DC benefits with $23.4 billion paid in benefits during the 2005 fiscal year. More work on this program, which is an increasingly important source of income and insurance for 24.4 million veterans and 45 million of their family members, seems warranted.

[37] Gruber (2000) uses a similar strategy to the one employed in this paper to estimate the effect of a change in Canada's disability program on labor supply. He exploits the fact that Quebec operated a separate program and uses individuals from that province as his control group.

References

Air Force Health Study (2000). "Air Force Health Study: An Epidemiological Investigation of Health Effects in Air Force Personnel Following Exposure to Herbicides. 1997 Follow-up Examination Results." Brook Air Force Base: Air Force Research Laboratory.

Autor, D., & Duggan, M. (2003). "The Rise in the Disability Rolls and the Decline in Unemployment." *Quarterly Journal of Economics*, 118(1), 157/206.

Autor, D., & Duggan, M. (2006). "The Growth in the Social Security Disability Rolls: A Fiscal Crisis Unfolding." forthcoming in the *Journal of Economic Perspectives*, Summer.

Black, D., Daniel, K., & Sanders, S. (2002). "The Impact of Economic Conditions on Participation in Disability Programs: Evidence from the Coal Boom and Bust." *American Economic Review*, 92(1), 27-50.

Blank, R. (2001). "What Causes Public Assistance Caseloads to Grow?" *Journal of Human Resources*, 36(1), 85-118.

Bound, J. (1989). "The Health and Earnings of Rejected Disability Insurance Applicants." *American Economic Review*, 482-503.

Bound, J., Burkhauser, R.V. (1999). "Economic Analysis of Transfer Programs Targeted on People with Disabilities." In O. Ashenfelter & D. Card (Eds.) *Handbook of Labor Economics*, 3C. New York: Elsevier Science Pub. Co.

Burkhauser, R.V., & Daly, M.C. (1999). "Disability and Work: The Experience of American and German Men." *Federal Reserve Bank of San Francisco Economic Review* 2, 17-29.

Calvert, G., Sweeney, M., Deddens, J. and D. Wall (1999). "An Evaluation of Diabetes Mellitus, Serum Glucose, and Thyroid Function among U.S. Workers Exposed to 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin." *Occupational and Enviormental Medicine*, 56: 270-276.

Center for Disease Control (2003). "Prevalence of Diabetes Impaired Fasting Glucose in Adults – United States, 1999-2000." *Morbidity and Mortality Weekly Report*, 52(35).

Cromwell, J., Hurdle, S., & Wedig, G. (1986). "Impacts of Economic and Programmatic Changes on Medicaid Enrollments." *Review of Economics and Statistics*, 68(2), 232-240.

Duggan, M., & Imberman, S. (2006). "Why Are the DI Rolls Skyrocketing? The Contribution of Population Characteristics, Program Changes, and Economic Conditions." forthcoming in D. Cutler and D. Wise (Eds.) *Health at Older Ages*. Chicago: University of Chicago Press.

Gruber, J. (2000). "Disability Insurance Benefits and Labor Supply." *Journal of Political Economy*, 1162-1183.

Hoynes, H (2000). "Local Labor Markets and Welfare Spells: Do Demand Conditions Matter?" *Review of Economics and Statistics*, 82(3), 351-368.

Kessler, R. et al. (2003). "Prevalence and Treatment of Mental Disorders, 1990 to 2003." *New England Journal of Medicine*, 352(24), 2515-2523.

Kubik, J. (1999). "Incentives for the Identification and Treatment of Children with Disability: The Supplement Security Income Program." *Journal of Public Economics*, 73(2), 187-215.

Institute of Medicine (2000). "Veterans and Agent Orange: Herbicide/Dioxin Exposure and Type 2 Diabetes." Washington D.C.: The National Academies Press.

Institute of Medicine (2003). "Veterans and Agent Orange: Update 2002." Washington D.C.: The National Academies Press.

Parsons, D. (1980). "The Decline in Male Labor Force Participation." *Journal of Political Economy*, 88(1), 117-134.

Rupp, K., & Stapleton, D. (1998). "Growth in Disability Benefits: Explanations and Policy Implications." Kalamazoo: W.E. Upjohn Insitute for Employment Research.

Singleton, P. (2006). "The Effect of Disability Insurance on Health Investment." University of Maryland, Mimeo.

Social Security Administration (2006). *Annual Statistical Supplement*, 2005.

United States General Accounting Office (2002). "Veterans' Benefits: VBA's Efforts to Implement the Veterans Claims Assistance Act Need Further Monitoring." GAO-02-412.

United States Department of Veterans Affairs (2003). "Agent Orange Brief." Environmental Agents Service, (131) A1.

Veterans Benefits Administration, Selected Years. *VBA Annual Benefits Report*. Available online at http://www.vba.va.gov/reports.htm.

Ziliak, J., Gundersen, C., & Figlio, D. (2003). "Food Stamp Caseloads over the Business Cycle." *Southern Economic Journal*, 69(4), 903-919.

