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Disability Rating and 1-Year Mortality Among Veterans With Service-Connected Health Conditions

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Abstract

Objectives: Military service is associated with an increased risk of disability and death after discharge. This study determined the relationships among characteristics, disability ratings, and 1-year mortality risks of veterans receiving compensation for service-connected health conditions (ie, conditions related to illnesses or injuries incurred or aggravated during military service).

Methods: This study included 4 010 720 living veterans who had ≥1 service-connected health condition and were receiving disability compensation on October 1, 2016. We obtained data on veteran demographic, military service, and disability characteristics from the Veterans Benefits Administration VETSNET file and on 1-year mortality from the Veterans Administration vital status file. We compared veteran characteristics and 1-year mortality rates within and between the following combined service-connected disability rating categories: low, 10% to 40% disability; medium, 50% to 90% disability; high, 100% disability. We used logistic regression analysis to determine the relationships between disability ratings and 1-year mortality rates.

Results: Of 4 010 720 veterans, 515 095 (12.8%) had high disability ratings, 1 600 786 (39.9%) had medium disability ratings, and 1 894 839 (47.2%) had low disability ratings. The 1-year mortality rates were 4.5% for those with high disability, 1.9% for those with medium disability, and 1.9% for those with low disability ratings. Compared with veterans with low disability ratings, veterans with high disability ratings had more than twice the odds of 1-year mortality (odds ratio = 2.45; 95% confidence interval, 2.40-2.50).

Conclusions: The combined disability rating is an important determinant of short-term survival among veterans with service-connected health conditions. Veterans with a 100% disability rating comprise a highly select group with increased short-term risk of death due at least in part to their military service. Future studies assessing the relationships among combat exposure, age, duration of disability, disability ratings, and survival would be valuable.

Keywords

depression, military service, posttraumatic stress disorder, PTSD, survival

Veterans who have served in the Armed Forces of the United States are eligible to receive compensation for service-connected health conditions (ie, illnesses or injuries incurred or aggravated during military service).[1-3] Military service, particularly involving combat exposure, is associated with increased risks of disability and death after discharge from military service.[4,5] Disability in the nonmilitary community is also associated with an increased risk of death, particularly for those with mental health and/or substance use disorders.[6] However, service-connected disability, as defined by the US Department of Veterans Affairs (VA), differs from disability as defined in nonmilitary social insurance or social welfare programs. The latter, which include the Social Security Administration Disability Insurance Benefit and Supplemental Security Income programs, typically consider inability to work as a key determinant of disability. In contrast, military service–connected disability is based on the average impairment in earning capacity that the service-connected

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conditions typically cause.[7] Thus, disabled veterans can work without losing disability benefits, whereas nonmilitary people who are involved with social insurance or social welfare disability programs cannot work or can work only limited hours.

Limited data are available on mortality rates and risks among veterans who receive compensation for service-connected health conditions. The little that is known about mortality and service-connected disability pertains to veterans with mental health disorders, particularly posttraumatic stress disorder (PTSD) and major depression. Almost 25% of veterans with service-connected disability have service-connected PTSD, and another 6% have service-connected major depression.[1] A 2015 study of veterans with mental health disorders reported on 1-year mortality rates for veterans with depression, substance use disorder, serious mental illness, and PTSD. Of veterans with PTSD, almost 75% had a service-connected disability rating (hereinafter, disability rating) of ≥50%.[8] Another 2015 study reported that 18% of veterans with depression had a disability rating of ≥70%.[9] Although these studies focused more on mental health disorders than service-connected disability, they provide a reference point for our examination of the relationships among service-connected health conditions (particularly but not only mental health disorders), disability ratings, and short-term mortality rates.

Our overarching goal was to add to the understanding of how disability affects short-term survival among veterans. Our primary objective was to compare characteristics of veterans within and between various combined disability rating categories. Based on our hypothesis that veterans with 100% disability ratings would have higher mortality rates than those with lower disability ratings, all other factors being equal, a secondary objective was to determine whether the risk for 1-year mortality was higher for veterans with a 100% disability rating than for veterans with lower disability ratings while controlling for various characteristics.

