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Military service, combat exposure, and health in the later lives of US men

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Abstract

Researchers have produced mixed findings regarding the relationship between military service, war-zone deployment, combat exposure, post-traumatic stress disorder (PTSD), and physical health at older ages. This article uses data drawn from the Health and Retirement Study (HRS) to estimate growth curve models that predict how self-rated health and life-threatening illness vary across groups of men defined as combat and non-combat veterans, compared to non-veterans. According to the findings, combat veterans have worse health than men who did not experience combat during the draft era decades after their service, while non-combat veterans have health that is similar to if not better than non-veterans. Combat veterans were less healthy than these other men based both on a subjective measure of self-rated health and on an objective count of life-threatening illnesses several decades after service. Studies that simply compare veterans to non-veterans may thus continue to produce mixed findings, because particular types of veterans serve in ways that relate differently to health.

Keywords

Military service, combat exposure, health

Introduction

In the early twenty-first century, 13.7 million American men over the age of 55 (or more than a third) were veterans, many of whom had served in wars stretching from World War II to Vietnam, were sent to foreign lands, and exposed to combat (U.S. Census Bureau, 2014). These men followed different pathways into and had distinct experiences while in the armed forces, which could lead them to have better or worse health than men who did not serve. Some service-members, for example, serve during wartime and are sent overseas to fight in combat, leading to the greater likelihood that they are exposed to trauma. Yet even during wartime, some service members are not sent into battle (MacLean, 2011).

Researchers have produced mixed findings regarding the relationship between military service, war-zone deployment, combat exposure, post-traumatic stress disorder (PTSD), and physical health at older ages. According to previous research, veterans had worse health than non-veterans, but such differences may reflect not an effect of service, but selection into the armed forces (Bedard & Deschenes, 2006; Dobkin & Shabani, 2009; Seltzer & Jablon, 1974). According to other research, veterans had worse health if they were deployed to a combat zone than if they were not, but only within the first five years after they returned from war (Boehmer,

Flanders, McGeehin, Boyle, & Barrett, 2004). Yet others have demonstrated that the negative association of deployment and health persists for longer (McCutchan et al., 2016). Others have focused not on deployment, but on combat exposure, and have demonstrated that men with this military experience were not at increased risk of heart disease decades after their service (Johnson et al., 2010). According to other research, combat veterans and prisoners of war had worse health than other veterans only if they had PTSD, which suggests that this disorder, rather than combat per se, is the relevant exposure (Boscarino, 2006; Kang, Bullman, & Taylor, 2006). Previous research thus leaves open the question of whether combat veterans indeed have worse health than men who did not see combat, particularly at older ages.

The following article disentangles the impact on older men's health of military service from that of combat exposure experienced decades earlier, by comparing three groups of men: combat veterans, non-combat veterans, and men who did not serve in the armed forces. It evaluates health outcomes among men who served and saw combat from World War II to the Vietnam eras. The analyses are based on retrospective reports of wartime exposure, which have been shown to be closely related to administrative records of conflict (B. Smith et al., 2007). They assess whether combat veterans had worse health based on self-reports and diagnoses of life-threatening illnesses than men who did not see combat, when such effects are measured decades later, while men were in their fifties and older.

Unhealthy veterans: Combat as a negative turning point

Some scholars have pursued research implicitly based on the theory that military service provides a negative turning point for health, due to combat exposure. Previous researchers have argued that combat veterans had higher rates of PTSD and mortality than men who did not see combat decades after their service (Elder, Clipp, Brown, Martin, & Friedman, 2009; Pizarro, Silver, & Prause, 2006; Schnurr & Spiro, 1999). Scholars have speculated that combat veterans have worse health than other men later in life because wartime exposures are associated with cumulative disadvantage as conveyed by trauma (MacLean, 2010). According to this view, veterans suffer long-term effects of wartime exposure, because they suffer mental and physical trauma during the transition to adulthood. Psychiatrists have argued that the wanderings of Odysseus after the Trojan War continue to echo in the lives of contemporary veterans who find it difficult to readjust to their post-war lives (Shay, 2002). Modern observers have demonstrated that US veterans experienced diminished quality of life when they returned home from fighting since at least the Civil War. During that war, veterans were thought to suffer from a condition called irritable heart (Dean, 1997). In the early part of the twentieth century, the US Congress established a network of medical facilities to rehabilitate veterans who had been negatively affected by combat during World War I, particularly those who had lost limbs (Linker, 2011). While psychiatrists have long been concerned with the psychological consequences of combat, they did not formally label the mental health effects of wartime exposure until 1980, when the Diagnostic and Statistical Manual first included the label of Post-Traumatic Stress Disorder (PTSD) (Laufer, Gallops, & Freywouters, 1984). More recently, scholars have begun to assess the physical and mental injuries experienced by the Americans returning from the contemporary wars in Iraq and Afghanistan (Institute of Medicine, 2013). These injuries may persist in later life, leading directly to ill health. Unfortunately, the data used in these analyses do not indicate whether or not the combatants were wounded.