Figure 1: # of Disability Compensation Recipients: 1976-2005

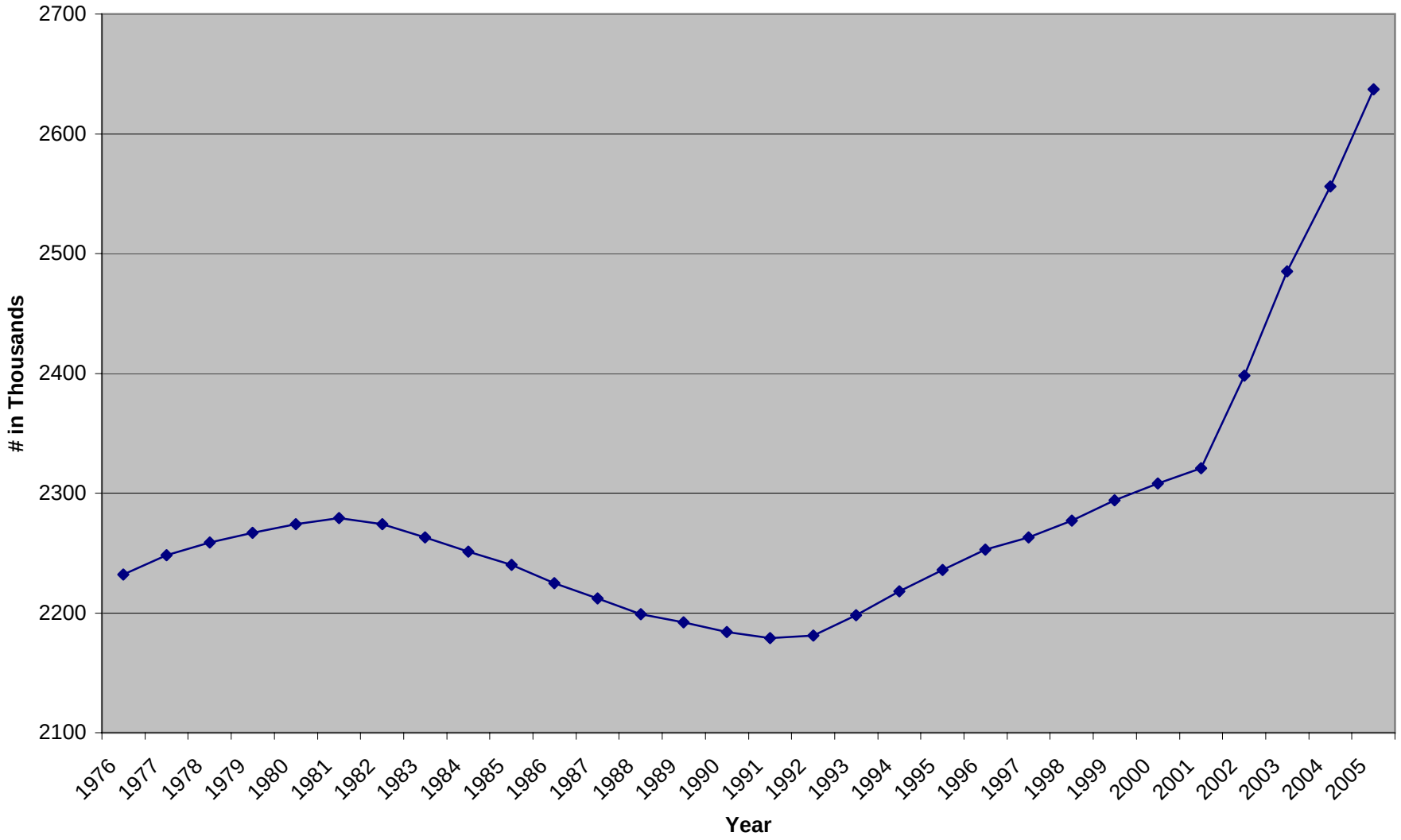

Figure 2: DC Enrollment for Vietnam and Peacetime Era Veterans

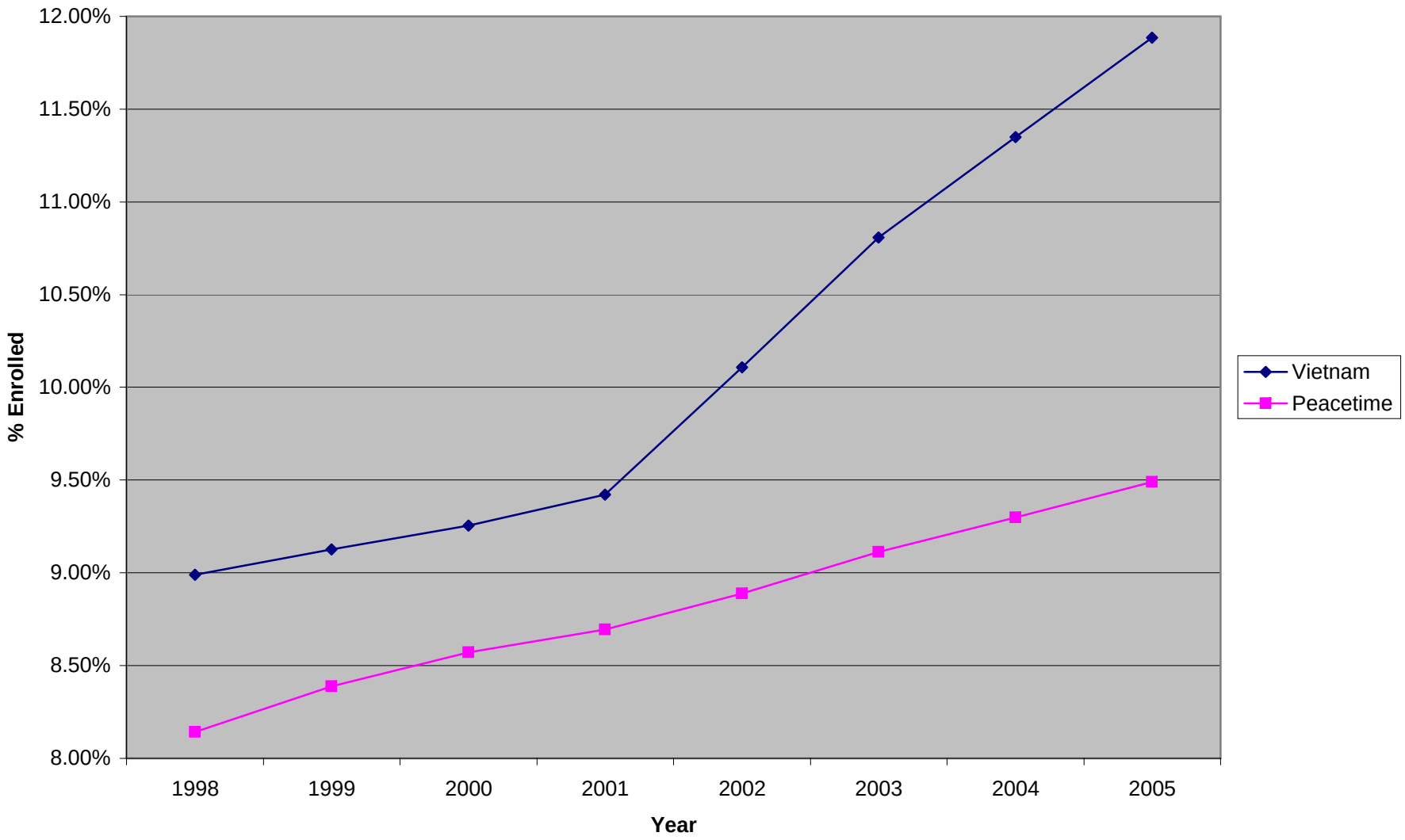

Table 1: Veteran Population Estimates by Era of Service in September of 2000 and 2005

	Number in Millions			Share	
	2000	2005	% Change	2000	2005
World War II Era	5.59	3.52	-37.0%	21.1%	14.4%
Between WWII and Korea	0.24	0.17	-29.2%	0.9%	0.7%
Korean War Era	3.50	2.90	-17.1%	13.2%	11.9%
Between Korea and Vietnam	2.88	2.61	-9.4%	10.8%	10.7%
Vietnam War Era	8.01	7.70	-3.9%	30.2%	31.6%
Between Vietnam and Gulf War	3.49	3.46	-0.9%	13.1%	14.2%
Gulf War Era	2.84	4.03	41.9%	10.7%	16.5%
Total # of Veterans	26.55	24.39	-8.1%	100.0%	100.0%

Data includes the number of veterans alive in September of 2000 and September of 2005 from each of seven different service eras. Individuals who served during a conflict and during peacetime are assigned to the conflict. Individuals serving during two or more of the four conflicts are assigned to the earliest conflict. Data were obtained from the VA's VP04 Ver 1.0 population estimates, which are available online at http://www.va.gov/vetdata/demographics/ and represent the VA's most recent estimates as of May, 2006.

Table 2: U.S. Department of Veterans' Affairs Expenditures: 1998-2005

	1998	1999	2000	2001	2002	2003	2004	2005
Compensation and Pension	$23,532	$24,231	$24,138	$24,927	$27,479	$29,698	$30,807	$32,068
Medical Expenditures	$21,087	$20,786	$23,267	$23,600	$25,073	$27,014	$29,086	$30,675
Education & Voc Rehab	$1,716	$1,814	$1,848	$1,715	$2,153	$2,398	$3,081	$3,155
Insurance and Indemnities	$2,435	$2,307	$2,223	$2,148	$2,063	$1,995	$1,928	$1,809
Operating Expenses	$1,539	$1,517	$1,698	$1,722	$1,933	$1,999	$2,003	$2,238
Construction	$655	$552	$396	$444	$481	$445	$438	$303
Total Spending	$50,964	$51,206	$53,569	$54,556	$59,182	$63,549	$67,343	$70,248

Data represents VA expenditures by category (in millions of 2005 dollars). Data for the 1999-2004 fiscal years is available online at http://www.va.gov/vetdata/GeographicInformation/index.htm. Data for 1998 and 2005 were obtained from the Department of Veterans Affairs following an email request.

