

# Association of Disability Compensation With Mortality and Hospitalizations Among Vietnam-Era Veterans With Diabetes

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 Supplemental content

**IMPORTANCE** It remains poorly understood whether income assistance for adults with low income and disability improves health outcomes.

**OBJECTIVE** To examine the association between eligibility for disability compensation and mortality and hospitalizations among Vietnam-era veterans with diabetes.

**DESIGN, SETTING, AND PARTICIPANTS** Quasiexperimental cohort study of a July 1, 2001, policy that expanded eligibility for disability compensation to veterans with “boots on the ground” (BOG) during the Vietnam era on the basis of a diagnosis of diabetes; veterans who were “not on ground” (NOG) remained ineligible. Participants were Vietnam-era veterans with diabetes in the Veterans Affairs Healthcare System. Difference-in-differences were estimated during early (July 1, 2001-December 31, 2007), middle (January 1, 2008-December 31, 2012), and later (January 1, 2013-December 31, 2018) postpolicy periods. Data analysis was performed from October 1, 2020, to December 1, 2021.

**EXPOSURES** Interaction between having served with BOG (as recorded in Vietnam-era deployment records) and postpolicy period.

**MAIN OUTCOMES AND MEASURES** Primary outcomes were all-cause mortality and hospitalizations.

**RESULTS** The study population included 14 247 BOG veterans (mean [SD] age at baseline, 51.2 [3.8] years; 25.7% were Black; 3.3% were Hispanic; 63.6% were White; and 6.9% were of other race) and 56 224 NOG veterans (mean [SD] age, 54.2 [6.3] years; 21.7% were Black; 2.1% were Hispanic; 67.1% were White; and 8.2% were of other race). Compared with NOG veterans, BOG veterans received \$8025, \$14412, and \$17 162 more in annual disability compensation during the early, middle, and later postpolicy periods, respectively. Annual mortality rates were unchanged (prepolicy mortality rates: 3.04% for BOG and 3.56% for NOG veterans), with adjusted difference-in-differences of 0.24 percentage points (95% CI, -0.08 to 0.52), -0.08% (95% CI, -0.40 to 0.24), and -0.08% (95% CI, -0.48 to 0.36), during the early, middle, and later postpolicy periods. Among 3623 BOG veterans and 19 174 NOG veterans with Medicare coverage in 1999, a population whose utilization could be completely observed in our data, BOG veterans experienced reductions of -7.52 hospitalizations per 100 person-years (95% CI, -13.12 to -1.92) during the early, -10.12 (95% CI, -17.28 to -3.00) in the middle, and -15.88 (95% CI, -24.00 to -7.76) in the later periods. These estimates represent relative declines of 10%, 13%, and 21%. Falsification tests of BOG and NOG veterans who were already receiving maximal disability compensation prior to the policy yielded null findings.

**CONCLUSIONS AND RELEVANCE** In this cohort study, disability compensation among Vietnam-era veterans with diabetes was not associated with lower mortality but was associated with substantial declines in acute hospitalizations. Veterans' disability compensation payments may have important health benefits.

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People with lower incomes have worse health and die sooner than those with higher incomes.<sup>1-3</sup> The association between income and health is evident throughout the life course, across the gradient of incomes, and in many countries, including those with universal health insurance and robust social welfare programs.<sup>1-10</sup>

Although income and health are associated, outside of randomized studies conducted in low-income countries, it remains unclear whether policy interventions that increase income improve health outcomes.<sup>11-21</sup> This evidence gap has high-stakes consequences. In 2019, approximately 8% of federal government spending (\$361 billion) provided income support, tax credits, or other benefits (besides health insurance) to low-income and disabled individuals.<sup>22</sup> Limited understanding about the health consequences of income assistance programs prevents policy makers from understanding their full value to society.<sup>23</sup> Moreover, if income assistance averts serious and costly health events, such as acute hospitalizations, then the costs of income support programs may be partially offset by less health care spending.

The Department of Veterans Affairs (VA) oversees the second largest source of disability-related income assistance in the US.<sup>24</sup> In 2020, more than 5 million veterans received a total of \$91 billion in compensation for disabling conditions related to military service.<sup>25</sup> These payments align with a core principle that predates the nation's founding: that the government should care for and compensate veterans who have sustained injuries or developed medical conditions during military service. The payments are large in magnitude (reaching an annual maximum of \$37 757 in 2021 for a veteran without dependents), not subject to federal or state income tax, typically made in perpetuity, and apply to individuals with lower socioeconomic status and worse health than the general population.<sup>26-31</sup> Therefore, while prior research has largely focused on the influence of disability compensation on veterans' employment decisions,<sup>24,32,33</sup> disability compensation may also have important benefits for health.

