Soldiering On Through Aging? The Subjective and Objective Health of Older U.S. Veterans

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Abstract

Veterans of the Vietnam War, the last large-scale U.S. engagement prior to the All-Volunteer Force era, have now largely reached retirement age, with record high rates of service-connected disability compared with veterans of earlier wars. Understanding the determinants of healthy aging among this cohort is important for assessing current and future needs of veterans, especially now that policies and events have generated another large wartime cohort, and for gaining insights into health dynamics over the life cycle. In this paper, we compare objective and subjective metrics of health across male veterans and nonveterans in a population-based panel survey of Americans over age 50, the Health and Retirement Study, which recently began collecting biomarkers. We revisit earlier results that suggest subjective self-reports by veterans may be overstated, a "soldiering on" effect, relative to objective measures of health. Our findings speak to the lifelong influences of earlier-life conditions and of the lingering challenges posed by exposure to combat.

Introduction

Advances in medical treatments and technology during the history of warfare have greatly increased the chances of surviving its immediate physical traumas (Institute of Medicine, 2010; Goldberg, 2010; Edwards, 2014). But the effects of combat exposure on well-being tend to be negative and lifelong in nature (MacLean and Elder, Jr., 2007; MacLean, 2010; Edwards, 2012), much like the budgetary costs of caring for veterans of major U.S. wars (Edwards, 2014).

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The effects of military service per se on health and mortality are often less clear (London and Wilmoth, 2006; Dobkin and Shabani, 2009; Angrist, Chen and Frandsen, 2010), probably because it represents a confluence of positive and negative impacts. Combat and learned smoking behavior (Bedard and Deschênes, 2006) are examples of the latter, while the "healthy warrior" effect associated with preservice screening and selection and the regimented command structure could exert positive influences on health over the life cycle.

In this paper, we aim to disentangle these countervailing influences of military service on well-being in later life by examining subjective and objective measures of health among nonveterans, noncombat veterans, and combat veterans. We expect healthy warriors to be objectively healthier at least initially, prior to exposure to the traumas of service and specifically combat. But we also suspect that their self reports could be systematically more optimistic, if the military culture either selects or produces such personalities. Although mortality is arguably the most objective health outcome, there are other important dimensions of health, and many previous studies have been limited to comparing self reports of health status between veterans and non-veterans. Although self-reported health status is correlated with and predictive of objective outcomes like mortality, there are also known biases in self reports that reflect cultural differences in responding or in knowledge obtained from the health care system (Crimmins et al., 2007). In previous work, we uncovered some evidence of differential reporting between nonveterans and veterans in terms of their self-reported health status compared to self reports of physicians' diagnoses of major diseases (MacLean and Edwards, 2014). Whether veterans are differentially "soldiering on" through aging by understating any deterioration in their health is a question of great interest.

We exploit recent improvements in data collection in order to reexamine these issues. The U.S. Health and Retirement Study (HRS) is a biennial panel survey that includes almost 4,000 veterans and asks about many aspects of health. Starting with its 2006 wave, the HRS also collects a rich array of biomarkers and physical measures of health in addition to self reports, and beginning in its 2008 wave, the HRS asks all veterans to report their highest rank and whether they had experienced combat. Although we cannot formally validate these self-reports, they are consistent with evidence from other survey data.

In the remainder of this extended abstract, we describe the data and some preliminary findings. We plan to conclude our analysis by the end of the year.

The Health and Retirement Study

Veterans in the HRS

The U.S. Health and Retirement Study is a representative biennial panel of Americans aged 50 and over. In its 2006 wave, HRS surveyed about 18,500 individuals, roughly 3,900 of whom were veterans. Based on questions about years spent in active service, about a third had served during the Vietnam conflict, one fifth during the Korean war, and another fifth during World War II, each with some overlap.

Questions about combat exposure and military rank at separation were added to the core survey starting in 2008 and asked of all veterans. Almost 3,400 male veterans were present in both 2006 and 2008 and answered these new questions. Roughly 30 percent reported they had ever fired a weapon against the enemy or come under enemy fire, while 10 percent had been either officers or warrant officers at final separation.

Biomarkers in the HRS

Starting with its 2006 wave, a rotating half of all respondents were asked to submit physical measures like grip strength and biomarkers such as blood pressure and genetic information. Use of the biomarkers data is restricted by the HRS, and the 2006 and 2008 data are distributed separately after successful application. The 2006 dataset contains information for roughly 1,700 male veterans and 1,400 male nonveterans of normalized levels[1] of the following five biomarkers:

- Glycosylated hemoglobin or **A1c**, a summary measure of blood sugar over roughly the past 120 days that is often used as an indicator of diabetes
- **Total cholesterol**, which is associated with cardiovascular disease, heart attack, stroke, kidney or artery disease, and other conditions
- High-density lipoprotein or **HDL** cholesterol, also called "good" cholesterol, associated with fewer vascular conditions
- C-reactive protein or **CRP**, an indicator of systemic inflammation. Chronic elevation of CRP is associated with cardiovascular disease, hypertension, and diabetes, and it can also indicate allostatic load, the wear and tear of stress
- **Cystatin C**, a marker of kidney function and potentially of cardiovascular disease

In addition to these metrics of blood composition in the restricted file, the public data release includes several physical measures collected during the same face-to-face interview. Of particular interest are these:

- **Systolic blood pressure** (up to 3 readings)
- **Diastolic blood pressure** (up to 3 readings)
- **Pulse** (up to 3 readings)

[1] The normalization procedure produces measures that are comparable to NHANES levels, and HRS recommends their use. The HRS documentation describes the technique in greater detail. It also describes the individual biomarkers, and I have paraphrased their characteristics here.