Methods

This study included 4 010 720 veterans who were alive, had at least 1 service-connected health condition, and were receiving disability compensation for the condition on October 1, 2016. We obtained the date of last disability compensation and data on demographic, military service, and disability characteristics from the Veterans Benefits Administration (VBA) VETSNET file, which provides a snapshot of demographic, disability, and financial characteristics of veterans receiving various benefits from the VA. The VETSNET file did not include data on when compensation was first awarded, so the total duration of compensation received was unknown.

We collected data from the VETSNET file on demographic characteristics, including age (≤50, 51-64, ≥65) and sex (male, female); military service, including service branch (Air Force, Army, Coast Guard, Marines, Navy) and paygrade (enlisted, warrant officer, officer); number of outpatient visits in the previous year; and number and type of service-connected health conditions (determined from VBA disability codes).

Disability ratings were determined in VETSNET by using the Schedule for Rating Disabilities (Schedule) in the VA's Web Automated Reference Material System.[10] Each service-connected health condition for each veteran was assigned a percentage disability rating, ranging from 0% to 100%, based on the Schedule. For veterans with >1 service-connected health condition, the overall disability rating was determined by using combined ratings tables.[11,12] The combined disability ratings ranged from 0% to 100% and were reported in increments of 10, so that all ratings ended in the digit 0. We categorized the disability rating as low (0%-40%), medium (50%-90%), or high (100%).

The definitions of both common service-connected health conditions and of presumptive disability due to Agent Orange exposure in the Vietnam theater used in VETSNET have been described previously.[1] The most common service-connected health conditions were identified by using VBA disability codes, and these conditions (and codes) included tinnitus (6260), hearing loss (6100), asthma (6602), sleep apnea (6847), ischemic heart disease (7005, 7006), genitourinary cancer (7528), diabetes mellitus (7913), chronic kidney disease (7530), chronic obstructive pulmonary disease (6604), traumatic brain disease (8045), migraine (8100), anxiety (9400), PTSD (9411), and major depression (9434).[10]

Legislation passed by the US Congress specifies that certain medical conditions are presumed to be service-connected based on a history of exposure to Agent Orange during service in the Vietnam theater.[13] These conditions are amyloid light chain (AL) amyloidosis (7717), chronic B-cell leukemia (7703), chloracne (7829), diabetes mellitus type 2 (7913), Hodgkin's disease (7709), ischemic heart disease (7005, 7006), multiple myeloma (7123), non-Hodgkin's lymphoma (7715), Parkinson's disease (8004), peripheral neuropathy–early onset (8510-8730), porphyria cutanea tarda (7815), prostate cancer (7528), respiratory cancers (6819), and soft-tissue sarcomas (7123, 8540). We presumed that veterans who had disability codes for these particular conditions, and who had served in the Vietnam theater of operations according to the VETSNET file, had service-connected health conditions due to Agent Orange exposure.

We obtained data on mortality from the VA vital status file, which contains survival information from the Social Security Administration Death Master File, Medicare Vital Status File, and other sources.[14] We linked data in the VETSNET and vital status files by using scrambled social security numbers. We defined survival time as the number of days from October 1, 2016, to death or to the last date of follow-up, which was September 30, 2017. This study was exempt from institutional review board review, because it was conducted for quality improvement purposes.

From 4 028 927 veterans, we excluded from the study 8012 veterans who were in the VETSNET file and who had

a 0% disability rating, which implied that the severity of the service-connected health condition was not sufficient to warrant compensation. We also excluded 10 195 veterans who were in the VETSNET file but either did not appear in the vital status file or who had a negative survival time (ie, date of death before October 1, 2016, indicating a probably erroneous match). Thus, we excluded a total of 18 207 veterans (0.5% of all veterans with service-connected health conditions on October 1, 2016) from the study. Of these, 17 413 (95.6%) were men and the mean (standard deviation [SD]) age was 74 (14) years. After exclusions, a total of 4 010 720 veterans comprised the study group.

