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Protective And Risk Factors For 5-Year Survival in the Oldest Old Veterans: Data From the Veterans Health Administration

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Abstract

Objectives—To characterize physical and mental diseases and utilization of healthcare services and identify factors associated with mortality among oldest-old patients using the Veterans Health Administration (VHA).

Design—Retrospective study with 5-year survival follow-up.

Setting—VHA system-wide.

Participants—A total of 721,588 veterans using the VHA aged 80 years or older as of October 2008: 80–89 years old (n = 665,249), 90–99 years old (n = 56,118), and 100–115 years old (n = 221).

Measurements—Patient demographics, physical and mental diseases, healthcare services, and 5-year survival were included.

Results—Accelerated failure time models identified protective and risk factors associated with mortality by age group. During a 5-year follow-up period, 44% of patients died with survival rates of 59% for 80's, 32% for 90's and 15% for 100's. In the multivariable model, protective effects for

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Author Contributions:

- **Cho, Copeland:** conceptual development, acquisition of subjects and/or data, analysis and interpretation of data, and preparation of manuscript, and critical review of manuscript
- **Stock, MacCarthy:** acquisition of subjects and/or data, analysis of data
- **Zeber, Restrepo, Ory, Stevens:** study design, manuscript preparation, and critical review of manuscript
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veterans 80–99 were being female, minority race/ethnicity, married, having certain physical and mental diagnoses (hypertension, cataract, dyslipidemia, posttraumatic stress disorder, bipolar disorder), urgent care visits, invasive surgery, and few (1–3) prescriptions. Risk factors were lower VHA priority status, physical and mental conditions (diabetes, anemia, congestive heart failure, dementia, anxiety, depression, smoking, substance abuse disorder), hospital admission, and nursing home care. For those in their 100s, married status, smoking, hospital admission, nursing home care, invasive surgery, and prescription use were significant risk factors; only ED use was protective.

Conclusion—Although the data are limited only to VHA care (thus missing Medicare services), this study shows many veterans served by VHA live to advanced old age despite multiple chronic conditions. Further study is needed to determine whether a comprehensive, coordinated care system like VHA is associated with greater longevity for very old persons.

Keywords

Health services; Oldest-old; Survival; Veterans

INTRODUCTION

According to the 2010 census, over 22.6 million veterans live in the U.S. of whom almost two million are over the age of 80 (1). With increased life expectancy and demographic shifts in our population, the proportion of oldest-old adults, aged over 80 years, continues to increase (2, 3). The publicly funded Veterans Health Administration (VHA) must care efficiently and effectively for its increasing population of veterans, who are older, sicker, and socioeconomically disadvantaged relative to civilians (4). The number of oldest-old veterans who received VHA benefits or services nearly doubled from approximately 880,000 in 2002 to 1.6 million in 2013 (5) with significant ramifications for demand for healthcare, especially in the area of long-term or domiciliary care (6).

A large body of literature has investigated the health consequences of military service, which represents a unique experience that often impacts future health status and medical needs. Many veterans encountered life-threatening environments during their military service (6), leading to higher incidence of physical and mental diseases and contributing to higher mortality compared to non-veterans (7, 8). Dobkin and Shabani reported that functioning and health status among Vietnam veterans deteriorated more rapidly than non-veterans (9). The association between mortality and chronic disease in veterans has been well-documented across numerous conditions such as chronic obstructive pulmonary disease, cancer, mental disorders, and type-2 diabetes (10–13). Moreover, many studies have shown that mental illness such as post-traumatic stress disorder (PTSD) is significantly associated with a high rate of mortality among old veterans (14, 15). These studies, nevertheless, did not differentiate between older adults aged 80 years and over and treated them as a homogeneous group with those 65 and over (i.e., 65+), although great differences in health conditions and healthcare services utilization exist between younger (64–80 years) and older (80 years and older) groups of old people (16,17).

Given the large number of veterans over age 80 and the increasing emphasis on managing the aging process, it is important to identify associations between healthcare utilization and survival for the VHA's oldest patients. Further, understanding how complex health conditions impact survival adds to our knowledge of key pathways connecting military service to health status and longevity. The purpose of this study was to: 1) examine the utilization of VHA health services and comorbidity among patients aged over 80 years; and 2) explore the demographic, clinical and health services correlates of mortality among these veterans.