Negative selection and health outcomes

Veterans may have worse health than other men, however, due not to a causal effect, but to selection. Scholars have long recognised that omitted variable and selection problems complicate inference in studies of military service during the draft era (Angrist, 1990). Even during that era, when service was more widespread than it is today, service-members tended to have different average characteristics than civilians, both because particular types of men may choose to enlist or to evade the draft and because the armed forces choose which potential recruits to accept. Selection fluctuated across the decades of the draft era, with the armed

forces taking relatively more recruits during wartime, particularly World War II and the Vietnam War, whom they might have rejected during peacetime (Flynn, 1993).

Indeed, veterans may suffer worse health if they are exposed to battle due to selection not just into service, but also into combat. Even during wartime, not all service members are sent into battle, nor do all experience combat. Service members have been more likely to serve in combat occupations and fight against the enemy if they have lower ability as measured by their cognitive test scores (Gimbel & Booth, 1996). Combat veterans have also tended to have grown up in families with lower socioeconomic attainment than non-combat veterans (Gimbel & Booth, 1996; MacLean, 2011), which has consistently been associated with worse health (Elo, 2009). Thus, combat veterans may also be more likely to die at young ages and suffer disease due not to their combat exposure, but to their pre-existing characteristics.

Positive selection into service and combat

Veterans may appear more or less unhealthy than non-veterans because of selection into the armed forces and into combat roles based on health. They may therefore have had better health, on average, before their service. People have long been excluded from the armed forces if they are in poor physical health, which includes having asthma or being overweight (National Research Council, 2006) and could also lead veterans to appear relatively healthy. Previous researchers have demonstrated that a variety of outcomes are affected by childhood health, including adult health, socioeconomic attainment, and military service. According to this research, for example, people who were unhealthy as children are unhealthier when they are adults (J. P. Smith, 2009). They also earn less than those who were healthy as children after they enter the labor market (Haas, Glymour, & Berkman, 2011). During the draft era, men were excluded from the armed forces if they had particular health conditions, meaning that service members were healthier, on average, than civilians (Flynn, 1993). Thus, veterans may appear healthier due not to their military experiences, but to enlistment standards. They would have had better health later in life even if they had not enlisted.

Combat veterans may also be healthier compared to people who did not see combat because of selection into combat occupations and deployment to war zones. Previous researchers have pointed out that the armed forces select troops who are in better health to fight, leading to a "healthy warrior" effect (Armed Forces Health Surveillance Center, 2007). In addition, during World War II, blacks served in segregated units and were therefore less likely to see combat than were whites (MacLean, 2011; Segal & Segal, 2004). Thus, combat veterans may have had fewer mental and physical illnesses than other people even had they stayed at home. They may also suffer worse health than they would have otherwise, but appear in relatively good health because their pre-combat physical and mental fitness mask the effects of any trauma they suffer.

Previous research on combat exposure and health: Primarily negative associations

Researchers have produced findings that are primarily consistent with the view of combat as a negative turning point, though the association appears to change as veterans age. According to some, combat veterans suffer worse health than those who did not experience combat. Scholars have assessed the health of veterans who were recently exposed to combat, demonstrating immediate increases in mental illness and death (Boehmer et al., 2004). In Croatia, people who fought in the war were more likely to experience "distress" in the year after combat ended than those who did not, though this effect appears to hold only for men (Kunovich & Hodson, 1999). In the US, Vietnam veterans were more likely to die of external causes, such as accidents or suicide, in the five years after their service if they deployed to Southeast Asia than if they did not (Boehmer et al., 2004). Yet these short-term effects did not persist; nor were these deployed veterans more likely to die from internal causes, such as illness (Boehmer et al., 2004). Among those serving during the early 2000s, service members and veterans had higher rates of PTSD and depression if they deployed to Iraq and Afghanistan (Hoge & Castro, 2006). These previous findings suggest that veterans may have suffered worse health in the years

immediately after their service if they deployed to war zones than if they served in the United States since at least the Vietnam War.

Other scholars have evaluated the association between combat and health among veterans at middle age, demonstrating alternately a negative association and no association (Boehmer et al., 2004; Boscarino, 2006). They have addressed the question of whether Vietnam and World War II veterans had better or worse health when they were middle aged if they had been sent to war zones and fought in combat when they were younger. According to this research, deployed veterans had higher mortality rates when they were in their thirties and forties compared to those who were not deployed (Boscarino, 2006). They also had higher rates of heavy drinking and drug use, though the evidence is mixed as to whether those rates were associated with mortality (Boehner et al., 2004, Boscarino, 2006). Among veterans who served between the World War II and Vietnam War eras, combat veterans were more likely than other men to report work-related disabilities (MacLean, 2010). Yet, according to other research, deployed Vietnam veterans only had higher rates of mortality in the first five years after their service, and were not distinguishable from non-deployed veterans when they were older (Boehmer et al., 2004).