This quasiexperimental study evaluated a change in VA disability policy in July 2001 that qualified some Vietnam-era veterans with diabetes for disability compensation. Specifically, we examined the association between eligibility for disability compensation with mortality and hospitalizations among veterans with diabetes. Prior studies have established large socioeconomic gradients in mortality and hospitalizations among persons with diabetes, prompting growing interest in interventions to address social determinants of health for this population.<sup>34-36</sup>

## Methods

### Policy Context and Study Design

On July 1, 2001, the VA added diabetes to the list of conditions presumptively connected to military service for all Vietnam-era veterans who served with "boots on the ground" (BOG) in Cambodia, Laos, or Vietnam during the

### Key Points

**Question** Is disability compensation associated with mortality and hospitalizations among Vietnam-era veterans with diabetes?

**Findings** In this 20-year difference-in-differences cohort study of a Veterans Affairs policy that qualified some Vietnam-era veterans with diabetes to receive disability compensation, eligibility for disability compensation was associated with marked reductions in hospitalizations but unchanged mortality.

**Meaning** Receipt of disability compensation may be associated with lower hospitalizations among US veterans, but does not appear to be associated with survival.

Vietnam War. The change in policy was motivated by an Institute of Medicine report that found a "limited/suggestive" association of Agent Orange, an herbicide used by the US government during the Vietnam War, with diabetes.<sup>37</sup> As a result of the VA's decision, a diagnosis of diabetes would qualify previously nondisabled BOG veterans for disability compensation and lower copayments for outpatient and hospital care. Vietnam-era veterans who were "not on ground" (NOG) remained ineligible for disability compensation due to diabetes.

We conducted a difference-in-differences study that examined changes in outcomes for BOG and NOG Vietnam-era veterans following the VA's July 2001 policy decision. We used the period from October 1, 1996, to September 30, 1998, to establish the presence of diabetes, from January 1, 1999 (October 1, 1999 for hospitalizations and outpatient visits), to June 30, 2001, to ascertain trends in prepolicy outcomes, and from July 1, 2001, to December 31, 2018, to measure postpolicy changes (eFigure 1 in the Supplement). Requiring an established diagnosis of diabetes prior to October 1, 1998, avoided the potential bias that the VA policy may have led some BOG veterans to seek a diagnosis of diabetes. To understand how differences between BOG and NOG veterans evolved after the policy change, we divided the postpolicy period into early, middle, and later periods of approximately 6 years each (period 1: July 1, 2001, to December 31, 2006; period 2: January 1, 2007, to December 31, 2012; period 3: January 1, 2013, to December 31, 2018). Data analysis was performed from October 1, 2020, to December 1, 2021. The VA Central IRB approved the study and waived the need for informed consent because the research involved no more than minimal risk to study participants. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

### Sources of Data/Study Population

We merged data from the Veterans Health Administration, Veterans Benefits Association, the Centers for Medicare & Medicaid Services, and Vietnam-era military deployment records from the Department of Defense. Further details are available in eMethods in the Supplement.

The primary study population included male veterans (99.8% of BOG veterans in the study cohort were male) with a

diagnosis of diabetes<sup>38</sup> in the Veterans Health Administration prior to October 1, 1998, and military service during the Vietnam-era (February 28, 1961, to May 7, 1975) (see eFigure 2 in the Supplement for flowchart). We excluded veterans with a history of disability compensation payments prior to 1999 and/or who served in the military for 20 or more years, the qualifying period for a military pension. Until January 2004, the Department of Defense deducted any VA disability compensation from the military pension.

### Outcomes

The primary outcomes were all-cause mortality and acute care hospitalizations (eTable 1 in the Supplement). Secondary outcomes included receipt of disability compensation, amount of disability compensation (in 2018 dollars), outpatient physician visits, and acute hospital days. The receipt and amount of disability compensation were recorded in monthly snapshots available annually each December. Because the use of VA data alone would not capture services financed by other payers, we conducted analyses of hospitalizations and outpatient visits after restricting to veterans who were enrolled in traditional (fee-for-service) Medicare in 1999 and only considered utilization that occurred in months when veterans were concurrently enrolled in traditional Medicare.<sup>39-41</sup>

### Exposure and Covariates

The primary exposures were BOG status, indicators for 3 postpolicy periods, and the interaction of BOG status with each postpolicy period. Demographic covariates included indicators for year of birth, race and ethnicity (non-Hispanic Black, Hispanic, non-Hispanic White, and other), urban residence, and the zip code-level proportion of persons with college attendance and with income below the federal poverty limit as reported in the 2000 US Census. Race and ethnicity were derived from VA administrative data. Veterans who were American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, other, or who were designated as multiple races were classified as other owing to small sample sizes. Clinical covariates included baseline blood pressure and glycated hemoglobin level (the values closest to January 1, 1999); the number of Elixhauser comorbidities identified between October 1, 1996, and September 30, 1998; and receipt of an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker, sulfonylurea, statin, or insulin prior to July 1, 2001. For continuous covariates, we converted values to quintiles with a category for missing. The proportion of missing covariates is reported in eTable 2 in the Supplement. We did not include postpolicy covariates because they may lie on the causal pathway between increased income and improved health.