- **Height** and **weight**, yielding **BMI**
- **Waist circumference**
- **Peak expiratory flow**, a measure of lung health
- **Grip strength**
- **Balance** and **walking** tests

A separate restricted file contains genetic information, which we do not analyze.

Sample characteristics

The HRS was not designed to compare veterans and nonveterans, and there are differences between the two groups in many characteristics. Chief among them is age. As shown in Figure 1, male veterans in the 2006 biomarker sample are older than male nonveterans and are more evenly distributed across age. The modes visible at ages 53 and 65 are the "Early Boomers" cohort added in 2004 and the younger nonveterans among the original HRS cohort from 1992. Figure 2 shows age-related differences in combat exposure in the sample, with clusters among cohorts who served in Vietnam and in World War II.

Table 1 summarizes demographic and socioeconomic characteristics among males 50 and over in the 2006 biomarker sample who also answered the 2008 question on combat exposure if eligible. In addition to being older on average, veterans in the sample are less likely to be Hispanic or African-American, more likely to be married, and have almost a year more education. Average levels of wealth and income are also different, and there are also differences among veterans according to combat exposure.

Table 2 depicts two statistics for each of the 9 biomarkers and physical measures across the three subgroups of men defined by veteran status and combat exposure. The first measure is the average level of the biomarker, and the second is the share of the subgroup with levels above or below the commonly used threshold indicating risks to health, and thus "at risk" as noted in the column header. Because biomarkers tend to vary strongly with age and other characteristics such as race and SES (Crimmins, Kim and Seeman, 2009), a simple comparison of average biomarker readings or prevalence of risky levels between veterans and nonveterans in HRS is unlikely to reveal the effects of veteran status, however.

Regression analysis

Table 3 reports regression coefficients and diagnostics for linear models of the 9 biomarker levels regressed on the two veteran status indicator variables and an array of socioeconomic and demographic controls. As is customary, CRP is logged because its distribution is highly skewed. The analysis reveals few significant coefficients on veteran status, although the controls are often predictive (not shown). Veteran status may be associated with 10 percent higher CRP levels, but only the coefficient on noncombat veterans is statistically significant, and only at the 10 percent level. Noncombat veterans may enjoy reduced levels of total cholesterol.

In unreported results, probability models of having risky levels of each of the 9 biomarkers similarly revealed few statistically significant patterns.

Discussion

TBD

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Table 1: Demographic and socioeconomic characteristics

	Nonveterans	Noncombat veterans	Combat veterans
Age in 2006	64.7	69.9	71.3
Share Hispanic	0.121	0.028	0.043
Share African-American	0.144	0.086	0.100
Share married in 2006	0.809	0.827	0.820
Years of education	12.4	13.3	13.2
Household wealth	576,161	679,375	468,051
Household income	87,962	69,560	61,045
N	1,437	1,123	399

Notes: Data are from the 2006 wave of the HRS. The universe is males present in 2006 and 2008 waves who provided at least 1 of 9 physical measures including 5 biomarkers, blood pressure, pulse, and height and weight, and who answered the question in 2008 on combat exposure.

Table 2: Average biomarker levels and shares with risky levels

	Nonveterans		Noncombat veterans		Combat veterans	
	Avg. level	Share at risk	Avg. level	Share at risk	Avg. level	Share at risk
A1c	5.84	0.156	5.82	0.145	5.88	0.159
Total cholesterol	198.10	0.153	192.38	0.115	187.78	0.118
HDL cholesterol	48.03	0.324	47.85	0.318	48.42	0.313
CRP	3.76	0.309	3.95	0.328	4.06	0.332
Cystatin C	1.06	0.083	1.10	0.095	1.19	0.157
Average systolic BP	133.65	0.280	133.46	0.266	133.68	0.261
Average diastolic BP	80.73	0.155	78.64	0.110	77.65	0.096
Average pulse	70.42	0.061	68.31	0.033	68.71	0.036
Objective BMI	29.06	0.379	29.14	0.383	28.44	0.337

Notes: See notes to Table 1. The shares of each group at risk are determined using the following thresholds, suggested by Crimmins, Kim and Seeman (2009) and the HRS documentation: A1c ≥ 6.4, Total cholesterol ≥ 240, HDL cholesterol < 40, CRP > 3.0, Cystatin C > 1.55, systolic BP ≥ 140, diastolic BP ≥ 90, pulse ≥ 90, BMI ≥ 30.