Still fewer researchers have explored the effects of combat among veterans who were over 50 years old, producing findings that suggest either a negative effect or no effect of wartime exposures at older ages. Looking at these older veterans, researchers have, for example, demonstrated that Vietnam veterans had relatively high rates of PTSD if they experienced combat than if they did not (Schnurr & Spiro, 1999). Similarly, World War II combat veterans had higher mortality rates than veterans who did not fight (Elder et al., 2009). Among Civil War veterans, men had worse health and died at younger ages if they served in companies where more of their comrades were killed (Pizarro et al., 2006). Yet other researchers have demonstrated that combat veterans do not appear to suffer worse physical health than non-combat veterans when they are assessed three or more decades after service (Johnson et al., 2010).

Hypotheses

The following analyses test hypotheses derived from the bulk of the preceding findings, which indicate negative effects of combat on health, potentially varying with age or cohort, along with possible countervailing effects of selection. They therefore test the following hypotheses:

- Hypothesis 1: Combat veterans have worse health than both non-veterans and non-combat veterans.
- Hypothesis 2a: Combat veterans have worse health than both non-veterans and non-combat veterans, and these gaps increase as they age.
- Hypothesis 2b: Combat veterans have worse health than both non-veterans and non-combat veterans, and these gaps decrease as they age.
- Hypothesis 3: Combat veterans have worse health than both non-veterans and non-combat veterans in some but not all cohorts.
- Hypothesis 4: Any associations between health and combat exposure will be explained or suppressed by the pre-service characteristics of combat veterans.

Data and Methods

Data

The analyses are based on the Health and Retirement Study (HRS), with a particular focus on the 2008 wave, when the respondents who were veterans were asked about combat exposure. The HRS was started in 1992, with an original sample of people born between 1931 and 1941. The data were designed to be longitudinal, with survey respondents providing information every two years. In the succeeding years, additional samples have been added to collect data from respondents who were born in both earlier and later years, with the aim of providing data about people who are 50 and over (National Institute on Aging, 2015). Due to the small number of female veterans, the analyses focus on the men who were born between 1908 and 1954 and thus were eligible to serve in the military between the years immediately before World War II through the Vietnam war.

In the HRS overall, the respondents who meet

these criteria amount to a sample of 10,217 men. The analyses are based on samples of men who were included in the 2008 wave who were born in the relevant birth-years and provided data on all of the analysis variables. The samples range between 6,247 and 6,250 respondents depending on the outcome studied. The analysis sample does not differ from the larger HRS sample in their assessment of their childhood health or in the probability that they were black. They do differ in that they were more likely to have been born later in the century, and are thus younger, on average. In addition, they have more educated parents and are more educated themselves. They are also more likely to be Hispanic. Therefore, we ran analyses on samples for which only the dependent variables were missing, substituting the mean when independent variables are missing, along with dummy variables to indicate missing data. The results of these analyses (available by request) do not differ substantively from those presented here.

Dependent variables

The analyses examine the impact of combat exposure by evaluating two dependent variables measured at every survey year. The first measure captures how respondents rate their own health based on responses to the question: "In general, would you say your health is …". Respondents are allocated to the following categories: 1 = poor; 2 = fair; 3 = good; 4 = very good; and 5 = excellent. Many previous researchers have argued that self-rated health reflects objective health. They have shown, for example, that people who rate their health as worse die sooner than do those who rate their health as better (Frankenberg & Jones, 2004). Following Wilmoth, et al. (2010), the models are based on a measure of self-rated health that is continuous.

The second measure assesses whether the respondent has been diagnosed with a life-threatening illness. It is based on that used by Link, Phelan, Miech, and Westin (2008) and reflects whether the respondent reports ever having been diagnosed with one of five serious health conditions: lung problems, cancer, diabetes, heart problems, and stroke. These illnesses, in turn, are associated with subsequent mortality (Link et al., 2008). The analyses are based on a measure of these illnesses that reflects the count. Other analyses (not shown, but available by request) use measures of both of these dependent variables that are dichotomous and produce results that are substantively similar.

Independent variables

The main independent variable captures a combination of veteran and combat status. The HRS has long asked whether respondents have served on active duty in the armed forces. In 2008, the respondents who had been on active duty were asked if they had ever fired at or were fired on by an enemy. This measure is combined with the previous one to construct a variable that indicates whether the respondent: 0 = did not serve on active duty; 1 = served on active duty but did not see combat; and 2 = served on active duty and saw combat. Unfortunately, the HRS does not include measures that would allow one to examine length of either service or combat exposure.