METHODS

Data Source and Sample

The retrospective study relied on administrative extracts from the VHA's electronic medical records system collected for the Surgical Treatment Outcomes for Patients with Psychiatric Disorders study (18). Among the 5.5 million patients treated in fiscal year 2009, 721,588 veterans aged over 80 years as of October 1, 2008 with diagnosis-generating care encounters were identified. Data were derived from the VHA's all-electronic medical record systems, major portions of which are copied nightly into the Corporate Data Warehouse (CDW) at the Austin Information Technology Center. Data in the CDW include all encounters (inpatient; outpatient including emergency department visits), prescription fills, lab tests and their results, other procedures, diagnoses, and demographic and enrollment data. The study was approved by the institutional review boards at South Texas and Central Texas Veterans Health Care Systems.

Measures

October 2008 to September 2009 served as the baseline fiscal year (FY2009) from which demographics, diagnoses, and healthcare utilization measures were obtained. Patient demographics included age, gender, race, Hispanic ethnicity, and marital status. Patients were categorized as aged 80–89 years, 90–99 years, or 100 and older as of October 1, 2008. Race was recoded as white, African American, Asian, and missing. VHA priority status captures why the veteran is eligible for VHA care; it is related to severity of illness and socioeconomic status (19, 20). Priority 1 identifies veterans who have been 50–100% disabled by a condition related to their military service (service-connected disability); these veterans incur no copays for care or pharmacy benefits. Priority 2 and 3 denote veterans with 10% to 40% service-connected disability; Priority 4 veterans are catastrophically disabled or homebound; Priority 5 are eligible based on low income; Priority 6 comprise various groups of military experiences such as Purple Heart award; Priority 2–6 veterans incur copays for pharmacy benefits. Priority 7 and 8 identify veterans who do not meet the above criteria and have agreed to copays for care and prescription medications. To simplify interpretation, we combined patients into Priority 1 vs Priority 2–6 vs Priority 7–8.

Medical comorbidity was indexed by the Charlson-Deyo score which includes weighted indicators of 19 comorbid conditions associated with one-year post-discharge mortality (i.e., myocardial infarct, chronic heart failure, peripheral vascular disease, stroke, dementia, chronic pulmonary disease, rheumatologic disease, peptic ulcer disease, liver disease, liver

failure, diabetes, diabetes with complication, hemiplegia or paraplegia, chronic kidney disease, solid tumor, leukemia/myeloma, metastatic solid tumors, HIV, and AIDS) (21). Additional chronic conditions were defined by ICD9 codes (Appendix A) (22–24).

Healthcare service measures included any occurrence of emergency department (ED) visits, urgent care visits, non-urgent outpatient services, hospital admission, intensive care unit admission, use of nursing home care, and receipt of major surgery. Number of medication classes, excluding “as needed” prescriptions and prescriptions for less than 30 days, was counted as a general measure of chronic comorbidity burden, classified as none, 1–3, or 4 or more (25). The number of antibiotic prescriptions and cancer-related medications were tallied to allow for severity adjustment of these conditions.

Follow-up mortality data through FY2013 was obtained from the mini-vitals file. Mini-vitals file provides best date of death based on four sources of information: inpatient VA records for stays terminating in death; the Beneficiary Identification Records Locator Subsystem (BIRLS) file of veterans for whom a death benefit claim has been filed; the U.S. government's Social Security Administration records; and Centers for Medicare and Medicaid Services records for health care coverage of elderly, disabled, or impoverished persons. The algorithm showed approximately 98% sensitivity relative to the National Death Index, the gold standard for death data in the United States (26). Survival in days from October 1, 2008 was measured to date of death or censored at five years (September 30, 2013). A dichotomous variable was created for Cox proportional hazards models denoting death during the follow-up period (1 = died; 0 = survived), with the survived value signaling censored follow-up.