We compared data on veteran demographic characteristics, military service, health care use, and individual service-connected health conditions, as well as 1-year mortality, by using the following combined disability rating categories: low (10%-40% disability), medium (50%-90% disability), and high (100% disability). We used logistic regression analysis to assess the association between combined disability rating and 1-year mortality by first entering all characteristics into the model and then forcing the combined disability rating into the model. We did not include the number of service-connected health conditions as a characteristic in the regression analysis because it was strongly associated with the combined disability rating. We also excluded tinnitus because of its high correlation with hearing loss.

We included 3 899 056 of the 4 010 720 veterans in the logistic regression analysis. Of the 111 664 veterans excluded because of missing data, 111 132 were missing data on 1 characteristic and 532 were missing data on >1 characteristic. Data on age were missing for 2832 veterans, data on sex were missing for 582 veterans, and data on military service branch were missing for 108 782 veterans.

Results

Of the 4 010 720 veterans with service-connected disabilities, 515 095 (12.8%) had a high disability rating, 1 600 786 (39.9%) had a medium disability rating, and 1 894 839 (47.2%) had a low disability rating (Table 1). Compared with the groups of veterans with low and medium disability ratings, the group with high disability ratings had a higher mean (SD) age (61 [15]) and a higher proportion who were aged ≥65 (56.6%), who were men (91.8%), who had served in the US Army (58.3%) or the US Marines (13.7%), and who had used VA health care in the previous year (75.3%). Compared with the group with low disability ratings, the group with medium disability ratings had higher proportions of veterans using VA health care in the previous year. In the group with high disability ratings, 44.6% had PTSD and 21.6% had diabetes.

Of all 4 010 720 veterans with service-connected disabilities, only 388 676 (9.7%) were women (Table 1), and they were on average 13 years younger than men. Of the 425 969 veterans who had service-connected disabilities and served in Vietnam, 108 166 (25.4%) were in the high disability group; of these, 89 073 (82.3%) had presumptive disability due to Agent Orange exposure.

At the 1-year mark, 3 921 250 (97.8%) veterans were alive and 89 470 (2.2%) were deceased (Table 2). Of the decedents, 77 620 (86.8%) were aged ≥65, 1763 (2.0%) were women, 23 117 (25.8%) had a 100% disability rating, 35 244 (39.4%) had hearing loss, 19 573 (21.9%) had PTSD, and 18 057 (20.2%) had diabetes mellitus.

The 1-year death rate was 23 times higher for veterans aged ≥65 (4.6%) than for veterans aged ≤50 (0.2%; Table 3). The 1-year death rate for men (2.4%) was 5 times higher than the 1-year death rate for women (0.5%). The 1-year death rate was 4.5% for veterans with a high disability rating, 1.9% for veterans with a medium disability rating, and 1.9% for veterans with a low disability rating. Veterans with a VA outpatient visit in the previous year had a higher death rate (2.7%) than those without a visit (1.7%), and veterans with an outpatient visit were on average 5 years older than their counterparts without a visit. The 1-year mortality rates for veterans with PTSD were 1.5% for veterans with low disability ratings, 1.6% for veterans with medium disability ratings, and 3.2% for veterans with high disability ratings. The 1-year mortality rates for veterans with major depression were 1.3% for veterans with low disability ratings, 1.2% for veterans with medium disability ratings, and 2.8% for veterans with high disability ratings.