Table 3A: Compensation and Pension Recipients by Program: 1998-2005

	1998	1999	2000	2001	2002	2003	2004	2005
Disability Compensation	2,277,049	2,294,453	2,308,186	2,321,103	2,398,287	2,485,229	2,555,696	2,636,979
Disability Pension	390,978	378,712	364,220	348,052	346,579	346,555	342,903	335,787
Death Compensation	310,299	311,631	313,408	313,540	315,731	319,998	324,019	329,184
Death Pension	291,483	274,106	257,106	241,467	230,267	223,553	215,253	206,594
Total C&P Recipients	3,269,809	3,258,902	3,242,920	3,224,162	3,290,864	3,375,335	3,437,871	3,508,544

Data represents the number of recipients of each program in September of each year. Data for the 1999-2004 fiscal years is available online from the VBA's Annual Benefits Report publication at http://www.vba.va.gov/reports.htm. Data for the 1998 and 2005 fiscal years were obtained from the Department of Veterans Affairs following an email request.

Table 3B: Compensation and Pension Expenditures by Program: 1999-2004

	1999	2000	2001	2002	2003	2004
Disability Compensation	$16,298	$16,755	$17,430	$19,095	$20,736	$21,290
Disability Pension	$2,520	$2,444	$2,396	$2,470	$2,530	$2,530
Death Compensation	$3,897	$3,892	$3,926	$3,873	$4,027	$4,011
Death Pension	$807	$750	$715	$705	$701	$692
Total Estimated	$23,520	$23,842	$24,467	$26,274	$27,993	$28,523

Data represents the total estimated expenditure by program in each fiscal year (in millions of 2005 dollars). Data for the 1999-2004 fiscal years is available online from the VBA's Annual Benefits Report publication at http://www.vba.va.gov/reports.htm. Totals differ slightly from those listed in Table 2 because this data is estimated while the data in Table 2 represents actual spending.

Table 4: Monthly Disability Compensation Benefit Amounts During the 2005 Fiscal Year

CDR	Baseline	1 child	1 spouse	1 child & 1 spouse	Each Add'l Child < 18	Each Add'l In School 18+
10%	$108	$108	$108	$108	$0	$0
20%	$210	$210	$210	$210	$0	$0
30%	$324	$350	$363	$391	$19	$62
40%	$466	$501	$518	$555	$26	$82
50%	$663	$707	$728	$775	$33	$103
60%	$839	$891	$917	$973	$39	$124
70%	$1,056	$1,117	$1,147	$1,212	$46	$144
80%	$1,227	$1,297	$1,331	$1,406	$52	$165
90%	$1,380	$1,459	$1,497	$1,581	$59	$186
100%	$2,299	$2,387	$2,429	$2,523	$66	$207

Data represents the monthly benefit amount by combined disability rating (CDR) and presence of dependents for Disability Compensation recipients during the 2005 fiscal year. This data and the corresponding data for earlier years can be obtained at http://www.vba.va.gov/bln/21/Rates/.

Table 5: # of DC Recipients and Average Monthly DC Benefits by CDR in September 2005

				Share with Each Rating				
	Recipients	Dollars	Avg Benefit	Gulf	Vietnam	Korea	WW II	Peacetime
0%	14,750	$ 1,077	$73	0.1%	0.3%	2.5%	1.4%	0.4%
10%	775,854	$ 84,320	$109	28.7%	22.6%	30.8%	33.6%	37.8%
20%	408,667	$ 86,559	$212	18.3%	13.6%	13.1%	12.6%	17.9%
30%	327,007	$ 118,152	$361	15.3%	11.0%	12.6%	13.3%	11.1%
40%	246,987	$ 128,960	$522	12.3%	9.0%	8.2%	8.1%	7.9%
50%	151,943	$ 111,510	$734	6.9%	5.9%	5.3%	5.7%	4.6%
60%	172,694	$ 214,934	$1,245	6.6%	6.8%	7.5%	7.0%	5.6%
70%	153,190	$ 278,788	$1,820	4.4%	8.2%	5.4%	5.2%	4.0%
80%	102,979	$ 207,865	$2,019	3.1%	5.3%	4.0%	3.9%	2.6%
90%	54,161	$ 118,872	$2,195	1.5%	2.9%	2.1%	2.2%	1.3%
100%	228,747	$ 602,586	$2,634	2.9%	14.3%	8.5%	7.0%	6.9%
Total	2,636,979	$ 1,953,622	$741	611,729	916,220	161,512	356,194	591,324

Data in the first three columns provides the number of DC recipients, the total amount paid, and the average monthly DC benefit by combined disability rating (CDR) in September of 2005. Data in the last five columns provides the share of DC recipients from each service era with each value of the CDR. Data were obtained from the Department of Veterans Affairs following an email request.