Analysis

Descriptive analyses included frequencies (percentages) and means (standard deviations, ranges) of demographic, clinical, and healthcare service measures, overall and by age group. Kaplan-Meier product-limit survival curves graphically summarized 5-year survival. While typically a Cox proportional hazards model would assess correlates of survival, the proportional hazards assumption was not met in this study. Therefore, accelerated failure time (AFT) models assuming a gamma distribution were used to examine demographic, clinical and healthcare services factors associated with survival for each age group separately, reporting the adjusted estimated ratios of the expected survival time and their 95% confidence intervals (CI). These models included demographic characteristics, physical and mental illness measures, healthcare services indicators, and medication measures. Sensitivity of effects to covariates was assessed; effects were robust in bivariate and reduced models. A reduced model was used with the 100’s group to conserve power. A criterion alpha level of less than .05 was used throughout. All analyses were conducted in SAS 9.2 (SAS Institute, Inc., Cary, NC) using PROC LIFEREG for AFT models and PROC LIFETEST to plot the Kaplan-Meier estimates.

RESULTS

Sample Characteristics

The study population consisted of 721,588 VHA patients; 665,249 in their 80's, 56,118 in their 90's, and 221 aged 100–115 (Table 1). The average age was 84 (*sd* = 3.3) years. Average days to death from the first day of FY2009 was 1,446 (*sd* = 542) days, approximately four years, with those over age 100 surviving an average of 848 (*sd* = 602) days. The majority were male (98%), white (90%) and non-Hispanic (97%). Two thirds of patients (67%) were married. With respect to VHA priority status, more than a third (38%) were priority 7 or 8 while 12% were priority 1; 6% qualified for VHA care because they were catastrophically disabled and 27% were impoverished. Women comprised an increasing proportion of each successive age group, such that 8% of those surpassing 100 years were women.

Clinical Factors and Healthcare Service Utilization

Charlson Comorbidity scores averaged 1.5 (*sd* = 1.7) indicating chronic disease was quite prevalent (72% had hypertension, 57% lipid disorders, 26% diabetes; see Table 2). Hypertension was decreasingly common with advancing age: 72% of octogenarians, 68% of nonagenarians, and 50% of centenarians. Dyslipidemia followed a similar pattern: 59% for 80's, 43% for 90's, and 16% for 100's. Dementia (2–5%), anemia (15–21%), and congestive heart failure (CHF; 9–14%) affected higher proportions of centenarians.

Diagnosis of mental illness was uncommon. Whereas many younger veterans have mental illnesses such as post-traumatic stress disorder (27), 5% of our patients had depression and only 2% were diagnosed with anxiety. Age group differences in healthcare utilization rates were observed. The centenarian group showed higher rates of ED visits (21% vs. 14% for 90s vs 12% for 80s) and hospital admissions (20% vs. 12% for 90s vs. 8% for 80s). The eldest veterans used fewer medications on average: proportion taking no medications was 26% for 100's vs. 14% for 90s vs. 11% for 80s.

Protective and Risk Factors for 5-year Survival

Overall, 56% of patients survived five years. Kaplan-Meier survival curves for the three age groups are displayed in Figure 1. As expected, octogenarians had a significantly higher survival rate (58%), followed by those in their 90s (32%) and centenarians (15%).

Adjusted models of survival over five years showed slightly different risk and protective factors among the three age groups (Table 3). For the 80's group, all risk and protective factors were significant. Being female (survival ratio 1.22), minority race/ethnicity (1.06 to 1.14), and married (1.07) were associated with longer survival. Many types of healthcare utilization including ED visits, urgent care visits, having invasive surgery, and taking 1–3 medications (vs. 0) were protective while hospital admission (0.68) and use of nursing home care (0.64) were significant risk factors for survival. Lower VHA priority status (0.89 to 0.9), diagnosis with some chronic conditions (e.g., diabetes, dementia, depression), and taking 4 or more medications (4+) were also a risk factor for veterans aged 80–89 years

(0.50 to 0.97), although cataract, dyslipidemia, and hypertension were protective (1.15 to 1.3).

For the nonagenarians, the patterns of risk and protective factors were similar to the octogenarians' except that two factors were uncorrelated (schizophrenia, ED use) and prescription of 4 or more medication was protective. Being female (1.25), minority race/ethnicity (1.08 to 1.18), and married status (1.03) had favorable survival ratios. Urgent care visits and taking medications (vs. 0) were also protective factors (1.04 to 1.13). Interestingly, selected physical and mental illnesses were associated with a reduced likelihood of death for the 90's group as well: hypertension (1.15), cataracts (1.25), dyslipidemia (1.23), post-traumatic stress disorder (1.33), and bipolar disorder (1.34). Diagnosis with other chronic conditions was a risk factor (diabetes, anemia, CHF, dementia, etc., 0.70 to 0.90). Priority status 1, Priority status 2–6, hospital admission, and use of nursing home care were significant risk factors for survival (0.67 to 0.97). In spite of showing protective effects among the 80-year-old group, being diagnosed with schizophrenia, having ED visits, or having invasive surgery were not significantly associated with mortality in the 90-year-olds.