The models also assess how the health of respondents may vary by either age or cohort. Respondents are included in the data between the ages of 55 and 88. We tested models that included linear and quadratic measures of age, but these results did not differ from those with just the linear measure. They also contain a categorical measure of cohort based on respondents' birth years to reflect the years during which men turned 18, or first became eligible to serve in the military (Wilmoth, Landes, London, & MacLean, Forthcoming). This variable allows the models to compare veterans to non-veterans. The resulting measure places respondents into one of the following 6 categories: 1 = pre-World War II; 2 = World War II; 3 = Post-World War II; 4 = Korean War; 5 = Post-Korea; or 6 = Vietnam War.

The analyses include three other variables that reflect characteristics that have been shown to predict military service during the draft era (MacLean, 2011). The first variable measures socioeconomic background based on reports of the respondent's mother's education. When mother's education is missing, the variable reflects father's education. The second variable specifies the respondent's race and ethnicity, whether the respondent is: non-Hispanic white, non-Hispanic black, or Hispanic. The third variable indicates health selection based on the self-rated health of the respondents reported

retrospectively for their childhood. Scholars have demonstrated that, in the absence of prospective data, retrospective measures of childhood health are both reliable and valid (Haas & Bishop, 2010; J. P. Smith, 2009).

In addition, the analyses include a measure of the respondent's own education, though this variable and health outcomes may be jointly determined by military service and may thus be vulnerable to what Sampson (2008) has labeled "included variable bias." Accordingly, we report results both with and without this measure.

Analytic strategy

The article presents results from multilevel models with random intercepts and random slopes, known as growth curve models, which are estimated in Stata 14 using the "mixed" command. In the current case, the models estimate the average slope of age, while allowing for individual variation around that slope. Respondents can contribute as many as nine observations based on the number of times that they are observed in the data in the specified age range between the 1992 and 2008 waves. The analyses present preferred models that are chosen by comparing Bayesian Information Criterion (BIC) statistics (Raftery, 1995). Figures are constructed based on these models to represent the marginal effect at the means (or at specified categories) using Stata's "margins" and "marginsplot" commands.

Results

Differences between non-veterans and veterans

Figure 1 presents average self-rated health by age and military status, comparing combat veterans to those who did not see combat and non-veterans. According to the figure, combat veterans rated their health as worse than non-combat veterans and similar to non-veterans when they were in their late 50s. They had self-rated health that was similar to non-combat veterans and better than that of non-veterans in their sixties and seventies. By the time they were in their late eighties, they rated their health again as worse than non-combat veterans and as more similar to that of non-veterans. These non-adjusted figures are partially consistent with hypothesis 1. Combat veterans had worse health at some ages than non-combat veterans, but did not rate their health as worse than non-veterans.

Figure 1. Observed health by age and combat status

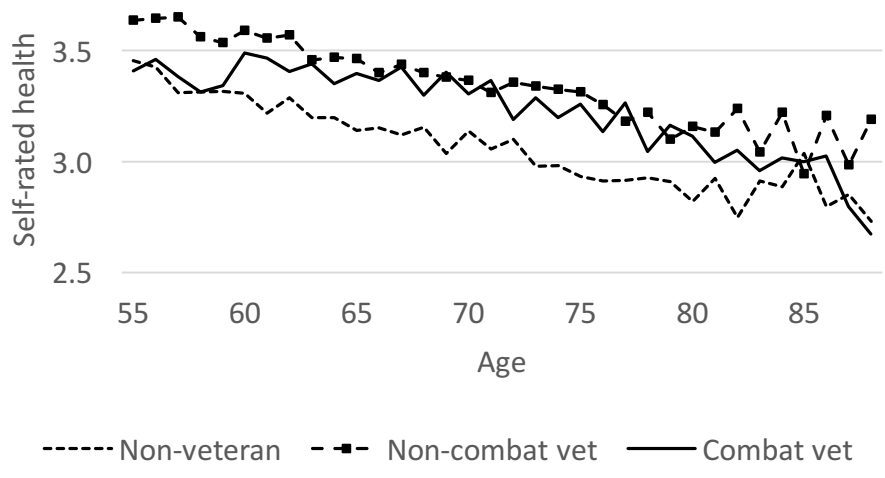
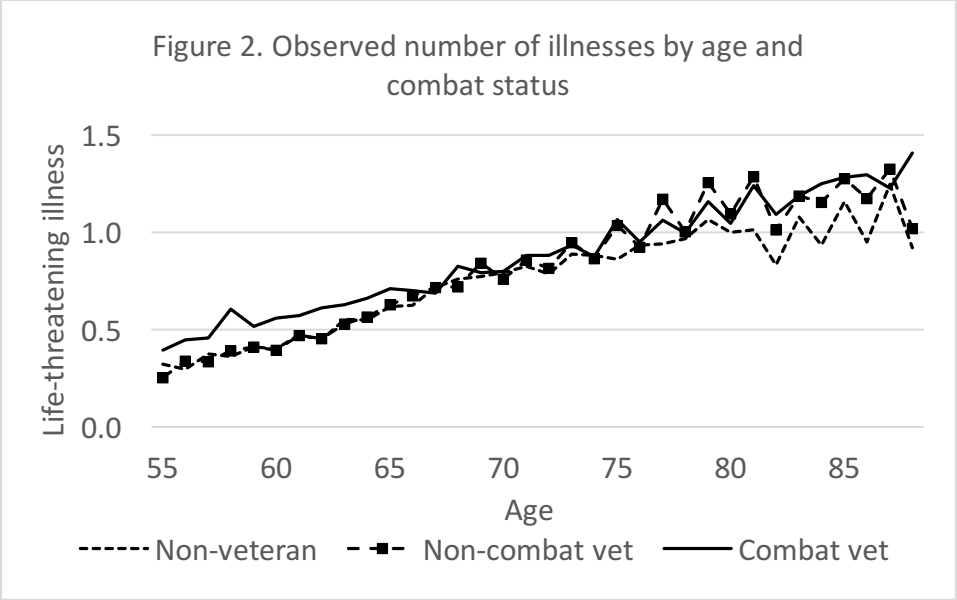