### Statistical Analysis

We constructed generalized linear models of the outcomes after including the independent variables and covariates as described above. To account for differences in age between BOG and NOG veterans, the primary model included fixed effects for birth year (eg, 1950) and fully interacted fixed effects for each combination of birth year and postpolicy era. The main

**Table 1. Baseline Characteristics of Boots-on-the-Ground (BOG) and Not-on-Ground (NOG) Vietnam-Era Veterans With Diabetes**

Characteristic	BOG veterans	NOG veterans
No.	14 247	56 224
Age, mean (SD), <sup>a</sup> y	52.1 (4.1)	54.2 (6.3)
Race and ethnicity, %		
Black	25.7	21.7
Hispanic	3.3	2.1
White	63.6	67.1
Other <sup>b</sup>	6.9	8.2
Baseline, mean (SD)		
Systolic blood pressure, <sup>a</sup> mm Hg	139.5 (20.9)	139.8 (21.2)
Diastolic blood pressure, <sup>a</sup> mm Hg	80.0 (12.04)	78.8 (12.3)
Glycated hemoglobin, <sup>a</sup> % of total hemoglobin	8.13 (2.00)	8.10 (1.96)
No. of Elixhauser comorbidities <sup>c</sup>	3.5 (2.3)	3.7 (2.5)
Use of ACEI/ARB before June 30, 2001, %	63	64
Use of sulfonylurea before June 30, 2001, %	54	54
Use of statin before June 30, 2001, %	40	41
Use of insulin before June 30, 2001, %	39	38
Urban, % <sup>a</sup>	74.2	73.8
Zip code-level proportion of persons with college attendance, <sup>a</sup> mean (SD)	28.4 (12.9)	28.5 (13.0)
Zip code-level proportion of persons living below poverty, <sup>a</sup> mean (SD)	13.1 (8.7)	12.9 (8.8)

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker.

<sup>a</sup> The recorded value closest to December 31, 1998.

<sup>b</sup> Race and ethnicity were derived from Department of Veterans Affairs administrative data. Veterans who were American Indian/Alaska Native, Asian, Native Hawaiian/Pacific Islander, other or who were designated as multiple races were classified as other owing to small sample sizes.

<sup>c</sup> Derived from data from October 1, 1996, to September 30, 1998.

coefficients of interest, the interactions between BOG status and postpolicy period, therefore reflected differences in outcome means for BOG vs NOG veterans in a specific postpolicy era, relative to the difference between BOG vs NOG means in the prepolicy era, among veterans born in the same year and after controlling for other covariates. The use of a concurrent control group of NOG veterans also accounts for the large secular decline in hospital admissions over the study period, particularly among older adults.<sup>42</sup> For mortality, outpatient visits, and hospitalizations, the unit of analysis was the person-quarter. Analyses of receipt of disability compensation and monthly compensation payment amount (in 2018 dollars) were conducted at the patient-year. We clustered standard errors at the person-level using generalized estimating equations. The eMethods in the Supplement provide the regression specification.

We conducted stratified analyses by race, zip code-level poverty, and number of comorbid conditions. Exploratory analyses also focused on deaths due to cardiovascular diseases and hospitalization for cardiovascular disease, diabetes, and heart failure, the 3 most common reasons for hospitalization in the cohort. We also separately modeled hospitalizations financed by VA and by Medicare and modeled mortality for the Medicare-enrolled cohort.