After excluding rare and inestimable factors (schizophrenia, bipolar disorder, post-traumatic stress disorder), the model within centenarian veterans found that ED use (1.5) was protective while being married, nicotine dependence, taking medications, hospitalization, invasive surgery, and nursing home care (0.07 to 0.63) increased risk of death. In summary, there were no common protective factor against mortality across age groups, medication burden and marital status had discordant effects, and shared risk factors were nicotine dependence, hospitalization and nursing home use.

DISCUSSION

Findings from this study suggest that healthcare utilization patterns correlate with survival among oldest-old veterans. Although previous studies have examined the association between chronic diseases and mortality (10–15, 28), this study is among the first to examine correlates of the incident rate of death among the oldest-old veterans, aged 80–115 years. As such, the findings of this study are noteworthy for several reasons. First, a surprising number of oldest-old veterans, three-quarters of a million persons in a single year, utilize the VHA. Existing studies about military service and health outcomes in late life have addressed veterans' experience of greater age-related changes in health and more rapid health declines over time compared to non-veterans (29). Findings from Wilmoth and her colleagues showed steeper health declines and higher mortality as veterans age (29). The patients in this study, however, appeared to have overcome any presumed health disadvantage of being veterans and survived past the age of 80. Moreover, a few chronic physical illnesses (hypertension, cataracts, dyslipidemia) and mental illnesses (bipolar disorder and post-traumatic stress disorder) did not correlate with mortality among veterans in the 80's and 90's groups. Possibly it is because ongoing care, as evidenced by these diagnoses, was effective, that engagement was the essential factor (30), or because the mental illnesses were late-onset or only recently disclosed (31). It would be informative to determine in future work when these veterans first developed their diagnosed conditions and whether their care differed from that of decedents.

Second, several variables were found to be risk factors (hospital admission, nursing home care, smoking) for death across three age groups. Not surprisingly, with regards for veterans who survived to very old age, the greatest risk to death was related to hospitalization, staying in nursing home, and smoking, which is in line with previous research (32–34). Using nursing home after hospitalization has been one of the most prevalent risk factors for mortality regardless of the aging process (35). Interestingly, visiting the ED was protective against death in the oldest old group. The Behavioral Model of Health Service Use developed by Andersen and colleagues (36, 37) may be considered relevant. This model assumes that mortality is a function of healthcare utilization behavior influenced by three factors: predisposing factors, enabling factors, and need (35, 36, 38, 39). Therefore, enrollment in the VHA system (i.e., available resources as a predisposing factor) and medical need (i.e., comorbidity as a need factor) might lead patients to visit the ED, which, in turn, may reduce the incident rate of death among oldest-old veterans (40). Future research should explore whether frequency of outpatient care is important. Surprisingly, diagnoses of hypertension, dyslipidemia, schizophrenia and bipolar disorder were negatively related to mortality. Treatment in controlling blood pressure and cholesterol has been effective in preventing stroke, other cardiovascular diseases, or total mortality among older adults (41). Studies, however, have shown conflicting results in the benefit of treatment among patients age 80 and older (42–44). The Hypertension in the Very Elderly Trial (HYVET) can be supportive for this result (45). Studies have shown that serious mental illness can reduce the lifespan among the general population (46) and among veterans (40). Why, then, do those illnesses appear to be protective factors for oldest-old veterans? One explanation is that the mental illnesses were late-onset or recently diagnosed (31). Another reason might be early treatment in the VHA system. That is, their physicians might be able to detect early signs of mental illness, provide effective treatment, and monitor follow-up, suggesting that engagement is strongly associated to survival, even when serious conditions are present or diagnosed. Or, the treatment may have focused on psychotherapy, foregoing antipsychotic medications associated with metabolic disorder. This might reduce the risk effects of serious mental illness in this study.