Figure 2 presents the average number of life-threatening illnesses by age and military status. When men were in their late fifties and early sixties, combat veterans had worse health than men in both other groups. Beginning in their early seventies, however, both types of veterans reported more life-threatening illnesses than did non-veterans. These findings also present evidence that is partially consistent with hypothesis 1, combat veterans tended to have worse health than men who did not see combat.



These differences, however, may reflect the differing characteristics of the men in the particular groups. Table 1 presents demographic traits by veteran status and combat exposure. The first two columns present the contrast between veterans and non-veterans. The third and fourth columns contain the same set of statistics for veterans based on whether they did or did not see combat. According to the table, one quarter of the male veterans in the analytic sample indicate that they experienced combat. Among all men in the sample, combat veterans represent approximately 14%.

Table 1. Characteristics of men in the Health and Retirement Study by veteran and combat status (means or proportions)

	Non-veteran	Veteran		Non-combat		Combat		
Mother's years of education	9.455	9.859	***	9.983	***	9.744	*	
	(4.030)	(3.151)		(3.167)		(3.059)		
Respondent's years of education	12.35	13.25	***	13.33	***	13.22	***	
	(3.907)	(2.680)		(2.640)		(2.634)		
Self-rated health (as child)	4.152	4.337	***	4.344	***	4.340	***	
	(1.013)	(0.894)		(0.878)		(0.918)		
Black	0.145	0.094	***	0.0897	***	0.106	**	
Hispanic	0.134	0.041	***	0.0391	***	0.0366	***	
Cohort (years turned 18)								
<1941 (Pre-WWII)	0.051	0.096	***	0.0671	*	0.156	***	†††
1941-1945 (WWII)	0.037	0.135	***	0.108	***	0.204	***	†††
1946-1949 (Post-WWII)	0.061	0.135	***	0.141	***	0.120	***	
1950-53 (Korean war)	0.111	0.155	***	0.172	***	0.108		†††
1954-63 (Post-Korea)	0.391	0.316	***	0.361	*	0.196	***	†††
1964-1973 (Vietnam war)	0.350	0.164	***	0.151	***	0.217	***	†††
Observations	2,995	3,421		2,353		874		

Note: Health and Retirement Study, 1992-2008. Standard deviations in parentheses.

* p<0.05, **p<0.01, *** p<0.001 (two-tailed tests of difference between specified group and non-veterans)

† p<0.05, ††p<0.01, ††† p<0.001 (two-tailed tests of difference between combat and non-combat veterans)

The table indicates that combat veterans were more similar to non-combat veterans before their service in terms of childhood characteristics than they were to non-veterans. According to the first two columns, veterans had more favorable traits than did non-veterans. They came from families in which the mothers had higher education. They had better self-rated health as children. They were less likely to be black or Hispanic. They themselves attained more education. The latter two columns show that combat veterans did not differ from non-combat veterans in terms of these pre-service characteristics. The findings are thus consistent with positive selection into the armed forces.

In addition, veterans came of age in different historical contexts than did non-veterans, while those who saw combat became eligible to serve in eras that differed from those who did not. Veterans were more likely than non-veterans to have been born earlier in the 20th century; they were more likely to have turned 18 in the eras through the Korean war. They were less likely to have come of age after that era. In addition, combat veterans were more likely than non-combat veterans to have become eligible to serve in the pre-World War II, World War II, and Vietnam eras.