**Table 2. Changes in Receipt of Disability Compensation, Award Amount, Outpatient Visits, and Acute Inpatient Days Among Boots-on-the-Ground (BOG) and Not-on-Ground (NOG) Vietnam-Era Veterans With Diabetes**

	Prepolicy (Jan 1999-Jun 2001)	Postpolicy period 1 (Jul 2001-Dec 2006)	Change from prepolicy period to period 1	Adjusted difference-in-differences for period 1 (95% CI)	Postpolicy period 2 (Jan 2007-Dec 2012)	Change from prepolicy period to period 2	Adjusted difference-in-differences for period 2 (95% CI)	Postpolicy period 3 (Jan 2013-Dec 2018 <sup>a</sup> )	Change from prepolicy period to period 3	Adjusted difference-in-differences for period 3 (95% CI)
Annual receipt of disability compensation, % (percentage points for estimates of change)										
BOG veterans	7.3	49.7	42.5	33.2 (32.4 to 34.0)	68.8	61.5	45.8 (44.8 to 46.8)	76.3	69.0	45.3 (44.1 to 46.5)
NOG veterans	1.8	9.2	7.5		14.8	13.0		22.1	20.3	
Monthly award amount, \$										
BOG veterans	97	937	840	669 (648 to 690)	1639	1542	1201 (1170 to 1232)	2059	1962	1430 (1390 to 1470)
NOG veterans	21	154	134		286	265		441	420	
Annual outpatient visits, <sup>b</sup> No.										
BOG veterans	15.2	16.7	1.5	0.4 (-0.2 to 1.0)	19.4	4.2	0.2 (-0.7 to 1.1)	19.4	4.2	-0.5 (-1.7 to 0.7)
NOG veterans	14.1	15.5	1.4		18.1	4.0		19.0	4.9	
Acute hospital days, <sup>a</sup> No.										
BOG veterans	5.9	5.6	-0.4	-1.0 (-1.5 to -0.4)	5.5	-0.4	-1.0 (-1.6 to -0.3)	5.2	-0.7	-1.7 (-2.4 to -1.0)
NOG veterans	5.3	5.7	0.4		6.0	0.7		6.3	1.0	

<sup>a</sup> Outpatient visits limited to data through December 31, 2017.

<sup>b</sup> This outcome measure was limited to persons enrolled in Medicare before 1999, annualized to 12 person-months of Medicare enrollment, and included

utilization financed by either the Department of Veterans Affairs or traditional Medicare. Dollar amounts inflation-adjusted to 2018.

Analyses of prepolicy trends are described in the eMethods in the Supplement. We examined changes in the composition of BOG and NOG veterans by modeling the baseline covariates as outcomes in difference-in-differences models.<sup>43</sup> In another sensitivity analysis, we included interactions of each covariate with postpolicy time period. To examine how enrollment in managed care may have affected our findings, we estimated the annual number of months of managed care enrollment and examined the use of hospital care among switchers to managed care vs those who remained in traditional Medicare. To explore the sensitivity of our results to missing covariates, we fitted a model that excluded all covariates other than birth year. Finally, we conducted a falsification test of BOG and NOG veterans who were already receiving maximal disability compensation payments prior to 1999. Statistical analyses were performed using SAS statistical software (Enterprise Guide 7.1; SAS Institute, Inc).

## Results

The study population included 70 471 Vietnam-era veterans, of which 14 247 were BOG veterans (mean [SD] age, 51.2 [3.8] years as of December 31, 1998; 25.7% were Black; 3.3% were Hispanic; 63.6% were White; and 6.9% were of other race), and 56 224 were NOG veterans (mean [SD] age, 54.2 [6.3] years; 21.7% were Black; 2.1% were Hispanic; 67.1% were White; and 8.2% were of other race) (Table 1). Absolute differences between BOG and NOG veterans in other characteristics were minimal. eTable 3 in the Supplement provides the prevalences of Elixhauser comorbidities. eTable 4 in the Supplement describes the 3623 BOG veterans and 19 174 NOG veterans enrolled in traditional Medicare in 1999.

### Disability Compensation Payments

Among BOG veterans, the annual proportion receiving disability compensation payments increased from 7.3% during the pre-

policy period (January 1999 and June 2001), to 49.7% during period 1, 68.8% during period 2, and 76.3% during period 3. Among NOG veterans, the concurrent proportions were 1.8% (prepolicy), 9.2% (period 1), 14.8% (period 2), and 22.1% (period 3) (Table 2). Thus, the adjusted difference-in-differences in the proportion receiving disability compensation payments were 33.2 percentage points (95% CI, 32.4-34.0) for period 1, 45.8 percentage points (95% CI, 44.8-46.8) for period 2, and 45.3 percentage points (95% CI, 44.1-46.5) for period 3. The mean inflation-adjusted monthly payment increased from \$97 during the prepolicy period to \$937, \$1639, and \$2059 in periods 1, 2, and 3, respectively. The concurrent change among NOG veterans was \$21 in the prepolicy period to \$441 in period 3, yielding an adjusted difference-in-differences in monthly awards of \$669 (95% CI, \$648-\$690) in period 1, \$1201 (95% CI, \$1170-\$1232) in period 2, and \$1430 (95% CI, \$1390-\$1470) in period 3, or annual differences of \$8025, \$14 412, and \$17 160, respectively.