It is important to acknowledge the study's limitations. First, severity of diagnosed conditions could not be captured. Patients in this study might have mild levels of mental health illness or dementia. Closer investigation of levels of mental illness or dementia would be a good topic for future research. Second, the sample of this study was derived from veterans who enrolled in VHA, a system that has traditionally catered to the most disadvantaged veterans of military service (47). Medicare data were not included although many VHA patients also benefit from Medicare. Results may not generalize to non-veterans, women, or persons who are healthier or wealthier than VHA patients. Furthermore, patients are generally eligible for VHA care because they are impoverished, disabled, multi-morbid or have specific military service experiences. Therefore, findings here may not generalize to patients covered by private health insurance or Medicare. Third, the survivorship effect was not considered. A few studies suggest that survival bias should be considered when focusing on very old age (48,49). For example, survivors into very late life could be assumed to have better status in domains such as physical health, behavioral health, and psychological aspects compared to their counterparts who were close to death or died prematurely (49). Patients included in this

study could have been functioning better on physical and mental health indicators than those who had died earlier. In other words, the sickest had already died and the survivors were able to cope either without dangerous medications (e.g., psychotherapy alone) or had milder cases. A longitudinal design can differentiate selective survivorship effects related to longevity and enhance our understanding of trajectories in the relationship between healthcare utilization and mortality.

Despite these limitations, this study has multiple strengths: especially focusing on a very large cohort of male participants aged 80 years and older. Furthermore, the VHA serves a large population of veterans representing a more disadvantaged population who would otherwise face difficulty accessing healthcare. One possible avenue towards improving the quality of life and longevity is a deeper understanding of healthcare utilization patterns among oldest-old persons. Currently the VHA is the only U.S. system designed to provide longitudinal coordinated care through the end of life. This may be an optimal model for patient longevity.

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Appendix A

ICD 9 codes for additional chronic conditions

Chronic conditions	ICD 9 codes
Dyslipidemia	272
Hypertension	401–405
Substance use disorders (SUD)	291–292, 303–305 excluding 305.1
Schizophrenia	295
Bipolar disorder	296.0–296.1, 296.4–296.8
Post-traumatic stress disorder	309.81
Major depressive disorder	296.2–296.3, 311
Any depressive disorder	296.82, 298.0, 300.4, 301.12, 307.44, 309.0–309.1, 309.28, 311
Nicotine dependence	305.1 or V15.82