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Preferred Models of Veterans' Health

Table 2 presents fit statistics for select models, which show that the veteran coefficients interacted with neither age nor cohort. The first set of models are those for self-rated health, while the second are those for life-threatening illness. In each of the two sets of models, the first model contains measures of combat status, pre-service characteristics, and age. The second model adds the measure of cohort, which improves the fit of the models. Models 3 and 4 test for interactions between the military status variable and the measures of first age and then cohort. In all cases, model 2 is preferred over the models with interactions, which suggests that military status does not interact with either age or cohort. These findings contradict hypotheses 2a, 2b, and 3, which suggested that the association between military status and health would vary by these attributes

Table 2. Fit statistics for selected models

	DF	BIC	Model Comparison	Difference
Models of life-threatening illness				
Model 1: Combat status, demographics, and age	13	45,207		
Model 2: 1 + cohort	18	44,868	2 - 1	-339.35
Models with interactions with military status				
Model 3: 2 + age	22	44,888	3 - 2	19.52
Model 4: 2 + cohort	28	44,947	4 - 2	78.79
Models of self-rated health				
Model 1: Combat status, demographics, and age	13	92,893		
Model 2: 1 + cohort	18	92,517	2 - 1	-376.03
Models with interactions with military status				
Model 3: 2 + age	22	92,535	3 - 2	17.51
Model 4: 2 + cohort	28	92,608	4 - 2	90.57

Predictors of illness, self-rated health, and depression

Table 3 contains estimates from growth curve models that predict health trajectories, which provide limited evidence of positive selection into the military, and suggest that combat veterans suffered worse health than did all other men. The first three columns reflect how different types of military service are associated with self-rated health, while the next three demonstrate these associations with the number of life-threatening illnesses. Within each set of three models, the first model presents these estimates net of just age and cohort, while the second model adds pre-service characteristics, and the third model adds completed educational attainment.

Table 3. Multilevel models predicting health trajectories

	Predicted self-rated health			Number of life-threatening illnesses		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Veteran type (ref: non-veteran)						
Non-combat veteran	0.236***	0.112***	0.064**	0.021	0.034	0.039
	[0.026]	[0.025]	[0.024]	[0.020]	[0.021]	[0.021]
Combat veteran	0.103**	-0.013	-0.066*	0.124***	0.135***	0.140***
	[0.036]	[0.035]	[0.034]	[0.029]	[0.029]	[0.029]
Age (years after 55)	-0.027***	-0.027***	-0.026***	0.036***	0.036***	0.036***
	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]
Cohort (ref: Korean war)						
Pre-World War II	0.467***	0.523***	0.557***	-0.365***	-0.376***	-0.380***
	[0.058]	[0.056]	[0.054]	[0.051]	[0.051]	[0.051]
World War II	0.205***	0.202***	0.216***	-0.379***	-0.377***	-0.378***
	[0.053]	[0.050]	[0.048]	[0.045]	[0.045]	[0.045]
Post-World War II	0.134**	0.136**	0.127**	-0.202***	-0.199***	-0.199***
	[0.047]	[0.045]	[0.043]	[0.038]	[0.038]	[0.038]
Post-Korean war	-0.107**	-0.153***	-0.185***	0.132***	0.143***	0.146***
	[0.035]	[0.033]	[0.032]	[0.028]	[0.028]	[0.028]
Vietnam war	-0.254***	-0.371***	-0.441***	0.301***	0.327***	0.335***
	[0.040]	[0.038]	[0.037]	[0.031]	[0.031]	[0.031]
Mother's education		0.043***	0.017***		-0.006*	-0.004
		[0.003]	[0.003]		[0.003]	[0.003]
Race/ethnicity (ref: Non-hispanic white)						
Black		-0.287***	-0.187***		0.036	0.025
		[0.035]	[0.034]		[0.029]	[0.029]
Hispanic		-0.220***	-0.037		-0.088*	-0.107**
		[0.044]	[0.043]		[0.036]	[0.037]
Self-rated childhood health		0.205***	0.173***		-0.053***	-0.049***
		[0.012]	[0.011]		[0.010]	[0.010]
Education			0.080***			-0.009**
			[0.004]			[0.003]
Intercept	3.580***	2.447***	1.831***	0.077**	0.350***	0.416***
	[0.035]	[0.064]	[0.069]	[0.027]	[0.053]	[0.059]
Number of observations	37,903	37,903	37,903	37,811	37,811	37,811
Number of respondents	6,250	6,250	6,250	6,247	6,247	6,247

Source: Health and Retirement Study, 1992-2008. Standard errors in brackets.