Estimating the odds of 1-year mortality while adjusting for veteran characteristics, the 1-year mortality rate was associated with age; veterans aged ≥65 had almost 16 times higher odds of death (odds ratio [OR] = 15.7; 95% confidence interval [CI], 15.1-16.4) than veterans aged ≤50 (Table 3). The 1-year mortality rate was also associated with the following service-connected conditions: ischemic heart disease (OR = 1.14; 95% CI, 1.12-1.16), chronic kidney disease (OR = 2.02; 95% CI, 1.84-2.21), chronic obstructive pulmonary disease (OR = 1.77; 95% CI, 1.69-1.84), and anxiety (OR = 1.16; 95% CI, 1.12-1.20). Veterans with the following service-connected conditions had more than 10% lower odds of death: sleep apnea (OR = 0.57; 95% CI, 0.55-0.60), genitourinary cancer (OR = 0.76; 95% CI, 0.74-0.78), diabetes (OR = 0.89; 95% CI, 0.87-0.91), migraine (OR = 0.78; 95% CI, 0.75-0.81), PTSD (OR = 0.67; 95% CI, 0.65-0.68), and Agent Orange exposure (OR = 0.89; 95% CI, 0.87-0.91).

Discussion

For veterans receiving compensation for service-connected health conditions, we found that veterans with 100% disability ratings were 2.5 times more likely to die than veterans with low disability ratings. Death rates for veterans with middle and low disability ratings were lower than for veterans with high disability ratings; however, more than 66 000 veterans in these 2 groups died during the study period. Although these findings are not surprising, they do confirm that disability ratings are not just numbers but also predictors of the inherent lifetime risks of military service, including premature death. Within this group, the risk of death was

Table 1. Characteristics of 4 010 720 veterans, by combined service-connected disability ratings,[a] from the Veterans Benefits Administration VETSNET file, October 1, 2016

Characteristic	Any Disability	Combined Service-Connected Disability Rating[a]		
		100%	50%-90%	10%-40%
Total, no. (%)	4 010 720	515 095	1 600 786	1 894 839
Age,[b] mean (SD), y	58 (17)	61 (15)	55 (17)	58 (17)
Age,[b] no. (%), y				
≤50	1 307 174 (32.6)	118 403 (23.0)	605 779 (37.8)	582 992 (30.8)
51-64	1 001 988 (25.0)	105 177 (20.4)	383 467 (24.0)	513 344 (27.1)
≥65	1 698 726 (42.4)	291 480 (56.6)	611 452 (38.2)	795 794 (42.1)
Women only, all ages	388 676 (9.7)	42 112 (8.2)	179 688 (11.2)	166 876 (8.8)
Service branch,[c] no. (%)				
US Air Force	670 991 (17.2)	65 988 (13.0)	249 715 (15.9)	355 288 (19.5)
US Army	1 986 942 (50.9)	295 924 (58.3)	846 915 (53.8)	844 103 (46.4)
US Coast Guard	37 660 (1.0)	3587 (0.7)	15 352 (1.0)	18 721 (1.0)
US Marines	514 467 (13.2)	69 361 (13.7)	212 699 (13.5)	232 407 (12.8)
US Navy	686 822 (17.6)	71 676 (14.1)	248 810 (15.8)	366 336 (20.1)
Other	5056 (0.1)	679 (0.1)	1937 (0.1)	2440 (0.1)
Pay grade, no. (%)				
Enlisted	3 045 862 (75.9)	414 398 (80.5)	1 316 798 (82.3)	1 314 666 (69.4)
Warrant officer	35 377 (0.9)	5653 (1.1)	17 623 (1.1)	12 101 (0.6)
Officer	260 388 (6.5)	30 360 (5.9)	111 590 (7.0)	118 438 (6.3)
Missing data	669 093 (16.7)	64 684 (12.6)	154 775 (9.7)	449 644 (23.7)
Outpatient visit in previous year, no. (%)	2 131 471 (53.1)	387 636 (75.3)	976 038 (61.0)	767 797 (40.5)
No. of service-connected health conditions, mean	5.0	7.7	6.5	2.9
Service-connected health condition,[d] no. (%)				
Hearing loss	1 333 441 (33.2)	115 525 (22.4)	453 161 (28.3)	764 755 (40.4)
Tinnitus	1 602 486 (40.0)	141 550 (27.5)	679 622 (42.5)	781 314 (41.2)
Asthma	136 595 (3.4)	15 699 (3.0)	64 194 (4.0)	56 702 (3.0)
Sleep apnea	339 666 (8.5)	60 364 (11.7)	217 998 (13.6)	61 304 (3.2)
Ischemic heart disease	312 860 (7.8)	84 187 (16.3)	140 843 (8.8)	87 830 (4.6)
Genitourinary cancer	130 918 (3.3)	47 172 (9.2)	47 625 (3.0)	36 121 (1.9)
Diabetes mellitus	490 368 (12.2)	111 409 (21.6)	231 341 (14.5)	147 618 (7.8)
Chronic kidney disease	8092 (0.2)	3586 (0.7)	3023 (0.5)	1483 (0.2)
Chronic obstructive pulmonary disease	48 750 (1.2)	9469 (1.8)	19 806 (1.2)	19 475 (1.0)
Traumatic brain disease	137 458 (3.4)	24 847 (4.8)	75 173 (4.7)	37 438 (2.0)
Migraine	427 550 (10.7)	69 913 (13.6)	230 271 (14.4)	127 366 (6.7)
Anxiety	191 206 (4.8)	23 196 (4.5)	97 844 (6.1)	70 168 (3.7)
Posttraumatic stress disorder	1 002 301 (25.0)	229 569 (44.6)	593 214 (37.1)	179 518 (9.5)
Major depression	247 943 (6.2)	43 355 (8.4)	139 041 (8.7)	65 547 (3.5)