Table 6: Veterans Receiving Disability Compensation Benefits by Service Era and Year: 1998-2005

		1998	1999	2000	2001	2002	2003	2004	2005
WWI + WWII	# Receiving	578,459	541,312	505,133	470,217	440,477	413,702	385,504	356,194
	% Change	-6.1%	-6.4%	-6.7%	-6.9%	-6.3%	-6.1%	-6.8%	-7.6%
	# Veterans	6,544,214	6,043,975	5,581,974	5,155,289	4,732,439	4,318,553	3,915,550	3,525,769
	% Receiving	8.84%	8.96%	9.05%	9.12%	9.31%	9.58%	9.85%	10.10%
Korean War	# Receiving	178,682	174,807	170,616	166,362	164,728	164,482	163,635	161,512
	% Change	-2.1%	-2.2%	-2.4%	-2.5%	-1.0%	-0.1%	-0.5%	-1.3%
	# Veterans	3,730,161	3,614,027	3,501,508	3,392,493	3,276,022	3,153,918	3,026,510	2,894,065
	% Receiving	4.79%	4.84%	4.87%	4.90%	5.03%	5.22%	5.41%	5.58%
Vietnam War	# Receiving	729,402	735,627	740,976	749,554	798,549	848,156	883,092	916,220
	% Change	0.8%	0.9%	0.7%	1.2%	6.5%	6.2%	4.1%	3.8%
	# Veterans	8,112,893	8,059,934	8,007,320	7,955,050	7,900,685	7,847,820	7,781,493	7,708,931
	% Receiving	8.99%	9.13%	9.25%	9.42%	10.11%	10.81%	11.35%	11.89%
Peacetime	# Receiving	549,862	560,567	566,833	569,190	575,413	582,863	587,331	591,324
	% Change	2.1%	1.9%	1.1%	0.4%	1.1%	1.3%	0.8%	0.7%
	# Veterans	6,753,021	6,683,154	6,614,009	6,545,581	6,473,128	6,396,841	6,316,380	6,231,463
	% Receiving	8.14%	8.39%	8.57%	8.70%	8.89%	9.11%	9.30%	9.49%
Gulf War	# Receiving	240,644	282,140	324,628	365,780	419,120	476,026	536,134	611,729
	% Change	19.2%	17.2%	15.1%	12.7%	14.6%	13.6%	12.6%	14.1%
	# Veterans	2,509,858	2,668,725	2,837,647	3,017,262	3,199,325	3,474,057	3,753,403	4,026,808
	% Receiving	9.59%	10.57%	11.44%	12.12%	13.10%	13.70%	14.28%	15.19%
Total	# Receiving	2,277,049	2,294,453	2,308,186	2,321,103	2,398,287	2,485,229	2,555,696	2,636,979
	% Change	0.6%	0.8%	0.6%	0.6%	3.3%	3.6%	2.8%	3.2%
	# Veterans	27,522,352	27,027,966	26,542,460	26,065,675	25,581,599	25,191,189	24,793,336	24,387,036
	% Receiving	8.27%	8.49%	8.70%	8.90%	9.38%	9.87%	10.31%	10.81%

Entries in this table represent the number of DC recipients, the number of veterans, and the fraction of veterans on DC by service era and year. Population data were obtained from the VA's most recent population estimates (summarized in Table 1) and DC enrollment data were obtained from the VBA's Annual Benefits Report publication, which is available online at http://www.vba.va.gov/reports.htm for the 1999-2004 fiscal years.

Table 7: The Fraction of DC Recipients and Awardees with Diabetes as a Covered Condition

	1999	2000	2001	2002	2003	2004
# with Diabetes	37808	37985	46395	111932	161551	191649
% with Diabetes	1.65%	1.65%	2.00%	4.67%	6.50%	7.50%
# Vietnam with Diabetes	18904*	18993*	27403*	88259	135011	163485
% Vietnam with Diabetes	2.57%	2.56%	3.03%	11.05%	15.92%	18.51%
# All Other with Diabetes	18904*	18992*	18992*	23673	26540	28164
% All Other with Diabetes	1.21%	1.21%	1.21%	1.48%	1.62%	1.68%

The first two rows summarize the number and percentage of DC recipients with diabetes at the end of each fiscal year. The next two rows provide this same information for Vietnam era veterans and the last two rows provide this data for veterans from all other eras. Entries with an asterisk are imputed. See Appendix Tables 1 and 2 for an explanation of the imputation procedure.