- p<0.05, **p<0.01, *** p<0.001 (two-tailed tests of significance)
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According to model 1, non-combat veterans had better health than combat veterans, who, in turn, were healthier than non-veterans net of age and cohort, which reflects the bivariate associations presented in figure 1. After accounting for pre-service characteristics in model 2, however, combat veterans no longer differed from non-veterans in their assessments of their own health. When educational attainment is added in model 3, combat veterans had worse health than both non-veterans and non-combat veterans. (In this, and in every model in the table, the differences between the combat and non-combat coefficients are significant at the .001 level.) These findings provide evidence that veterans were positively selected into service, consistent with hypothesis 4. They are also consistent with hypothesis 1, which suggested that combat veterans suffer worse health compared to men who did not fight.

As shown in models 4 through 6, combat veterans also suffered worse health than did all other men when measured by number of life-threatening illnesses. The estimates of the veteran status variables do not differ statistically across models despite the addition of pre-service characteristics and educational attainment, which is not consistent with hypothesis 4. The associations are not altered by preservice characteristics in the case of illness. Across the various models, however, combat veterans have more life-threatening illnesses, which is consistent with hypothesis 1.

Figure 3 presents predicted trajectories of self-rated health derived from model 3. These predictions are net of background characteristics, education and cohort, reflecting the paths among non-Hispanic white men who turned 18 during the Korean war and who had average childhood health, parental education, and educational attainment. According to the figure, men saw declining health as they aged, with non-combat veterans having better health than both non-veterans and combat veterans. The figure highlights the conclusion that non-combat veterans had better health after their service when compared to non-veterans, while combat veterans did not, decades later.

Figure 3. Fitted self-rated health by age and combat status

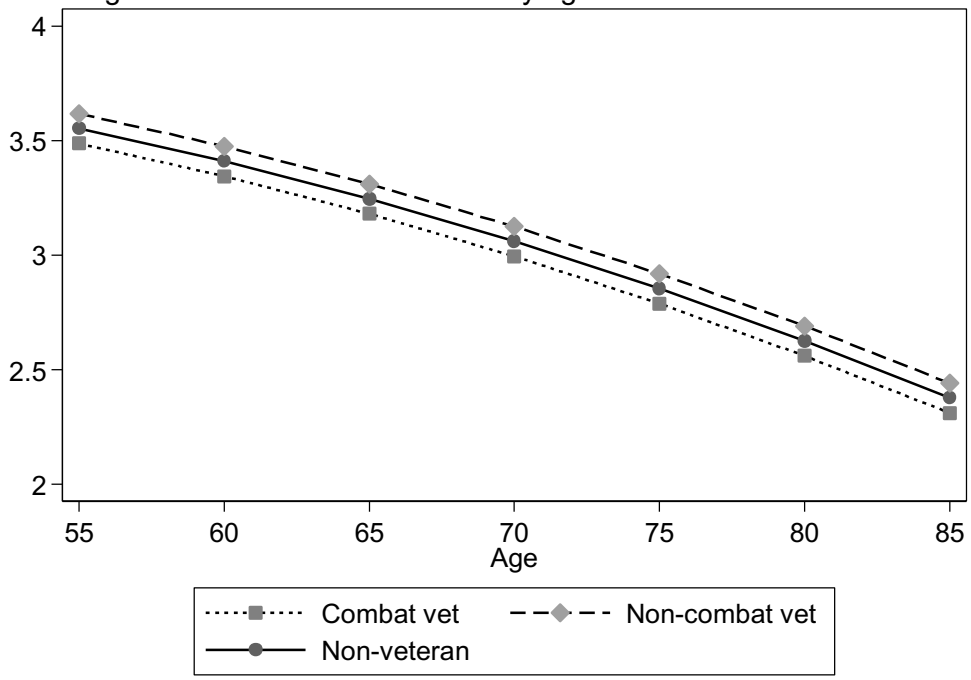
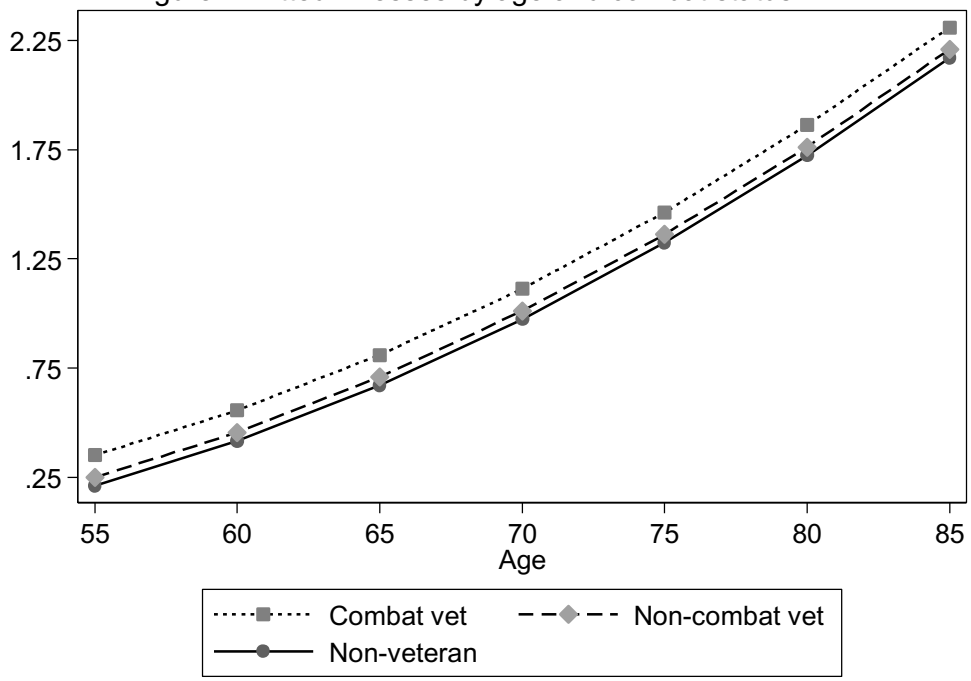