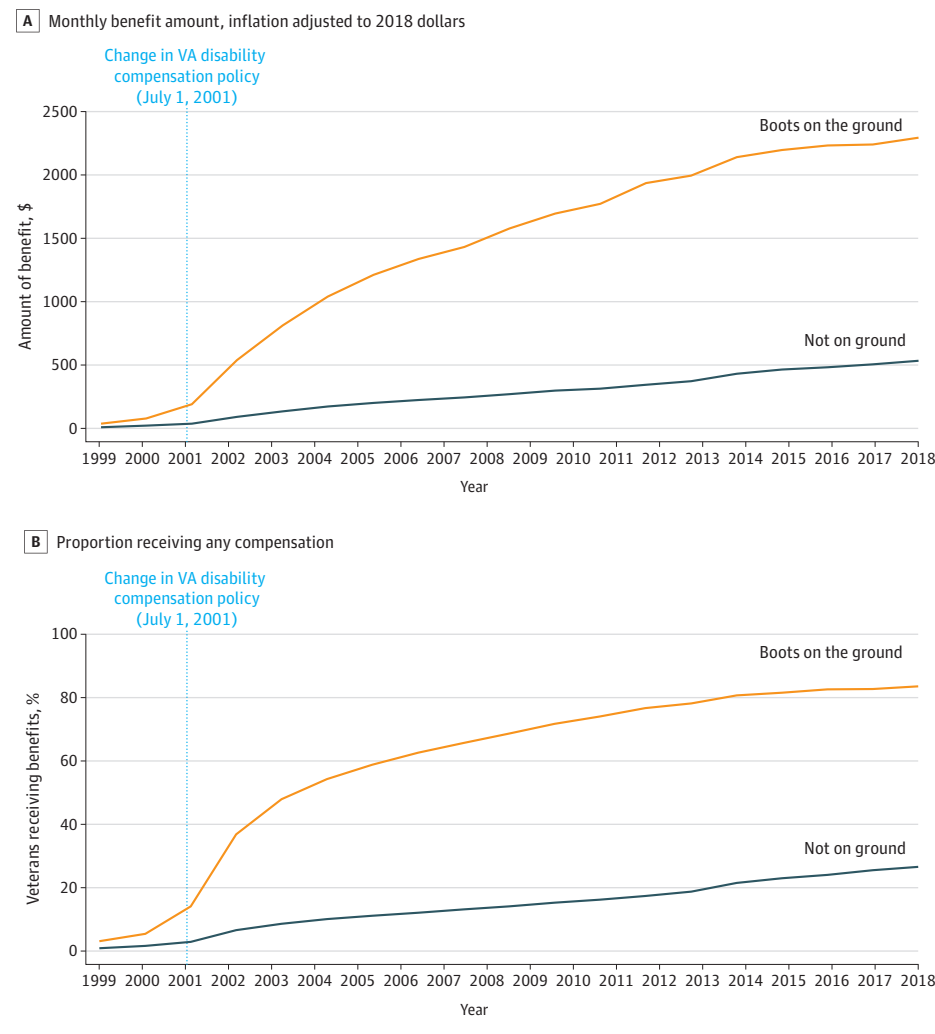
Figure 1 shows the proportion receiving disability compensation and the mean award amount. eFigure 3 in the Supplement provides the mean annual award amount among those receiving compensation.

### Mortality, Hospital Utilization, and Outpatient Visits

Annual mortality rates for BOG and NOG veterans are shown in Figure 2A. Unadjusted annual mortality rates for BOG veterans were 3.04% in the prepolicy period, 4.08% in period 1, 5.12% in period 2, and 7.36% in period 3. The corresponding unadjusted mortality rates for NOG veterans were 3.56% (prepolicy period), 4.40% (period 1), 5.84% (period 2), and 8.24% (period 3). In fully adjusted models, the difference-in-differences estimates were 0.24 percentage points (95% CI, -0.08 to 0.52) in period 1, -0.08% (95% CI, -0.40 to 0.24) in period 2, and -0.08% (95% CI, -0.48 to 0.36) in period 3.