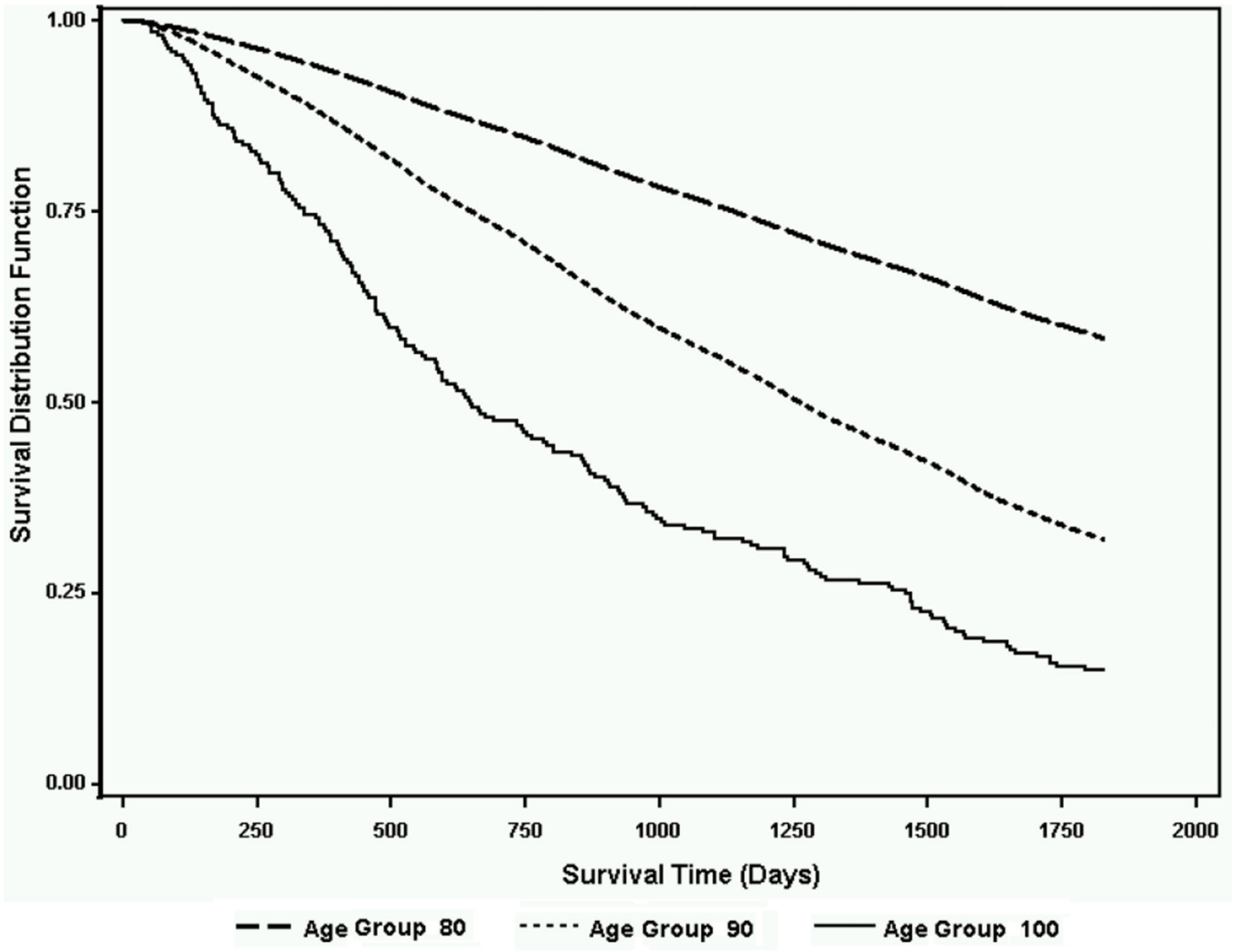

Figure 1.
Kaplan-Meier Survival Curves by Age Group

Table 1

Characteristics of Veterans Health Administration Patients aged 80–115 in FY2009

	All Vets (*n*=721,588)		80's (*n*=665,249)		90's (*n*=56,118)		100's (*n*=221)	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Age in years (range: 80–115; M, sd) ***	84.3	3.3	83.7	2.6	91.5	1.8	101.3	2.3
Survival in days (M, sd) ***	1,446	541.7	1,468	531.1	1,188	595.2	847.7	602.0
Charlson Comorbidity Score (range: 0–34; M, sd) ***	1.5	1.7	1.5	1.7	1.4	1.7	1.2	1.5
Female ***	16,581	2.3	14,784	2.2	1,779	3.2	18	8.1
Race (missing/unknown=140,610) ***								
White	525,070	90.4	484,494	90.5	40,443	89.0	133	75.1
African American	44,074	7.6	40,166	7.5	3,881	8.5	27	15.3
Other	11,834	2.0	10,708	2.0	1,109	2.4	17	9.6
Hispanic ***	19,981	2.8	18,294	2.8	1,676	3.0	11	5.0
Married ***	482,933	66.9	452,406	68.0	30,466	54.3	61	27.6
Census Region ***								
Northeast	150,671	20.9	138,617	20.8	12,009	21.4	45	20.4
Midwest	176,044	24.4	163,405	24.6	12,596	22.5	43	19.5
South	266,909	37.0	246,553	37.1	20,281	36.1	75	33.9
West	118,387	16.4	108,079	16.3	10,259	18.3	49	22.2
Puerto Rico and Virgin Islands	9,577	1.3	8,595	1.3	973	1.7	9	4.1
Veterans Health Administration Priority Status ***								
Priority 1	89,038	12.3	80,353	12.1	8,651	15.4	34	15.4
Priority 2–6	356,940	49.5	326,758	49.1	30,047	53.5	135	61.1
Priority 7–8	275,610	38.2	258,138	38.8	17,420	31.0	52	23.5

*** $p<.001$

Table 2

Clinical and Healthcare Service Factors of Veterans Health Administration Patients Aged 80–115 in FY2009