Table 8: Number of DC Recipients by Combined Disability Rating for Vietnam and Peacetime Era

Panel A: Vietnam Era DC Recipients

	Number of Recipients			*Change 2000-2005*			Avg Monthly	Estimated Impact
CDR	1998	2000	2005	Predicted	Actual	Difference	DC Benefit	on 2005 DC $
0%	1,413	1,644	2,479	578	835	258	$73.00	$225,585
10%	236,893	227,800	207,282	-22,733	-20,518	2,215	$108.68	$2,888,062
20%	106,162	102,836	124,332	-8,315	21,496	29,811	$211.81	$75,770,965
30%	103,715	100,946	100,510	-6,923	-436	6,487	$361.31	$28,123,807
40%	66,412	66,094	82,895	-795	16,801	17,596	$522.13	$110,249,647
50%	42,490	43,772	53,922	3,205	10,150	6,945	$733.89	$61,162,501
60%	39,097	41,805	62,581	6,770	20,776	14,006	$1,244.59	$209,181,044
70%	29,063	38,443	75,350	23,450	36,907	13,457	$1,819.89	$293,882,465
80%	17,712	21,450	48,994	9,345	27,544	18,199	$2,018.52	$440,820,325
90%	8,513	10,192	26,441	4,198	16,249	12,052	$2,194.78	$317,404,898
100%	77,932	85,994	131,434	20,155	45,440	25,285	$2,634.29	$799,295,864
Total	729,402	740,976	916,220	28,935	175,244	146,309	-	$2,339,005,163

Panel B: Peacetime Era DC Recipients

	Number of Recipients			*Change 2000-2005*			Avg Monthly	Estimated Impact
CDR	1998	2000	2005	Predicted	Actual	Difference	DC Benefit	on 2005 DC $
0%	2,791	2,704	2,442	-218	-262	-45	$73.00	-$38,985
10%	242,816	239,621	223,582	-7,988	-16,039	-8,052	$108.68	-$10,500,443
20%	105,401	107,411	106,140	5,025	-1,271	-6,296	$211.81	-$16,002,616
30%	62,041	64,169	65,452	5,320	1,283	-4,037	$361.31	-$17,503,401
40%	38,409	41,738	46,725	8,323	4,987	-3,336	$522.13	-$20,898,937
50%	20,200	22,196	26,934	4,990	4,738	-252	$733.89	-$2,219,287
60%	22,104	25,477	32,877	8,433	7,400	-1,033	$1,244.59	-$15,420,493
70%	11,878	14,732	23,622	7,135	8,890	1,755	$1,819.89	$38,326,798
80%	7,230	9,048	15,106	4,545	6,058	1,513	$2,018.52	$36,648,231
90%	3,281	4,152	7,576	2,178	3,424	1,247	$2,194.78	$32,829,540
100%	33,711	35,585	40,868	4,685	5,283	598	$2,634.29	$18,903,655
Total	549,862	566,833	591,324	42,428	24,491	-17,937	-	$44,124,062

Data summarized in columns 2-4 represent the actual number of DC recipients by CDR in September of 1998, 2000, and 2005 for the Vietnam and peacetime service eras. The next column lists the predicted change from 2000 to 2005 if the 1998-2000 trend had continued through 2005. Columns 6 and 7 list the actual change and the discrepancy between the actual and predicted values. Column 8 lists the average monthly benefit by CDR in September of 2005 and the final column multiplies this amount by 12 (to annualize) and by the discrepancy listed in column 7.

Table 9: Determinants of County-Level Growth in DVA Compensation and Pension Expenditures: 1998-2004

	1998-2001		2001-2004		1998-2004					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Unemp Rate$_{t-1}$	0.059	-0.097	0.889***	0.883***	0.051	-0.122	-0.140	-0.188		
	(.181)	(.160)	(.258)	(.230)	(.182)	(.158)	(.129)	(.132)		
Post * Unemp Rate$_{t-1}$					0.848***	1.019***	0.582***	0.832***		
					(.230)	(.293)	(.178)	(.242)		
Δ Unemp Rate$_t$									-0.123	0.000
									(.176)	(.168)
Post * Δ Unemp Rate$_t$									0.614	0.325
									(.533)	(.476)
Δ Population$_t$	0.830***	0.506***	0.752***	0.342***	0.792***	0.426***	0.826***	0.517***	0.825***	0.517***
	(.131)	(.209)	(.159)	(.183)	(.138)	(.186)	(.110)	(.188)	(.106)	(.190)
Δ Log(Comp+Pen)$_{t-1}$		0.423***		0.498***		0.462***		0.378***		0.371***
		(.156)		(.122)		(.136)		(.163)		(.163)
Year = 2004					0.121***	0.102***	0.136***	0.114***	0.159***	0.151***
					(.013)	(.017)	(.010)	(.017)	(.010)	(.011)
Constant	0.063	0.042	0.183	0.137	0.063	0.040	0.072	0.048	0.066	0.040
	(.007)	(.013)	(.018)	(.022)	(.007)	(.012)	(.005)	(.012)	(.002)	(.011)
# Observations	3136	3136	3136	3136	6272	6272	6272	6272	6272	6272
R-squared	0.196	0.325	0.168	0.368	0.471	0.576	0.564	0.625	0.563	0.621
State Effects?	No	No	No	No	No	No	Yes	Yes	Yes	Yes