[a]Service-connected disability ratings were determined by using the Schedule for Rating Disabilities in the Veterans Administration (VA) Web Automated Reference Material System.[10] For veterans with >1 service-connected condition, the overall disability rating was determined by using combined ratings tables.[11] Combined disability ratings ranged from 0% to 100% and were reported in increments of 10. Disability ratings were categorized as low (10%-40%), medium (50%-90%), or high (100%).

[b]Data on age were missing for 2832 veterans, resulting in smaller populations for each combined service-connected disability rating: 100% disability (n = 515 060), 50% to 90% disability (n = 1 600 698), 10% to 40% disability (n = 1 892 130), and any disability (n = 4 007 888).

[c]Data on service branch were missing for 108 782 veterans, resulting in smaller populations for each combined service-connected disability rating: 100% disability (n = 507 215), 50% to 90% disability (n = 1 575 428), 10% to 40% disability (n = 1 819 295), and any disability (n = 3 901 938). "Other" includes US Merchant Marine and US Public Health Service.

[d]Service-connected conditions are illnesses or injuries that are incurred or aggravated during military service. Most veterans had >1 service-connected condition; as such, percentages in these categories total to >100%. Conditions are listed in order of severity, from conditions with lower ratings to chronic disease conditions to mental health brain injury conditions.

highest for enlisted personnel. This finding suggests that rank may also predict premature death and is consistent with evidence showing that enlisted personnel have lower socioeconomic status and relatively less privilege than officers.[15]

According to VA regulations, total or 100% disability exists "when there is present any impairment of mind or body which is sufficient to render it impossible for the average person to follow a substantially gainful occupation."[16] Veterans with this high disability rating comprise a distinct subgroup of veterans with service-connected health conditions. They receive the highest level of compensation, they are provided cost-free medical care (including medications for treatment of any disability), and they and their families are eligible for many other benefits.

Table 2. Demographic characteristics, military service, health care use, service-connected health condition characteristics, and combined disability ratings[a] of 4 010 720 veterans, by vital status,[b] from the Veterans Benefits Administration VETSNET file, October 1, 2016