	All Vets (*n*=721,588)		80's (*n*=665,249)		90's (*n*=56,118)		100's (*n*=221)	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Physical Illness								
Diabetes***	186,620	25.9	176,162	26.5	10,439	18.6	19	8.6
Hypertension***	515,954	71.5	477,536	71.8	38,308	68.3	110	49.8
Dementia***	16,469	2.3	14,632	2.2	1,827	3.3	10	4.5
Dyslipidemia***	414,310	57.4	390,199	58.7	24,076	42.9	35	15.8
Anemia***	107,442	14.9	96,696	14.5	10,699	19.1	47	21.3
CHF***	66,011	9.2	59,053	8.9	6,927	12.3	31	14.0
Cataract***	96,931	13.4	91,062	13.7	5,845	10.4	24	10.9
Mental Illness								
Anxiety***	17,157	2.4	15,383	2.3	1,770	3.2	4	1.8
Major Depressive Disorder***	4,393	0.6	4,183	0.6	210	0.4	-	-
Any depression***	36,253	5.0	32,523	4.9	3,717	6.6	13	5.9
Nicotine Dependence***	16,030	2.2	15,071	2.3	956	1.7	3	1.4
Schizophrenia	2,278	0.3	2,118	0.3	159	0.3	1	0.5
Bipolar Disorder***	1,616	0.2	1,552	0.2	64	0.1	-	-
Post-traumatic Stress Disorder***	12,578	1.7	11,799	1.8	779	1.4	-	-
Substance Abuse Disorder***	14,911	2.1	14,122	2.1	787	1.4	2	0.9
Healthcare Services (Any)								
ED visits***	173,627	24.1	159,326	24.0	14,231	25.4	70	31.7
Urgent Care Visits***	46,614	6.5	43,236	6.5	3,369	6.0	9	4.1
Non-Urgent Outpatient Services***	720,677	99.9	664,493	99.9	55,967	99.7	217	98.2
Hospital Admission***	150,018	20.8	136,194	20.5	13,745	24.5	79	35.8
Intensive Care Unit Admission	35,394	4.9	32,732	4.9	2,649	4.7	13	5.9

	All Vets (*n*=721,588)		80's (*n*=665,249)		90's (*n*=56,118)		100's (*n*=221)	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Nursing Home Care***	41,343	5.7	36,482	5.5	4,829	8.6	32	14.5
Invasive Surgery***	27,209	3.8	25,646	3.9	1,557	2.8	6	2.7
Healthcare Services (FY2009)								
ED visits***	85,830	11.9	77,790	11.7	7,993	14.2	47	21.3
Urgent Care Visits***	20,609	2.9	18,824	2.8	1,781	3.2	4	1.8
Non-Urgent Outpatient Services***	720,522	99.9	664,348	99.9	55,957	99.7	217	98.2
Hospital Admission***	61,177	8.5	54,523	8.2	6,611	11.8	43	19.5
Intensive Care Unit Admission***	11,481	1.6	10,430	1.6	1,046	1.9	5	2.3
Nursing Home Care	11,557	1.6	9,892	1.5	1,648	2.9	17	7.7
Invasive Surgery***	8,626	1.2	8,062	1.2	563	1.0	1	0.5
Medication Class Count***								
0 prescription	82,331	11.4	74,453	11.2	7,821	13.9	57	25.8
1–3 prescriptions	154,494	21.4	142,212	21.4	12,234	21.8	48	21.7
4+ prescriptions	484,763	67.2	448,584	67.4	36,063	64.3	116	52.5
Died from FY2009–FY2013***	314,190	43.5	275,926	41.5	38,076	67.9	188	85.1

*** p<.001

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Table 3

Characteristics Associated with 5- Year Survival by Age Group among Veterans Health Administration Patients Aged 80–115