Dependent variable in each column is equal to the change in the log of DVA Compensation and Pension expenditures. This county level data was obtained at http://www.va.gov/vetdata/GeographicInformation/index.htm. Specifications (1) through (4) include one observation for each county (either the 1998-2001 or the 2001-2004 change) while specifications (5) through (10) include two observations per county. The variable Unemp Rate is equal to the unemployment rate at the beginning of the period (thus either 1998 for the 1998-2001 change or 2001 for the 2001-2004 change). The change in population variable is equal to the change in the log of the veteran population in the county. The change in the log of Comp and Pen spending controls for the pre-existing trend in spending. The variable Post is equal to one for the 2001-2004 change and zero otherwise. All standard errors are clustered by state and all specifications are weighted by the veteran population in the county.

Table 10: Determinants of Growth in Compensation and Pension Expenditures: 1998-2004

	2001-2004				1998-2001	
	(1)	(2)	(3)	(4)	(5)	(6)
Vietnam DC Fraction 12/04	.171**	.198***			-0.038	-.100***
	(.066)	(.044)			(.066)	(.045)
√ietnam Diabetes DC Fraction 12/04			.590***	.500***		
			(.150)	(.087)		
Vietnam Other DC Fraction 12/04			-.004	0.071		
			(.076)	(.045)		
Δ Log(Comp+Pen)$_{t-1}$		.578***		.566***		.551***
		(.082)		(.081)		(.089)
Constant	0.112	0.068	0.129	0.082	0.069	0.067
	(.032)	(.023)	(.030)	(.021)	(.031)	(.022)
# Observations	3126	3126	3126	3126	3126	3126
R-squared	0.014	0.346	0.047	0.363	0.001	0.268

The dependent variable in all specifications is equal to the log change in compensation and pension expenditures (from 2001-2004 in columns 1 through 4 and from 1998-2001 in columns 5 and 6). The first explanatory variable represents the fraction of DC spending in the county paid to Vietnam veterans in December of 2004. The next two variables equal the fraciton of DC spending paid to Vietnam veterans with diabetes and the fraction of DC spending paid to all other Vietnam veterans, respectively. All standard errors are clustered by state and all specifications are weighted by the veteran population in the county.

Appendix Table 1: Service-Connected Disabilities by Body System for DC Recipients at End of Fiscal Years

Body System	1998	1999	2000	2001	2002	2003	2004
Musculoskeletal System	2204797	2280843	2346864	2412412	2524243	2652380	2786986
Skin	697081	711700	722474	731378	750407	770083	778521
Impairment of Auditory Acuity	463306	483532	505298	530931	587524	665419	742211
Neurological Conditions	302864	313252	322904	331653	369377	422448	581442
Mental Disorders	395329	403175	409071	414679	433618	463223	488333
Digestive System	424188	429546	432920	434606	440931	448128	452307
Cardiovascular System	326947	339195	348645	357259	385924	419039	442640
Respiratory System	286199	293179	298789	303890	314021	325106	334866
Endocrine System	*56416*	*57576*	*58719*	*68040*	*134905*	*185908*	*217126*
Diabetes Only	-	*37808*	*37985*	*46395*	*111932*	*161551*	*191649*
Diabetes & Vietnam Only	-	*18904**	*18993**	*27403**	*88259*	*135011*	*163485*
Diabetes & All Other	-	*18904**	*18992**	*18992**	*23673*	*26540*	*28164*
Not Diabetes	-	*19768*	*20734*	*21645*	*22973*	*24357*	*25477*
Genitourindary System	132164	136852	141583	145938	161387	180785	196268
Eye	103007	103704	104050	104472	108407	113553	117256
Infectious Diseases	49754	49042	47980	46714	46586	46576	46045
Gynecological System	28939	32004	34547	36667	39325	41905	44156
Dental and Oral Conditions	24715	25798	26798	27572	28924	30171	31114
Hemic and Lymphatic System	20354	20792	21153	21471	22216	23122	24996
Total	5516060	5699958	5842529	5989327	6370768	6812203	7309744

Data were obtained from the 2000 and 2004 versions of the VBA's Annual Benefits Report. Entries with an asterisk were estimated because they were not publicly available. We assume that the number of Vietnam DC recipients with diabetes is equal to the corresponding number of non-Vietnam DC recipients with diabetes in 1999 and 2000. This is likely to be approximately correct given that 46 percent of DC recipients with diabetes in October of 1998 were from the Vietnam era. We further assume that the number of non-Vietnam veterans with diabetes in 2001 is unchanged from its 2000 level. The values for 2002, 2003, and 2004 are not imputed.