Characteristic	1-Year Vital Status, No. (%)	
	Alive	Deceased
Total	3 921 250 (100)	89 470 (100)
Age,[c] y		
≤50	1 304 349 (33.3)	2825 (3.2)
51-64	993 003 (25.3)	8985 (10.0)
≥65	1 621 106 (41.4)	77 620 (86.8)
Women only, all ages	386 913 (9.9)	1763 (2.0)
Service branch[d]		
US Air Force	657 587 (17.2)	13 404 (15.5)
US Army	1 939 710 (50.8)	47 232 (54.7)
US Coast Guard	36 991 (1.0)	669 (0.8)
US Marines	505 520 (13.2)	8947 (10.4)
US Navy	671 302 (17.6)	15 520 (18.0)
Other	4542 (0.1)	514 (0.6)
Pay grade		
Enlisted	2 991 245 (76.3)	54 617 (61.0)
Warrant officer	34 777 (0.9)	600 (0.7)
Officer	256 086 (6.5)	4302 (4.8)
Missing data	639 142 (16.3)	29 951 (33.5)
Outpatient visit in previous year	2 074 847 (52.9)	56 624 (63.3)
Combined service-connected disability rating[a]		
100%	491 178 (12.5)	23 117 (25.8)
50%-90%	1 571 142 (40.1)	29 644 (33.1)
10%-40%	1 858 130 (47.4)	36 709 (41.0)
Service-connected health condition[e]		
Hearing loss	1 298 197 (33.1)	35 244 (39.4)
Asthma	134 957 (3.4)	1638 (1.8)
Sleep apnea	337 545 (8.6)	2121 (2.4)
Ischemic heart disease	299 126 (3.2)	13 734 (15.1)
Genitourinary cancer	126 141 (3.2)	4777 (5.3)
Diabetes mellitus	472 311 (12.0)	18 057 (20.2)
Chronic kidney disease	7566 (0.2)	526 (0.6)
Chronic obstructive pulmonary disease	46 214 (1.2)	2536 (2.8)
Traumatic brain disease	135 776 (3.5)	1682 (1.9)
Migraine	424 364 (10.8)	3186 (3.6)
Anxiety	187 039 (4.8)	4167 (4.7)
Posttraumatic stress disorder	982 728 (25.1)	19 573 (21.9)
Major depression	244 275 (6.2)	3668 (4.1)
Agent Orange exposure[f]	297 028 (7.6)	12 264 (13.7)

[a]Service-connected disability ratings were determined by using the Schedule for Rating Disabilities in the Veterans Administration (VA) Web Automated Reference Material System.[10] For veterans with >1 service-connected condition, the overall disability rating was determined by using combined ratings tables.[11] Combined disability ratings ranged from 0% to 100% and were reported in increments of 10. Disability ratings were categorized as low (10%-40%), medium (50%-90%), or high (100%).

[b]Data on mortality obtained from the VA vital status file, which contains survival information from VA sources and from the Social Security Administration Death Master File and Medicare Vital Status File.[14]

[c]Data on age were missing for some veterans, resulting in a population of 4 007 888 veterans for this category.

[d]Data on service branch were missing for 108 782 veterans, resulting in the following populations for each combined service-connected disability rating: 100% disability (n = 507 215), 50% to 90% disability (n = 1 575 428), 10% to 40% disability (n = 1 819 295), and any disability (n = 3 901 938).

[e]Most veterans had >1 service-connected health condition, so percentages in these categories total to >100%. Conditions are listed in order of severity, from conditions with lower ratings to chronic disease conditions to mental health brain injury conditions.

[f]A total of 425 969 veterans had served in the Vietnam theater of operations according to the VETSNET files, of which 309 292 had disability codes for particular conditions and were presumed to have service-connected conditions due to Agent Orange exposure.

Relatively little is known about the association between service-connected mental health conditions and veteran mortality. However, in US communities at large, mortality rates are high for veterans with disabilities caused by mental health and substance use disorders.[6] We did not evaluate substance use disorders, noting that disability compensation for these disorders is not available to US veterans. However, we did assess several other mental health disorders. In our study, more than 1 million veterans had service-connected PTSD, 82% of whom had a combined disability rating of

Table 3. Demographic characteristics, military service, health care use, service-connected health conditions, and combined disability ratings[a] of 3 899 056 veterans,[b] by 1-year mortality, from the Veterans Benefits Administration VETSNET file on October 1, 2016