	80's (*n*=665,249)		90's (*n*=56,118)		100's (*n*=221)	
	Survival Ratio (95% CI)	***p***	**Survival Ratio (95% CI)**	***p***	**Survival Ratio (95% CI)**	***p***
Female	1.22 (1.20,1.24)	<0.01	1.25 (1.19,1.30)	<0.01	1.53 (0.99,2.37)	0.06
White race (reference)						
African American	1.07 (1.06,1.08)	<0.01	1.11 (1.07,1.14)	<0.01	1.30 (0.89,1.90)	0.18
Asian	1.06 (1.03,1.08)	<0.01	1.18 (1.12,1.25)	<0.01	0.98 (0.63,1.52)	0.93
Hispanic	1.14 (1.12,1.16)	<0.01	1.08 (1.03,1.13)	<0.01	1.09 (0.63,1.88)	0.76
Missing Race	1.01 (1.00,1.01)	0.17	0.99 (0.97,1.01)	0.33	1.49 (1.07,2.08)	0.02
Married	1.07 (1.07,1.08)	<0.01	1.03 (1.01,1.05)	<0.01	0.63 (0.49,0.81)	<0.01
Veterans Health Administration Priority 7–8 (reference)						
Priority 1	0.9 (0.89,0.91)	<0.01	0.97 (0.95,1.00)	0.04	0.73 (0.49,1.07)	0.11
Priority 2–6	0.89 (0.89,0.90)	<0.01	0.94 (0.92,0.96)	<0.01	0.83 (0.62,1.11)	0.21
Diabetes	0.88 (0.88,0.89)	<0.01	0.90 (0.88,0.92)	<0.01	1.31 (0.85,2.02)	0.22
Hypertension	1.15 (1.14,1.16)	<0.01	1.15 (1.13,1.17)	<0.01	1.18 (0.92,1.51)	0.19
Anemia	0.85 (0.84,0.85)	<0.01	0.90 (0.88,0.92)	<0.01	1.14 (0.84,1.55)	0.39
CHF	0.65 (0.64,0.66)	<0.01	0.70 (0.68,0.71)	<0.01	0.88 (0.61,1.26)	0.49
Cataract	1.28 (1.27,1.29)	<0.01	1.25 (1.22,1.28)	<0.01	1.09 (0.73,1.61)	0.68
Dementia	0.72 (0.71,0.73)	<0.01	0.82 (0.79,0.85)	<0.01	0.69 (0.38,1.25)	0.22
Dyslipidemia	1.3 (1.29,1.31)	<0.01	1.23 (1.21,1.25)	<0.01	1.39 (1.00,1.93)	0.05
Anxiety	0.68 (0.67,0.69)	<0.01	0.79 (0.76,0.82)	<0.01	1.36 (0.59,3.12)	0.47
Depression	0.50 (0.49,0.50)	<0.01	0.68 (0.66,0.7)	<0.01	0.81 (0.50,1.33)	0.41
Nicotine Dependence	0.6 (0.59,0.61)	<0.01	0.78 (0.73,0.84)	<0.01	0.14 (0.02,0.78)	0.03
Post-traumatic Stress Disorder	1.37 (1.34,1.4)	<0.01	1.33 (1.25,1.43)	<0.01	^	-------
Bipolar Disorder	1.12 (1.07,1.18)	<0.01	1.34 (1.07,1.68)	0.01	^	-------
Schizophrenia	1.08 (1.03,1.12)	<0.01	0.97 (0.85,1.11)	0.68	^	-------
Substance Abuse Disorder	0.77 (0.75,0.79)	<0.01	0.88 (0.82,0.96)	<0.01	7.22 (0.89,58.74)	0.06
ED visits	1.03 (1.02,1.04)	<0.01	1.02 (0.99,1.05)	0.22	1.5 (1.02,2.20)	0.04

	80's (n=665,249)		90's (n=56,118)		100's (n=221)	
	Survival Ratio (95% CI)	***p***	**Survival Ratio (95% CI)**	***p***	**Survival Ratio (95% CI)**	***p***
Urgent Care Visits	1.13 (1.11,1.15)	<0.01	1.13 (1.08,1.18)	<0.01	1.56 (0.61,4.01)	0.35
Hospital Admission	0.68 (0.68,0.69)	<0.01	0.67 (0.65,0.69)	<0.01	0.48 (0.29,0.77)	<0.01
Nursing Home Care	0.64 (0.63,0.65)	<0.01	0.67 (0.64,0.71)	<0.01	0.52 (0.30,0.90)	0.02
Invasive Surgery	1.14 (1.11,1.16)	<0.01	1.05 (0.98,1.13)	0.17	0.07 (0.01,0.35)	<0.01
Medication Class Count: 0 prescriptions (reference)						
Medication Class Count: 1–3 prescriptions	1.13 (1.12,1.14)	<0.01	1.11 (1.08,1.14)	<0.01	0.67 (0.47,0.96)	0.03
Medication Class Count: 4+ prescriptions	0.97 (0.96,0.98)	<0.01	1.04 (1.02,1.07)	<0.01	0.69 (0.51,0.95)	0.02

^Insufficient cases of the variables produced non-positive definite convergence in the 100's model and were excluded in the final model.