Appendix Table 2: Service-Connected Disabilities by Body System for New DC Recipients in Fiscal Year

Body System	1998	1999	2000	2001	2002	2003	2004
Musculoskeletal System	107400	119485	111663	110520	156339	164970	164297
Skin	32013	34236	30334	28047	41453	42766	36955
Impairment of Auditory Acuity	23370	27321	28654	31995	59241	75316	76836
Neurological Conditions	13124	13567	13261	12927	28794	33575	28922
Mental Disorders	17043	17680	16613	16065	25402	31022	23564
Digestive System	17873	18823	16807	15109	21501	22017	19078
Cardiovascular System	13638	15588	14594	14253	26643	28069	28315
Respiratory System	14855	15842	14423	14190	19304	20678	19239
Endocrine System	*2350*	*2501*	*2485*	*5918*	*39852*	*36897*	*26206*
Diabetes Only	*-*	*1217*	*1183*	*4741*	*38652**	*35697**	*25006**
Diabetes & Vietnam Only	*-*	*609***	*592***	*4150**	*38061**	*35106**	*24415**
Diabetes & All Other	*-*	*608**	*591**	*591**	*591**	*591**	*591**
Not Diabetes	*-*	*1284*	*1302*	*1177*	*1200**	*1200**	*1200**
Genitourindary System	6411	6716	6502	6270	13392	14993	12884
Eye	3129	3314	3043	2998	5320	5708	4774
Infectious Diseases	2486	2524	2280	2081	3300	3233	2702
Gynecological System	2958	3154	2678	2285	2795	2780	2487
Dental and Oral Conditions	1365	1533	1518	1310	2087	1915	1616
Hemic and Lymphatic System	985	1032	1025	923	1262	1484	1822
Total	259000	283316	265880	264891	446685	485423	449697

Data were obtained from the 2000 and 2004 versions of the VBA's Annual Benefits report. Entries with an asterisk were estimated because they were not publicly available. We assume that the number of diabetes awards to Vietnam veterans was the same as the number of diabetes awards to all other veterans in the 1999 and 2000 fiscal years. This is likely to be approximately correct given that 46 percent of DC recipients with a diabetes diagnosis in October of 1998 were from the Vietnam era. We further assume that the number of diabetes awards to non Vietnam era veterans does not change after the 2001 reform, which seems reasonable given the much larger increase in diabetes cases among Vietnam veterans. And finally, we assume that the number of endocrine system awards that are not diabetes remains unchanged following the 2001 reforms. This seems reasonable given that the number of diabetes cases increased by 159,000 from 2000 to 2004 whereas the corresponding increase for other endocrine conditions was approximately 5,000.

Appendix Table 3: Impact on DC Spending from 2002-2041

Year	Unadjusted	Mortality Rate	Adjusted
2001	$0	-	$0
2002	$558	-	$558
2003	$1,115	-	$1,115
2004	$1,673	-	$1,673
2005	$2,230	-	$2,230
2006	$2,230	2.665%	$2,127
2007	$2,230	2.915%	$2,024
2008	$2,230	3.195%	$1,920
2009	$2,230	3.495%	$1,816
2010	$2,230	3.810%	$1,712
2011	$2,230	4.145%	$1,608
2012	$2,230	4.520%	$1,505
2013	$2,230	4.940%	$1,402
2014	$2,230	5.405%	$1,299
2015	$2,230	5.920%	$1,198
2016	$2,230	6.485%	$1,098
2017	$2,230	7.105%	$999
2018	$2,230	7.800%	$903
2019	$2,230	8.585%	$809
2020	$2,230	9.460%	$718
2021	$2,230	5.935%	$662
2022	$2,230	7.010%	$603
2023	$2,230	12.670%	$516
2024	$2,230	13.920%	$435
2025	$2,230	15.265%	$362
2026	$2,230	16.700%	$295
2027	$2,230	18.230%	$237
2028	$2,230	19.860%	$186
2029	$2,230	21.585%	$143
2030	$2,230	23.405%	$107
2031	$2,230	25.325%	$78
2032	$2,230	27.295%	$56
2033	$2,230	29.250%	$39
2034	$2,230	31.160%	$26
2035	$2,230	33.000%	$17
2036	$2,230	34.750%	$11
2037	$2,230	36.490%	$7
2038	$2,230	38.315%	$4
2039	$2,230	40.230%	$2
2040	$2,230	42.240%	$1
2041	$2,230	45.430%	$1
Total	-	-	$30,501

Mortality rate is the average annual mortality rate for person born in 1943, which is almost identical to the average mortality rate for Vietnam veterans in 2001. Expenditures are discounted using a two percent real discount rate and multiplying by the probability of surviving into the year. No adjustments for mortality are made prior to 2005 given that our estimate of $2.23 billion incorporates any exits prior to 2005.