Characteristic	Deaths,[c] No.	1-Year Mortality Rate, %	1-Year Mortality Odds Ratio (95% CI)
Total	89 470	2.2	
Age,[d] y			
≤50	2825	0.2	1.00 (Reference)
51-64	8985	0.9	3.61 (3.45-3.77)
≥65	77 620	4.6	15.7 (15.1-16.4)
Sex			
Female	1763	0.5	0.54 (0.51-0.56)
Male	87 687	2.4	1.00 (Reference)
Service branch[e]			
US Air Force	13 404	2.0	0.89 (0.87-0.91)
US Army	47 232	2.4	1.00 (Reference)
US Coast Guard	669	1.8	0.93 (0.86-1.01)
US Marines	8947	1.7	0.88 (0.86-0.90)
US Navy	15 520	2.3	1.02 (1.00-1.04)
Other	514	10.2	2.54 (2.31-2.79)
Pay grade			
Enlisted	54 617	1.8	1.17 (1.14-1.21)
Warrant officer	600	1.7	0.90 (0.83-0.98)
Officer	4302	1.7	1.00 (Reference)
Missing data	29 951	4.5	1.89 (1.83-1.95)
Health care use			
Outpatient visit in previous year	56 624	2.7	1.06 (1.04-1.08)
No outpatient visits in previous year	32 846	1.7	1.00 (Reference)
Combined service-connected disability rating[a]			
100%	23 117	4.5	2.45 (2.40-2.50)
50%-90%	29 644	1.9	1.32 (1.30-1.34)
10%-40%	36 709	1.9	1.00 (Reference)
Service-connected health condition[f]			
Hearing loss	35 244	2.6	0.98 (0.97-1.00)
Asthma	1638	1.2	0.93 (0.88-0.98)
Sleep apnea	2121	0.6	0.57 (0.55-0.60)
Ischemic heart disease	13 734	4.4	1.14 (1.12-1.16)
Genitourinary cancer	4777	3.6	0.76 (0.74-0.78)
Diabetes mellitus	18 057	3.7	0.89 (0.87-0.91)
Chronic kidney disease	526	6.5	2.02 (1.84-2.21)
Chronic obstructive pulmonary disease	2536	5.2	1.77 (1.69-1.84)
Traumatic brain disease	1682	1.2	1.09 (1.03-1.14)
Migraine	3186	0.7	0.78 (0.75-0.81)
Anxiety	4167	2.2	1.16 (1.12-1.20)
Posttraumatic stress disorder	19 573	2.0	0.67 (0.65-0.68)
Major depression	3668	1.5	0.94 (0.95-1.01)
Agent Orange exposure[g]	12 264	4.0	0.89 (0.87-0.91)

[a]Service-connected disability ratings were determined by using the Schedule for Rating Disabilities in the Veterans Administration (VA) Web Automated Reference Material System.[10] For veterans with >1 service-connected condition, the overall disability rating was determined by using combined ratings tables.[11] Combined disability ratings ranged from 0% to 100% and were reported in increments of 10. Disability ratings were categorized as low (10%-40%), medium (50%-90%), or high (100%).

[b]A total of 3 899 056 of the 4 010 720 veterans in the study were included in the logistic regression analysis. Of the 111 664 excluded, 111 132 were missing data for 1 characteristic and 532 were missing data for >1 characteristic. Data were missing for the following characteristics: age (n = 2832), sex (n = 582), and military service branch (n = 108 782).

[c]Mortality data obtained from the VA vital status file, which contains survival information from VA sources as well as from the Social Security Death Master File and Medicare Vital Status File.[14]

[d]Data on age were missing for some veterans, resulting in a smaller total population of 89 430 veterans for this category.

[e]Data on service branch were missing for 108 782 veterans, resulting in smaller populations for each combined service-connected disability rating: 100% disability (n = 507 215), 50% to 90% disability (n = 1 575 428), 10% to 40% disability (n = 1 819 295), and any disability (n = 3 901 938).

[f]Each service-connected health condition was treated as a binary variable in regression analysis, with the "no" category as the referent. Most veterans had >1 service-connected health condition. The number of service-connected health conditions was not included as a characteristic variable in regression analysis because it was strongly associated with the combined disability rating. Tinnitus also was not included because of its high correlation with the auditory condition. Conditions are listed in order of severity, from conditions with lower ratings to chronic disease conditions to mental health brain injury conditions.