Figure 2B shows trends in the annual number of hospitalizations per 100 person-years. Among BOG veterans, the mean number of hospitalizations per 100 person-years was 79.05 in the prepolicy period, 79.70 in period 1, 79.55 in period 2, and

**Figure 1. Disability Compensation Among Boots-on-the-Ground and Not-on-Ground Vietnam-Era Veterans With Diabetes From 1999 to 2018**



Panels A and B show trends in the receipt of disability compensation for boots-on-the-ground (BOG) and not-on-ground (NOG) Vietnam-era veterans with diabetes from 1999 to 2018. On July 1, 2001, the Department of Veterans Affairs (VA) added diabetes to the list of disabling medical conditions related to military service for BOG veterans only; NOG veterans remained ineligible for disability compensation related to diabetes. A, Mean monthly award amount, with all values inflation-adjusted to 2018 dollars; B, Proportion of veterans who received any disability compensation.

75.90 in period 3. Among NOG veterans, the rate of hospitalizations per 100 person-years was 74.64 in the prepolicy period, 82.38 in period 1, 87.78 in period 2, and 90.09 in period 3. The adjusted difference-in-differences estimates were  $-7.52$  hospitalizations per 100 person-years (95% CI,  $-13.12$  to  $-1.92$ ) in period 1,  $-10.12$  (95% CI,  $-17.28$  to  $-3.00$ ) in period 2, and  $-15.88$  (95% CI,  $-24.00$  to  $-7.76$ ) in period 3. These estimates represent relative declines of 10% (period 1), 13% (period 2), and 21% (period 3) (Table 3). The adjusted difference-in-differences estimates for outpatient utilization were all less than 1 visit across all postpolicy time periods (Table 2). The findings for acute inpatient days were qualitatively similar to those observed for inpatient admissions.

### Stratified and Sensitivity Analyses and Cause-Specific Outcomes

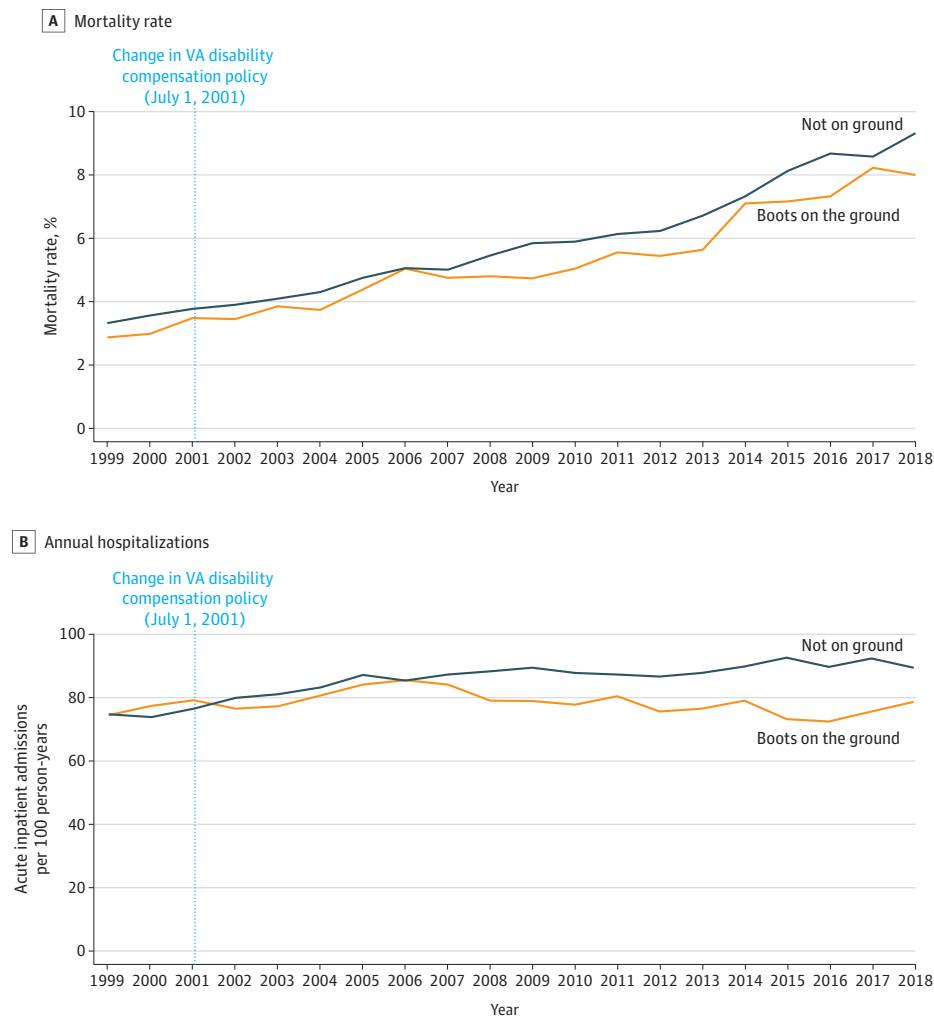
In exploratory analyses, we did not find evidence that the association between eligibility for disability compensation and outcomes varied by race and ethnicity, socioeconomic status, or number of comorbidities at baseline (eTables 5 and 6