Figure 4 presents trajectories estimated in the same manner as above derived from model 3, but this time for life-threatening illnesses. According to the figure, men became increasingly ill as they grew older. Combat veterans had worse heath than men in both other groups when measured by these diagnoses. Similar to that above, this figure also suggests that combat veterans suffered worse health after their service while non-combat veterans did not.

Figure 4. Fitted illnesses by age and combat status



Discussion

This article assesses whether combat has a long-lasting association with health and finds evidence that it does. Combat veterans were less healthy than non-combat veterans based both on a subjective measure of self-rated health and on an objective count of life-threatening illnesses. They also were less healthy than non-veterans, as they were diagnosed with more life-threatening illnesses, net of pre-service characteristics. Yet they did not differ statistically from men who had not served in the military in their subjective assessment based on the measure of self-rated health, until completed education is considered. These findings are consistent with hypothesis 1. Furthermore, they suggest that studies that simply compare veterans to non-veterans may continue to produce mixed findings, because particular types of veterans serve in ways that relate differently to health.

Yet the analyses suggest that the associations between veteran status and health did not vary across time, at least at these older ages. They did not produce evidence that differences between veterans and non-veterans changed with age, as predicted by hypotheses 2a and 2b. Nor did they indicate that these differences varied across the eras in which men were first eligible to enlist, as predicted by hypothesis 3.

More broadly, scholars have demonstrated that later life outcomes may be affected by traumatic events earlier in life. People are more likely to die at younger ages, for example, if they have been incarcerated (Pridemore, 2014). They may experience long-term effects of a variety of stressors if they grew up in less privileged families (Pearlin,

Schieman, Fazio, & Meersman, 2005). The current findings suggest that combat may fall into this category of a stressor that produces effects not just in the short-term but throughout the life course. In addition, people may be injured in combat, leading to long-term health consequences.

The current set of analyses are limited in at least four ways that would lead them to underestimate the negative association of combat with health. First, the HRS only asked veterans in the core survey about combat exposure in 2008. The analyses are therefore based on information provided by the veterans who remained in the survey until that year. They might therefore underestimate the negative association of combat with health if the veterans who were less healthy were more likely to die or to leave the survey for other reasons than were the unhealthy non-veterans before that wave.

Second, the survey is designed to collect data from people older than 50. As suggested by previous research, veterans may be most negatively affected by combat in the years immediately after they stop serving. If combat veterans suffered worse health and were therefore less likely to participate in the survey, the analyses might further underestimate the negative effects of battle.

Third, the HRS does not include information about PTSD. Researchers have argued that it is this medical condition, rather than combat per se that harms health. In the current set of analyses, combat veterans are included regardless of whether they have PTSD or not, which could lead to an understatement of the impact of PTSD. Nevertheless, the analyses demonstrate that combat itself does have persistent long-term associations with at least these two measures of health.

Fourth, veterans may have served in the military and in combat due to characteristics that are not fully captured by the independent variables that are included in the current analyses to correct for selection. All veterans may appear to have better health when they are older because the armed forces choose recruits at least partly on the basis of health, excluding potential service-members who are in worse health. Indeed, the preceding findings demonstrate both that veterans had better self-rated health than non-veterans as children and that non-combat veterans rated their health as better than other men when they were older. If service-members were deployed to war zones because they were healthier, as posited by the healthy warrior hypothesis, then the analyses would further underestimate the harmful consequences of combat.

Despite these limitations, the findings have implications for the contemporary era, when more than two million service members have been deployed to the wars in Iraq and Afghanistan. Journalists and lawmakers have recently become concerned that the government is not attending adequately to the health care needs of veterans through the Department of Veterans Affairs (United States Government Accountability Office, 2012). These contemporary veterans have already had to deal with elevated risks of depression and PTSD, as well as suicide. As they grow older, they may also confront increased risks of poor health and life-threatening illness.

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