Table 3: OLS estimates of the marginal effect of veteran status on levels of biomarkers

	Noncombat veteran	Combat veteran	N	R^2
A1c	0.015	0.061	2,496	0.0340
	(0.047)	(0.064)		
Total cholesterol	−1.669	−5.406**	2,362	0.0439
	(1.886)	(2.606)		
HDL cholesterol	0.054	0.883	1,893	0.0155
	(0.729)	(0.993)		
log CRP	0.100*	0.100	2,386	0.0301
	(0.057)	(0.079)		
Cystatin C	−0.027	0.045*	2,350	0.0986
	(0.020)	(0.027)		
Average systolic BP	−0.819	−0.943	2,894	0.0205
	(0.834)	(1.166)		
Average diastolic BP	−0.547	−1.093	2,894	0.0632
	(0.489)	(0.684)		
Average pulse	−0.607	0.030	2,894	0.0472
	(0.508)	(0.710)		
Objective BMI	0.225	−0.410	2,779	0.0280
	(0.209)	(0.289)		

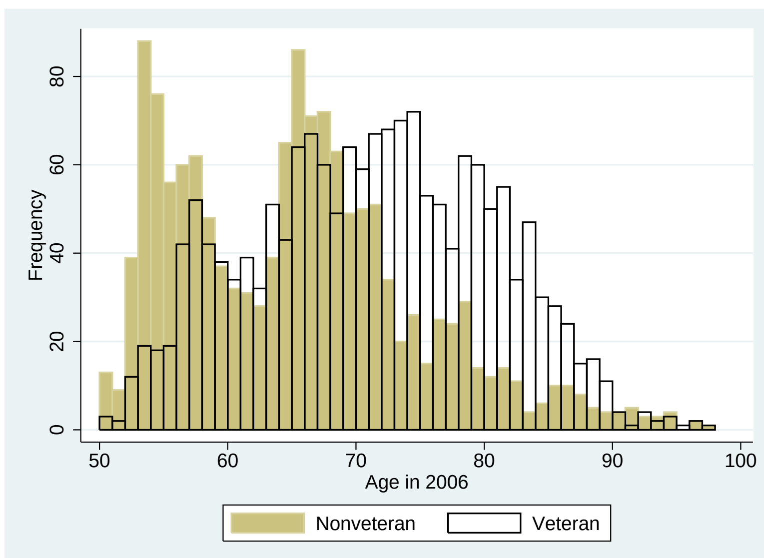
Notes: See notes to Table 1. Each row reports results from a separate ordinary least squares regression of the level of the biomarker on indicator variables for noncombat veterans and for combat veterans, shown in the first two columns; indicators for Hispanic identity, being African American, being married in 2006, and for education level (not shown), and on household wealth and household income (not shown). Asterisks denote statistical significance at the 10 percent (*), 5 percent (**) and 1 percent (***) levels.

Table 4: OLS estimates of the marginal effect of being African American on log CRP

	African American	N	R^2	Sample
Log CRP	0.171**	2,515	0.0283	All men
	(0.082)			
Log CRP	0.111	1,156	0.0367	Nonveterans
	(0.115)			
Log CRP	0.316**	908	0.0376	Noncombat veterans
	(0.146)			
Log CRP	0.085	322	0.0553	Combat veterans
	(0.225)			

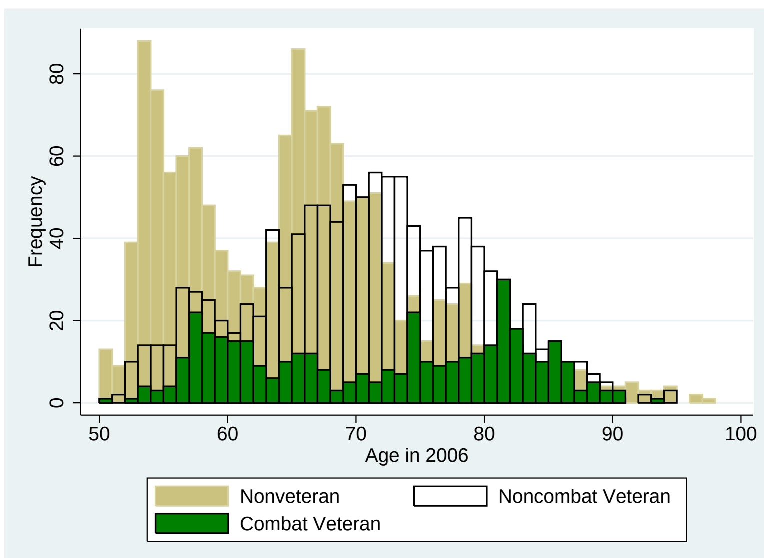
Notes: See notes to Table 3.

Figure 1: Age differences by veteran status among males in the 2006 biomarker sample



Notes: The sample consists of male veterans and nonveterans in the 2006 wave of HRS who provided at least 1 of 9 physical measures including 5 biomarkers, blood pressure, pulse, and height and weight.

Figure 2: Age differences by veteran status and combat exposure among males in the 2006 biomarker sample



Notes: The sample consists of male veterans and nonveterans in the 2006 wave of HRS who provided at least 1 of 9 physical measures including 5 biomarkers, blood pressure, pulse, and height and weight, and who answered the question in 2008 on combat exposure.