[g]A total of 425 969 veterans had served in the Vietnam theater of operations according to the VETSNET files, of which 309 292 had disability codes for particular conditions and were presumed to have service-connected conditions due to Agent Orange exposure.

50% to 100%. These findings are similar to the findings in a 2010-2012 study in which 75% of veterans with a medical diagnosis of PTSD had a ≥50% disability rating. The 1-year mortality rate for veterans with service-connected PTSD in our study was 2.0%, which was similar to the 1.9% 1-year mortality rate in the same study for veterans with a PTSD diagnosis.[8] Although we found that veterans with PTSD, compared with veterans without PTSD, had lower odds of short-term mortality, other studies have reported that PTSD is associated with poorer long-term survival.[5]

We identified nearly 250 000 veterans with service-connected major depression, 47% of whom had a combined disability rating of 70% or higher. This proportion was substantially larger than the 18% with this same disability rating reported by Zivin et al[9] and the 44% who had a combined disability rating of 50% or higher in the study by Trivedi et al.[8] In addition, we observed a 1-year mortality rate of 1.5% for veterans with service-connected depression. In contrast, Zivin et al[9] reported a 1-year mortality rate of 3.7% and Trivedi et al[8] noted a 1-year mortality rate of 2.9%, both of which were based on a general population of veterans with a diagnosis of depression. One reason for the differences in results may be that the mean age of our cohort was 52 (vs 59 and 57 in the studies by Zivin et al and Trivedi et al, respectively). Another reason may be that both Zivin et al and Trivedi et al reported on a cohort consisting of all veterans with depression, rather than limiting the group as we did to veterans with service-connected depression. One additional reason for the differences may be that both Zivin et al and Trivedi et al used *International Classification of Diseases, Ninth Revision* codes to define depression, whereas we used VBA disability codes to define the condition.

Our findings suggest that veterans with 100% disability ratings are more likely to die within a year than veterans with lower disability ratings. One implication of this finding is that veterans likely to have 100% disability and awaiting determination of their disability claims may be more likely to die before those claims are determined.[17] The death of the claimant does not necessarily mean that the disability determination process stops; it is possible for an eligible substitute claimant to continue that process. Nevertheless, it is promising that during the past several years, the VBA instituted new policies that have sped up the review process and reduced the backlog of these claims. Although the time it takes for a claim to be processed depends on several factors, including the number of conditions, complexity of those conditions, and amount of evidence needed to establish the claim, the most recent reports indicate that 78% of disability claims were determined within 125 days of submission.[18]

Limitations

This study had several limitations. First, the VETSNET file did not contain sufficient information to reliably assess the effect of combat exposure on mortality. Also, the file did not provide the dates when veterans became eligible for disability compensation. As such, we were unable to determine how long they had been receiving compensation. However, age may have been a reasonable proxy for how long compensation had been received. Because the initial eligibility date was not available, we used the VETSNET date of the most recent disability compensation as the start date; as such, the follow-up interval used in the study was short. Having an accurate eligibility date would have extended the time of follow-up, making it possible to more completely assess the association between service-connected health conditions and long-term survival. Second, before starting the study, we excluded a small number (0.5%) of veterans who had either 0% disability or negative or missing survival times. We also excluded nearly 3% of veterans from multivariate analysis because of missing data. However, these exclusions most likely had little or no effect on the study results, because they comprised such a small proportion of the group. Finally, we cannot rule out the possible occurrence of age-related confounding of mortality prediction results because of medical comorbidities or severity of illnesses unrelated to military service.

Conclusion

Our findings point to the importance of the combined disability rating as an important determinant of short-term survival among veterans with service-connected health conditions. Veterans with a 100% disability rating comprise a highly select group with increased risk of death due at least in part to their military service. Future studies assessing the relationships among combat exposure, age, duration of disability, disability ratings, and survival would be valuable.

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