in the Supplement). Eligibility for disability compensation was not associated with mortality due to cardiovascular disease and all-cause mortality among the Medicare-enrolled cohort (eTables 7 and 8 in the Supplement). BOG veterans experienced reductions in hospitalizations for diabetes and heart failure compared with concurrent trends for NOG veterans (eTable 7 in the Supplement). In period 3, the difference-in-differences estimate for hospitalizations due to heart failure was  $-2.36$  per 100 person-years (95% CI,  $-4.08$  to  $-0.64$ ), a relative reduction of 37%. For hospitalizations due to diabetes, the difference-in-differences estimate was  $-1.64$  (95% CI,  $-3.20$  to  $-0.12$ ), a relative reduction of 41%. Changes in hospitalizations for cardiovascular conditions for BOG veterans relative to NOG veterans were not statistically significant. The reductions in acute inpatient admissions were larger for Medicare-financed hospitalizations compared with VA-financed hospitalizations (eTable 9 in the Supplement).

Prepolicy outcome trends are reported in eTable 10 in the Supplement. The composition of BOG and NOG veterans, as measured by baseline characteristics, remained unchanged



Figure 2. Mortality and Hospitalizations Among Boots-on-the-Ground and Not-on-Ground Vietnam-Era Veterans With Diabetes from 1999 to 2018



On July 1, 2001, the Department of Veterans Affairs (VA) added diabetes to the list of disabling medical conditions related to military service for boots-on-the-ground (BOG) veterans only; not-on-ground (NOG) veterans remained ineligible for disability compensation related to diabetes. A, Trends in annual mortality rates for BOG and NOG Vietnam-era veterans with diabetes from 1999 to 2018. Each point estimate reflects the unadjusted mortality rate among veterans who were alive at the beginning of the calendar year. B, Trends in the number of hospitalizations per 100 person-years among persons enrolled in traditional Medicare before 1999. Hospitalizations were annualized to 12 person-months of Medicare enrollment and included utilization financed by either the VA or traditional Medicare.

over time (eTables 11 and 12 in the Supplement). Analyses that interacted all covariates with postpolicy period (eTable 13 in the Supplement) and that excluded covariates other than birth year and interactions of birth year with postpolicy period yielded results consistent with the main analysis (eTable 14 in the Supplement). Growth in managed care was higher among NOG veterans relative to BOG veterans (eTable 15 in the Supplement). For both groups, use of hospital care was greater those who switched to managed care compared with stayers in traditional Medicare (eFigure 4 in the Supplement). The falsification analyses did not detect significant changes in mortality or hospitalizations for BOG veterans who were receiving maximal disability compensation prior to 1999 (eTable 16 in the Supplement).

## Discussion

This analysis has 3 main findings. First, we observed substantial uptake of disability compensation payments among newly

eligible BOG veterans with diabetes following the VA's 2001 decision to add diabetes as a disabling condition related to military service. Second, despite a large and sustained level of increased income, we did not find evidence that disability compensation was associated with lower mortality rates for BOG veterans. The CIs for these null findings were tightly bound around 0. Third, among veterans concurrently enrolled in Medicare, a population whose utilization could be completely observed in our data, eligibility for disability compensation was associated with substantial reductions in acute hospitalizations. The relative declines increased from 10% to 21% over the study period, which coincided with both increasing uptake of disability compensation and larger payments amounts for BOG veterans. Scaling the decline in acute hospitalizations by the 33- to 46-percentage-point increase in receipt of disability compensation suggests reductions of 23 to 35 hospitalizations per 100 person-years, or 29% to 46% relative reductions, among BOG veterans with diabetes who began receiving disability compensation as a result of the decision.

**Table 3. Changes in Annual Mortality and Hospitalization Rates Among Boots-on-the Ground (BOG) and Not-on-Ground (NOG) Vietnam-Era Veterans With Diabetes**

	Prepolicy (Jan 1999-Jun 2001)	Postpolicy period 1 (Jul 2001-Dec 2006)	Change from prepolicy period to period 1	Adjusted difference-in-differences for period 1 (95% CI)	Postpolicy period 2 (Jan 2007-Dec 2012)	Change from prepolicy period to period 2	Adjusted difference-in-differences for period 2 (95% CI)	Postpolicy period 3 (Jan 2013-Dec 2018 <sup>a</sup> )	Change from prepolicy period to period 3	Adjusted difference-in-differences for period 3 (95% CI)
<b>Annual mortality rate, % (percentage points for changes)</b>										
BOG veterans	3.04	4.08	1.04	0.23 (-0.07 to 0.53)	5.12	2.08	-0.08 (-0.42 to 0.25)	7.36	4.32	-0.06 (-0.47 to 0.35)
NOG veterans	3.56	4.40	0.84		5.84	2.28		8.24	4.68	
<b>No. of hospitalizations per 100 person-years<sup>a</sup></b>										
BOG veterans	79.05	79.70	0.65	-7.52 (-13.12 to -1.92)	79.55	0.50	-10.12 (-17.28 to -3.00)	75.90	-3.15	-15.88 (-24.00 to -7.76)
NOG veterans	74.64	82.38	7.74		87.78	13.15		90.09	15.45	

<sup>a</sup> This outcome measure was limited to persons enrolled in Medicare before 1999, annualized to 12 person-months of Medicare enrollment, and included

utilization financed by either the Department of Veterans Affairs or traditional Medicare.

Our finding that greater income payments were not associated with lower mortality aligns with prior quasiexperimental studies among adults in high-income countries. For instance, among Swedish and British lottery players, large wind-fall payments have not been consistently associated with better health.<sup>16-19,44</sup> A cut in Social Security payments for adults born after December 31, 1916, was associated with unexpected decreases in mortality, potentially because affected beneficiaries were more likely to engage in postretirement work that may offer health benefits.<sup>13</sup> Given prior evidence that disability compensation was associated with lower veteran employment rates,<sup>24,32</sup> our results should reassure policy makers that veterans' exit from the labor market was not associated with an increased mortality risk.

An evaluation of "Mincome," a universal basic income program in a Manitoba, Canada, community from 1974 to 1979, found that income payments were associated with an 8.5% decrease in acute hospitalizations.<sup>45</sup> We build on this evidence by focusing on population with a high degree of comorbidity and social risk. Further, while other studies have examined rare historical events or unique cohorts with unclear generalizability, this analysis focused on a contemporary program available to 1 in 7 US adult men.

Why were compensation payments not associated with improved survival among US veterans? If the association between income and mortality is mediated by access to insurance coverage, then our null finding may relate to our focus on a population enrolled in the VA, an equal-access health system. Another possibility is that the health effects of greater income may be less evident for middle-aged or older adults than for younger populations, given evidence that the gradient between income and health among adults may originate from exposure to poverty in childhood.<sup>9</sup> Finally, it is possible that associations between income and survival may primarily relate to the lower earnings of people who are sick or unobserved confounding factors, rather than a causal relationship.<sup>15</sup> The absence of a mortality difference despite large and sustained compensation payments should temper expectations that

increasing income among middle-aged or older adults will invariably improve life expectancy.

The rapid growth in veterans disability compensation payments has motivated interest in reducing federal expenditures through restricting eligibility or lowering compensation payments.<sup>46</sup> For instance, the Congressional Budget Office estimated that a 30% reduction in veterans' compensation payments at age 67 years would save \$24 billion between 2021 and 2030.<sup>47</sup> As policy makers consider these changes, our study offers evidence that veterans' disability payments may yield offsetting reductions in hospitalizations, particularly those financed by Medicare. This finding suggests that the evaluations of the VA disability compensation program should consider its influence on health spending that occurs outside the Department of Veterans Affairs.

### Limitations

Our study has limitations. First, we cannot exclude the possibility that BOG and NOG veterans were differentially affected by other secular trends during the 17.5-year postpolicy period. Second, the degree to which these findings extend beyond the VA disability compensation program and to conditions other than diabetes is unclear. Third, we lacked data on utilization for managed care enrollees, though switching to managed care was more common among NOG veterans, and those who switched to managed care had greater use of hospital care prior to switching. Fourth, the primary outcomes were limited to mortality and hospitalizations; future studies should examine other end points. Fifth, the receipt of regular income payments may have ameliorated social risk factors common among veterans, such as housing instability and food insecurity,<sup>48,49</sup> but our data lacked information on these factors. Sixth, the VA policy also qualified some BOG veterans for lower VA copayments. However, it is unlikely that reduced cost-sharing explained the reductions in hospitalizations, given that outpatient utilization remained unchanged, and prior evidence suggests that inpatient cost-sharing deters hospitalizations.<sup>50,51</sup>

## Conclusions

In this cohort study, the expansion of eligibility for disability compensation to Vietnam-era veterans with diabetes was as-

sociated with substantial declines in hospitalizations but unchanged mortality. These findings can inform future decisions about the veterans disability compensation program and guide other evaluations of the health effects of income support programs.

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